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EDEXCEL GCSE (9-1) MATHS: QUESTIONS BY TOPIC

## Equations & Inequalities (A2)

**GCSE (9-1) Mathematics (1MA1) · Higher tier**

74 questions · 304 marks · Mark schemes included

Past papers June 2017 - June 2025 · 5 sub-topics

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**HOW TO USE THIS BOOKLET**

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

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# QUESTIONS

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74 questions · 304 marks · 5 sub-topics

SUB-TOPIC A2a

## LINEAR EQUATIONS

Sub-topic A2a · 14 questions · 54 marks · lowest tariff first



9  $3x^{-1}(4x - x^3) = a + bx^n$  for all the values of  $x$  that are not zero.

Find the value of  $a$ , the value of  $b$  and the value of  $n$ .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

$$n = \dots\dots\dots$$

(Total for Question 9 is 2 marks)

10 Solve  $\frac{14 - x}{3} = 3x$

$$x = \dots\dots\dots$$

(Total for Question 10 is 2 marks)



**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1** Solve  $5x - 6 = 3(x - 1)$

$x =$  .....

**(Total for Question 1 is 3 marks)**

- 2** Emily buys a pack of 12 bottles of water.  
The pack costs £5.64

Emily sells all 12 bottles for 50p each.

Work out Emily's percentage profit.

Give your answer correct to 1 decimal place.

.....%

**(Total for Question 2 is 3 marks)**



7 Solve  $\frac{5-x}{2} = 2x-7$

$x = \dots\dots\dots$

(Total for Question 7 is 3 marks)



- 3 Andrew invests £4500 in a savings account for 2 years.  
The account pays compound interest at a rate of 3.4% per year.

Calculate how much Andrew has in this savings account at the end of the 2 years.

£.....

(Total for Question 3 is 2 marks)

- 4 Solve  $5x - 14 = 52 - x$

$x =$  .....

(Total for Question 4 is 3 marks)



17 Solve  $\frac{5x}{3x-1} - \frac{2x}{3x+1} = 1$

$x = \dots\dots\dots$

(Total for Question 17 is 3 marks)



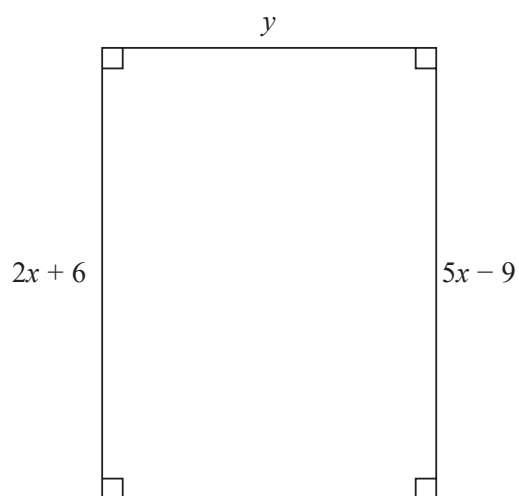
11 Solve  $\frac{3x-2}{4} - \frac{2x+5}{3} = \frac{1-x}{6}$

$x = \dots\dots\dots$

(Total for Question 11 is 4 marks)



6 Here is a rectangle.



All measurements are in centimetres.

The area of the rectangle is  $48 \text{ cm}^2$ .

Show that  $y = 3$

(Total for Question 6 is 4 marks)



14 Here are two squares, **A** and **B**.



**A**



**B**

The length of each side of square **B** is 4 cm greater than the length of each side of square **A**.  
The area of square **B** is  $70\text{ cm}^2$  greater than the area of square **A**.

Find the area of square **B**.

Give your answer correct to 3 significant figures.

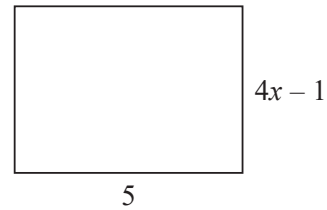
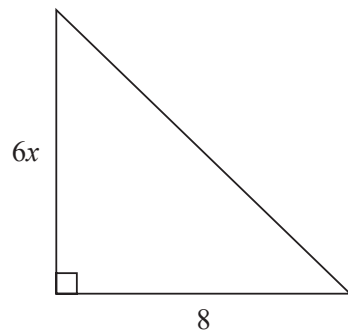
You must show all your working.

.....  $\text{cm}^2$

(Total for Question 14 is 4 marks)



- 5 Here is a triangle and a rectangle.



All measurements are in centimetres.

The area of the triangle is  $10 \text{ cm}^2$  greater than the area of the rectangle.

Work out the value of  $x$ .

$x = \dots\dots\dots$

(Total for Question 5 is 4 marks)

21 Solve  $\frac{1}{x+4} + \frac{3}{2-2x} = 1$

(Total for Question 21 is 4 marks)



19 Solve  $22 < \frac{m^2 + 7}{4} < 32$

Show all your working.

(Total for Question 19 is 5 marks)



- 3 Rick, Selma and Tony are playing a game with counters.

Rick has some counters.

Selma has twice as many counters as Rick.

Tony has 6 counters less than Selma.

In total they have 54 counters.

the number of counters Rick has : the number of counters Tony has =  $1 : p$

Work out the value of  $p$ .

$p = \dots\dots\dots$

(Total for Question 3 is 5 marks)



7 Mano has three shelves of books.

There are  $x$  books on shelf **A**.

There are  $(3x + 1)$  books on shelf **B**.

There are  $(2x - 5)$  books on shelf **C**.

There is a total of 44 books on the three shelves.

All the books have the same mass.

The books on shelf **B** have a total mass of 7500 g.

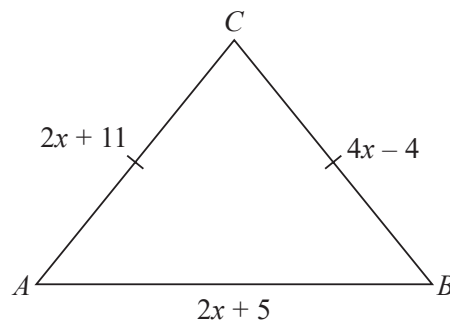
Work out the total mass of the books on shelf **A**.

..... g

(Total for Question 7 is 5 marks)



- 7 The diagram shows triangle  $ABC$ .



In the diagram, all measurements are in centimetres.

$$AC = BC$$

The perimeter of the triangle is 72 cm.

Work out the area of the triangle.

.....  $\text{cm}^2$

(Total for Question 7 is 5 marks)



SUB-TOPIC A2b

# QUADRATIC EQUATIONS

Sub-topic A2b · 13 questions · 53 marks · lowest tariff first



- 15** Tracey is going to choose a main course and a dessert in a cafe.  
She can choose from 8 main courses and 7 desserts.

Tracey says that to work out the number of different ways of choosing a main course and a dessert you add 8 and 7

- (a) Is Tracey correct?  
You must give a reason for your answer.

(1)

12 teams play in a competition.  
Each team plays each other team exactly once.

- (b) Work out the total number of games played.

(2)

(Total for Question 15 is 3 marks)

- 16** Solve  $(x - 2)^2 = 3$

Give your solutions correct to 3 significant figures.

(Total for Question 16 is 2 marks)



13 Write  $x^2 + 6x - 7$  in the form  $(x + a)^2 + b$  where  $a$  and  $b$  are integers.

(Total for Question 13 is 2 marks)

14 Cone **A** and cone **B** are mathematically similar.

The ratio of the volume of cone **A** to the volume of cone **B** is 27 : 8

The surface area of cone **A** is  $297 \text{ cm}^2$

Show that the surface area of cone **B** is  $132 \text{ cm}^2$

(Total for Question 14 is 3 marks)



19 Given that  $x^2 - 6x + 1 = (x - a)^2 - b$  for all values of  $x$ ,

(i) find the value of  $a$  and the value of  $b$ .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

(2)

(ii) Hence write down the coordinates of the turning point on the graph of  $y = x^2 - 6x + 1$

$$(\dots\dots\dots, \dots\dots\dots)$$

(1)

(Total for Question 19 is 3 marks)

8 Solve  $x^2 = 5x + 24$

(Total for Question 8 is 3 marks)

9 (a) Write down the value of  $7^0$

(1)

(b) Find the value of  $3 \times 3^6 \times 3^{-6}$

(1)

(c) Find the value of  $2^{-4}$

(1)

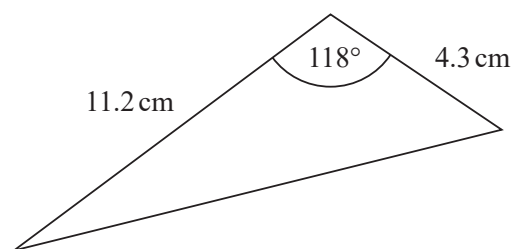
(d) Find the value of  $27^{\frac{1}{3}}$

(1)

(Total for Question 9 is 4 marks)



18 Here is a triangle.



Work out the area of the triangle.  
Give your answer correct to 3 significant figures.

..... cm<sup>2</sup>

(Total for Question 18 is 2 marks)

19 Solve  $6x^2 + 5x - 6 = 0$

.....

(Total for Question 19 is 3 marks)



- 21 The equation of a curve is  $y = 4x^2 - 56x$   
The curve has one turning point.

By completing the square, show that the coordinates of the turning point are  $(7, -196)$   
You must show all your working.

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(Total for Question 21 is 3 marks)



17 Given that

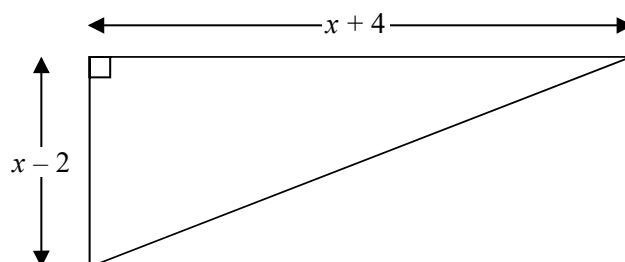
$$x^2 : (3x + 5) = 1 : 2$$

find the possible values of  $x$ .

.....  
(Total for Question 17 is 4 marks)



14 The diagram shows a right-angled triangle.



All the measurements are in centimetres.

The area of the triangle is  $27.5 \text{ cm}^2$

Work out the length of the shortest side of the triangle.  
You must show all your working.

..... cm

(Total for Question 14 is 4 marks)

19 Solve  $\frac{1}{2x-1} + \frac{3}{x-1} = 1$

Give your answer in the form  $\frac{p \pm \sqrt{q}}{2}$  where  $p$  and  $q$  are integers.

(Total for Question 19 is 4 marks)



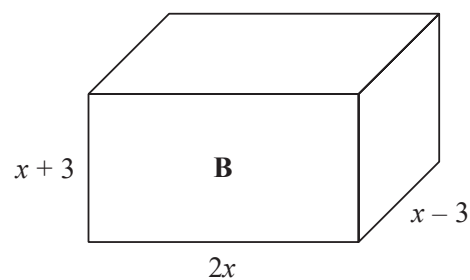
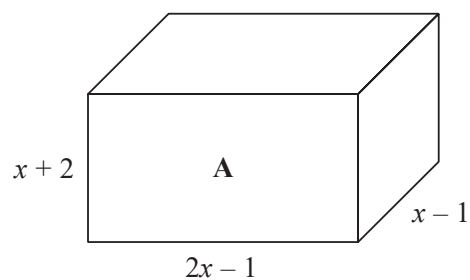
19 Solve  $\frac{1}{x} - \frac{1}{x+1} = 4$

Give your answer in the form  $a \pm b\sqrt{2}$  where  $a$  and  $b$  are fractions.

(Total for Question 19 is 5 marks)



13 Here are two cuboids.



All lengths are measured in centimetres.

The volume of cuboid A is  $142 \text{ cm}^3$  greater than the volume of cuboid B.

Work out the value of  $x$ .

$x = \dots\dots\dots$

(Total for Question 13 is 5 marks)



17 (a) (i) Write  $x^2 - 8x + 3$  in the form  $(x - a)^2 - b$  where  $a$  and  $b$  are integers.

.....  
(2)

(ii) Hence, write down the coordinates of the turning point on the graph of  $y = x^2 - 8x + 3$

(....., .....)  
(1)

(b) Solve  $7x^2 + 8x - 5 = 0$   
Give your solutions correct to 3 significant figures.

.....  
(3)

Alex has to find the solutions of the quadratic equation  $3k^2 + 10k - 8 = 0$   
Here is his working and answer.

$$(3k - 2)(k + 4) = 0$$

$$k = 2 \text{ or } k = -4$$

(c) What mistake has Alex made?

.....  
(1)

(Total for Question 17 is 7 marks)



- 9 (a) Expand and simplify  $(x - 2)(2x + 3)(x + 1)$

.....  
(3)

$$\frac{y^4 \times y^n}{y^2} = y^{-3}$$

- (b) Find the value of  $n$ .

.....  
(2)

- (c) Solve  $5x^2 - 4x - 3 = 0$   
Give your solutions correct to 3 significant figures.

.....  
(3)

.....  
(Total for Question 9 is 8 marks)



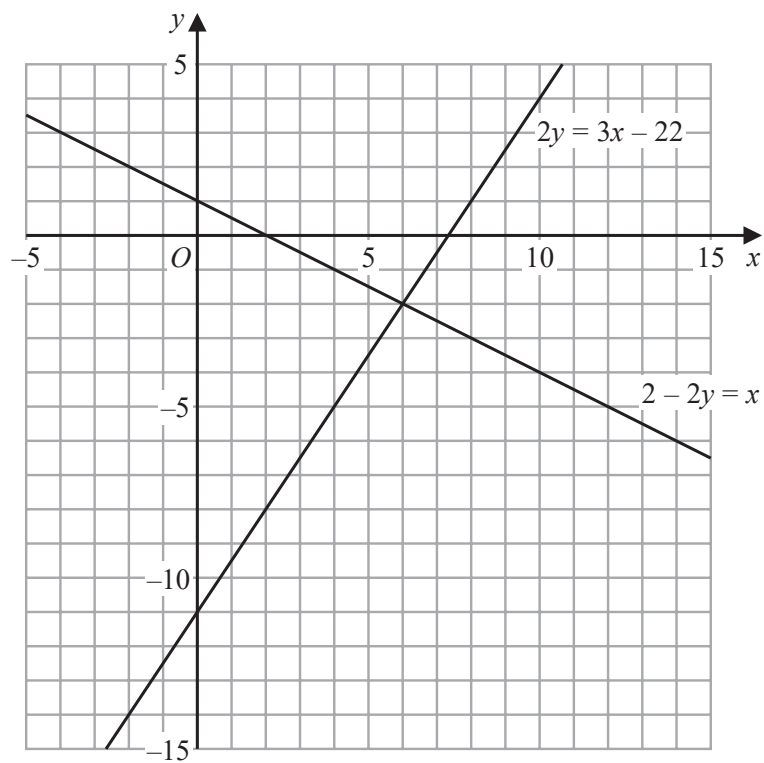
SUB-TOPIC A2c

# SIMULTANEOUS EQUATIONS

Sub-topic A2c · 17 questions · 65 marks · lowest tariff first



9



Use these graphs to solve the simultaneous equations

$$\begin{aligned}2 - 2y &= x \\ 2y &= 3x - 22\end{aligned}$$

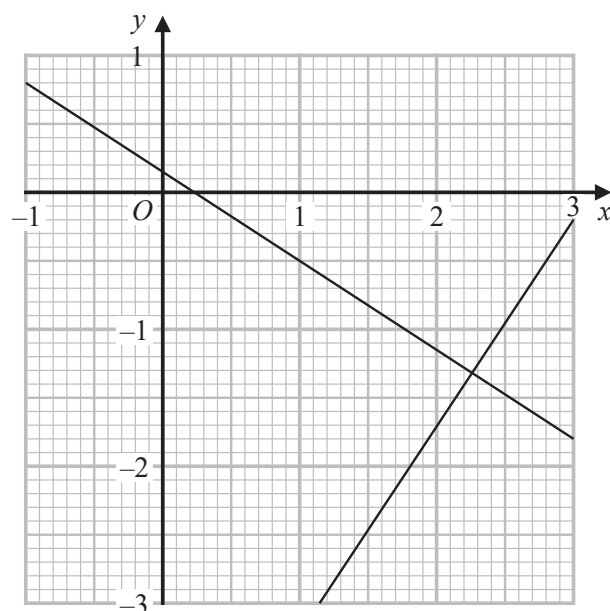
$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 9 is 1 mark)



- 10 The graphs with equations  $3y + 2x = \frac{1}{2}$  and  $2y - 3x = -\frac{113}{12}$  have been drawn on the grid below.



Using the graphs, find estimates of the solutions of the simultaneous equations

$$3y + 2x = \frac{1}{2}$$

$$2y - 3x = -\frac{113}{12}$$

$x =$  .....

$y =$  .....

(Total for Question 10 is 2 marks)



2 Solve the simultaneous equations

$$\begin{aligned}3x + y &= -4 \\ 3x - 4y &= 6\end{aligned}$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 2 is 3 marks)



6 Solve the simultaneous equations

$$\begin{aligned}5x + y &= 21 \\ x - 3y &= 9\end{aligned}$$

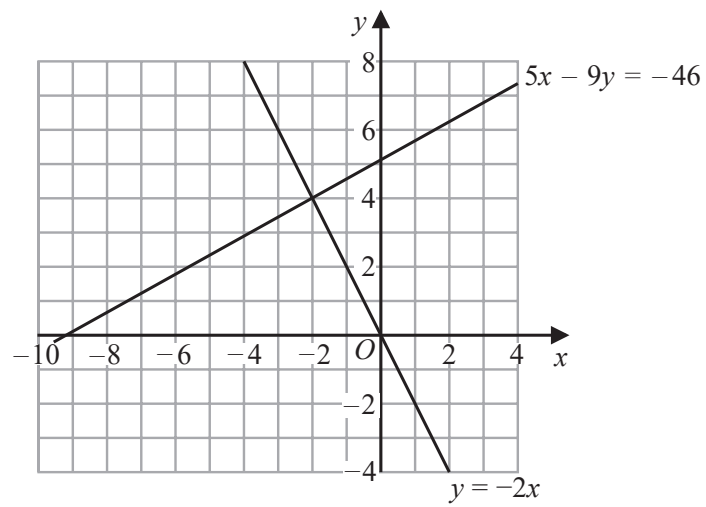
$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 6 is 3 marks)



6



(a) Use these graphs to solve the simultaneous equations

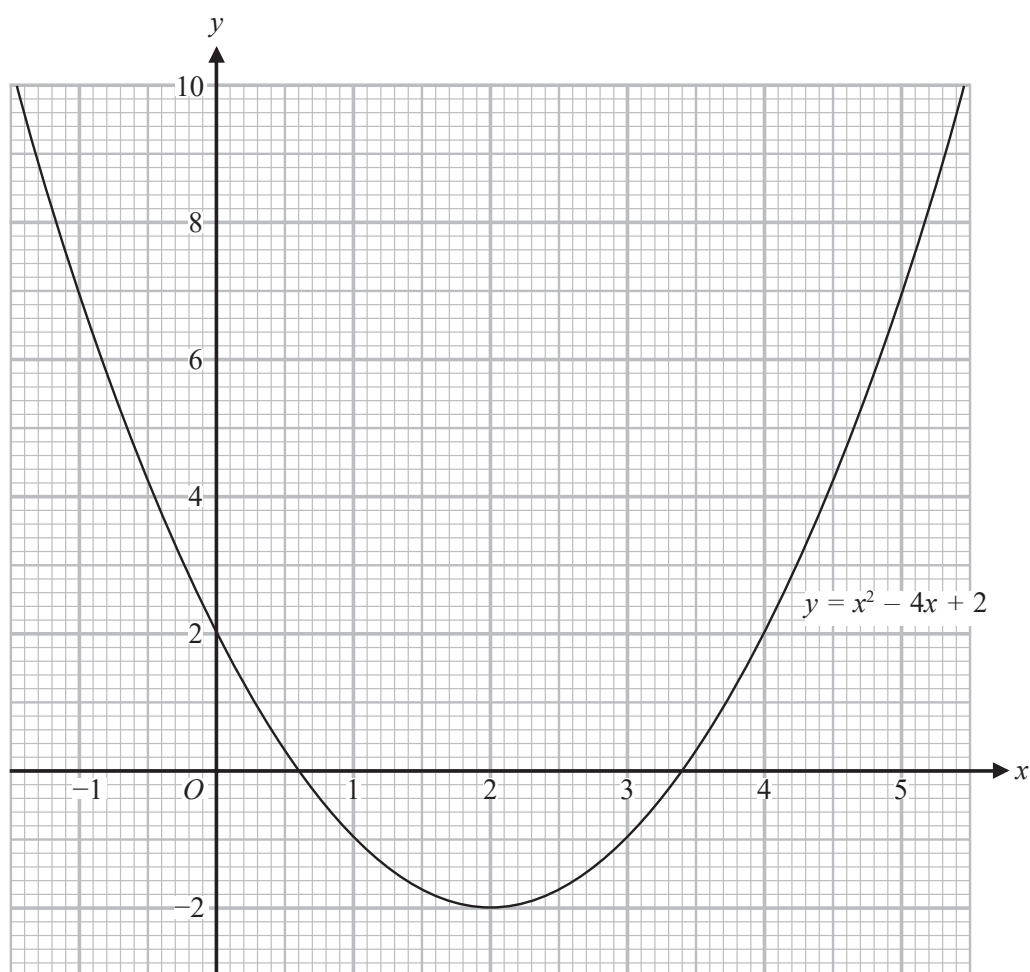
$$\begin{aligned}5x - 9y &= -46 \\ y &= -2x\end{aligned}$$

$x =$  .....

$y =$  .....

(1)





(b) Use this graph to find estimates for the solutions of the quadratic equation  $x^2 - 4x + 2 = 0$

.....  
(2)

(Total for Question 6 is 3 marks)

10 (a) Write down the value of  $100^{\frac{1}{2}}$

.....  
(1)

(b) Find the value of  $125^{\frac{2}{3}}$

.....  
(2)

(Total for Question 10 is 3 marks)

11 3 teas and 2 coffees have a total cost of £7.80  
5 teas and 4 coffees have a total cost of £14.20

Work out the cost of one tea and the cost of one coffee.

tea £.....

coffee £.....

(Total for Question 11 is 4 marks)



**16** The curve **C** has equation  $y = x^2 + 3x - 3$

The line **L** has equation  $y - 5x + 4 = 0$

Show, algebraically, that **C** and **L** have exactly one point in common.

(Total for Question 16 is 4 marks)



12 Solve the simultaneous equations

$$5x + 2y = 11$$

$$4x + 3y = 6$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 12 is 4 marks)



11 Use algebra to solve the simultaneous equations

$$\begin{aligned}2x + 6y &= 5 \\ 3x - 4y &= -12\end{aligned}$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 11 is 4 marks)



**10** Solve the simultaneous equations

$$5x - 2y = 23$$

$$2x - 3y = 18$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

**(Total for Question 10 is 4 marks)**



10 Use algebra to solve the simultaneous equations

$$4x - 5y = 20$$

$$6x + 7y = -57$$

You must show all your working.

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 10 is 4 marks)



**20** Solve the simultaneous equations

$$\begin{aligned}y^2 &= 3x^2 + 4 \\ y + 2x &= 7\end{aligned}$$

Give your solutions correct to 3 significant figures.

(Total for Question 20 is 4 marks)



**20** Solve algebraically the simultaneous equations

$$\begin{aligned}x^2 + y^2 &= 25 \\ y - 3x &= 13\end{aligned}$$

.....  
(Total for Question 20 is 5 marks)



19 Solve algebraically the simultaneous equations

$$\begin{aligned}2x^2 - y^2 &= 17 \\ x + 2y &= 1\end{aligned}$$

.....  
(Total for Question 19 is 5 marks)



**20** Solve algebraically the simultaneous equations

$$x^2 - 4y^2 = 9$$

$$3x + 4y = 7$$

(Total for Question 20 is 5 marks)



**22** **L** is the straight line with equation  $y = 2x - 5$

**C** is a graph with equation  $y^2 = 6x^2 - 25x - 8$

Using algebra, find the coordinates of the points of intersection of **L** and **C**.  
You must show all your working.

(....., .....)

(....., .....)

(Total for Question 22 is 5 marks)

**TOTAL FOR PAPER IS 80 MARKS**



21 Solve algebraically the simultaneous equations

$$\begin{aligned}3x^2 + 2y^2 &= 44 \\ 3x + y &= 2\end{aligned}$$

(Total for Question 21 is 5 marks)



SUB-TOPIC A2d

# INEQUALITIES

Sub-topic A2d · 24 questions · 98 marks · lowest tariff first



**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1** Solve  $7x - 27 < 8$

.....  
(Total for Question 1 is 2 marks)

**2** Write 124 as a product of its prime factors.

.....  
(Total for Question 2 is 2 marks)



16 Solve  $(4x - 3)(x + 5) < 0$

(Total for Question 16 is 2 marks)



21 Solve  $(3x - 1)(5x + 2) < 0$

(Total for Question 21 is 2 marks)



19 Solve  $2x^2 + 3x - 2 > 0$

(Total for Question 19 is 3 marks)



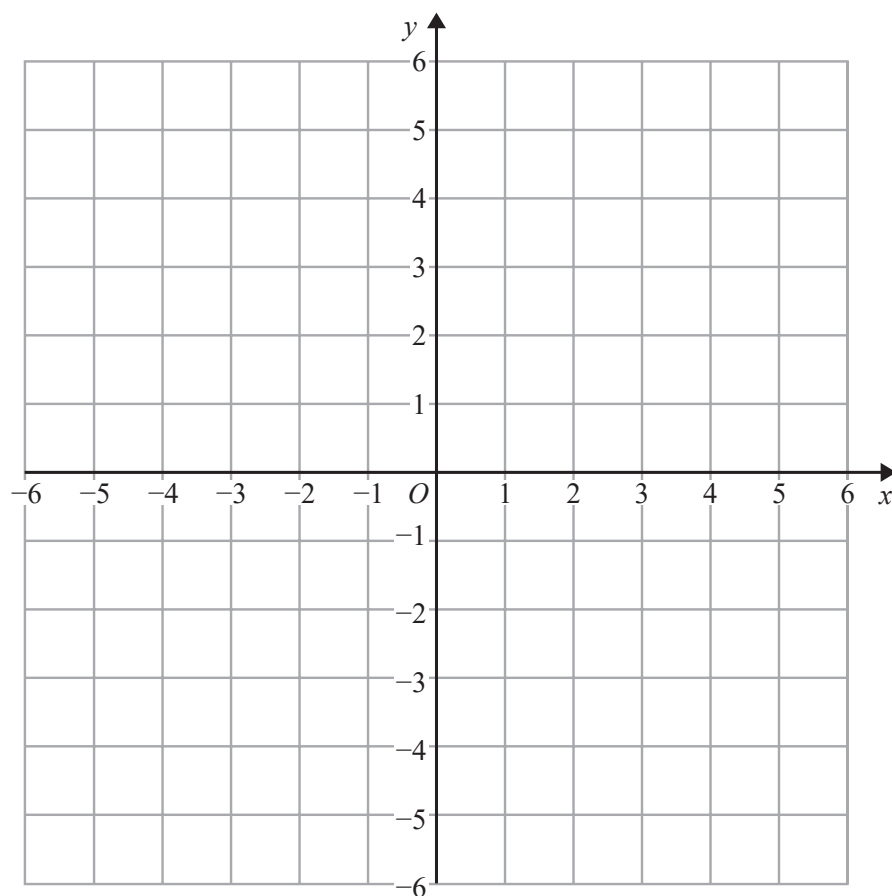
14 On the grid, shade the region that satisfies all these inequalities.

$$y > 1$$

$$x + y < 5$$

$$y > 2x$$

Label the region **R**.



(Total for Question 14 is 3 marks)

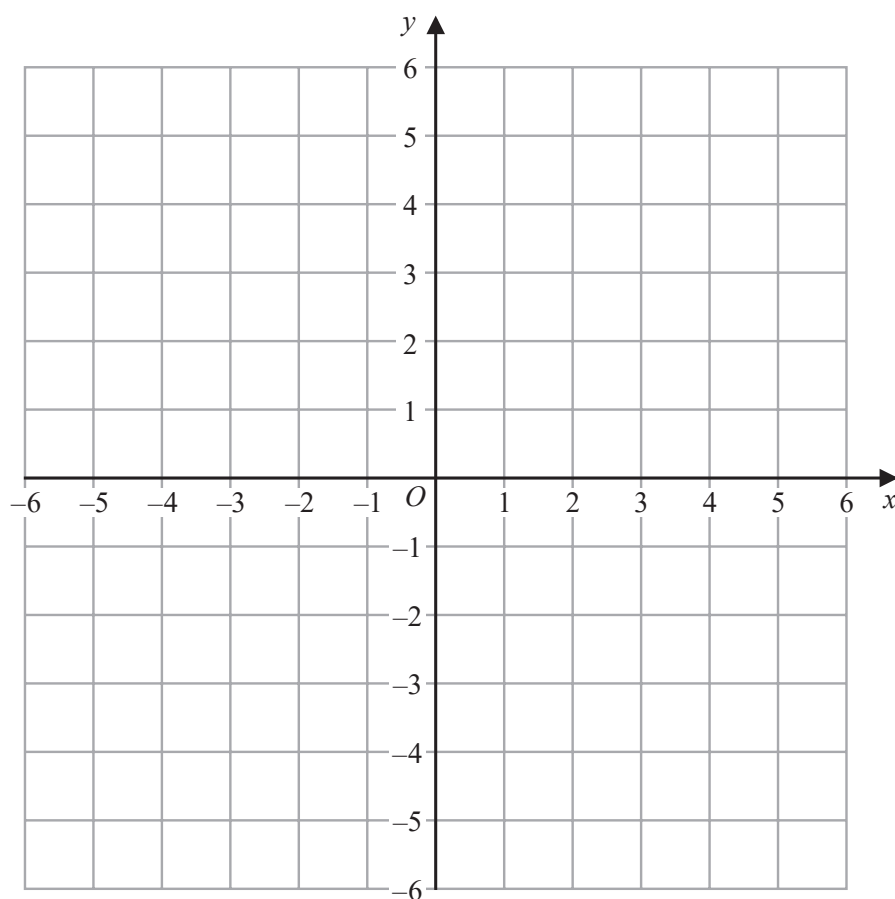
17 On the grid show, by shading, the region that satisfies all of these inequalities.

$$2y + 4 < x$$

$$x < 3$$

$$y < 6 - 3x$$

Label the region **R**.



(Total for Question 17 is 3 marks)

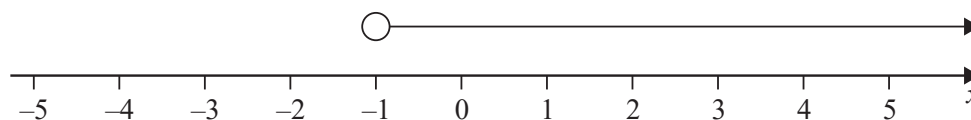


Answer ALL questions.

Write your answers in the spaces provided.

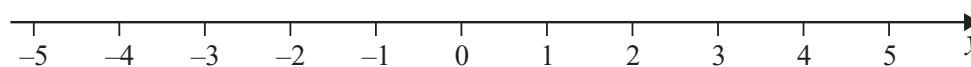
You must write down all the stages in your working.

- 1 (a) Write down the inequality shown on this number line.



(1)

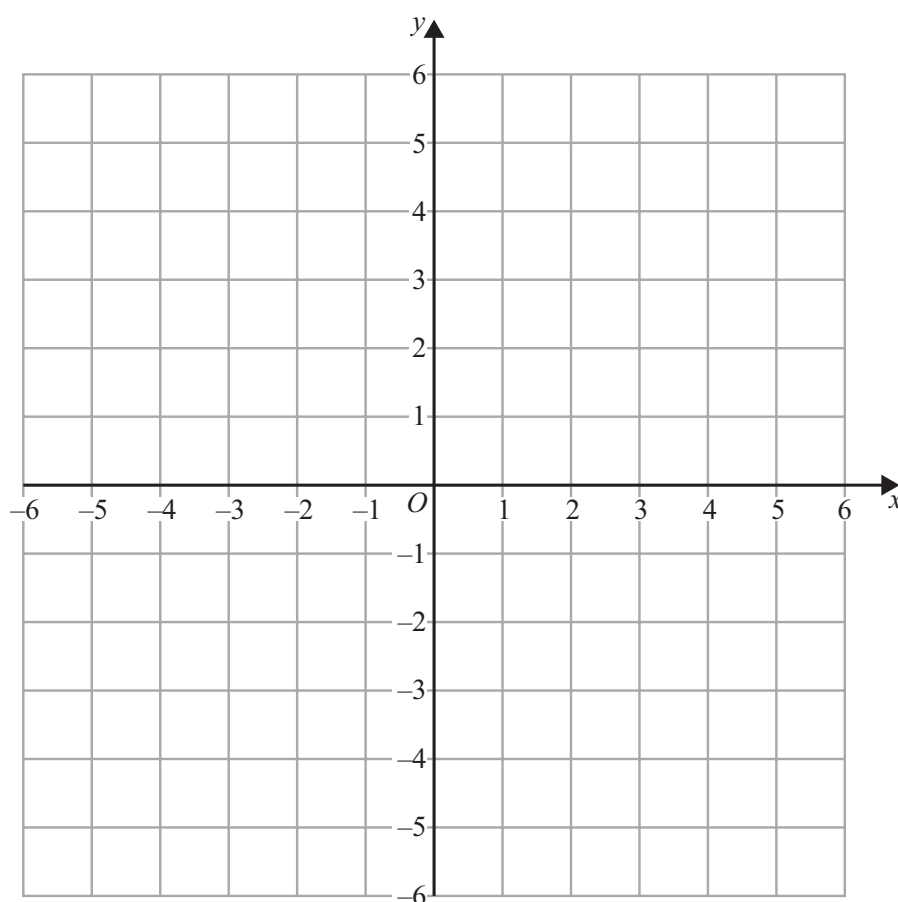
- (b) On the number line below, show the inequality  $-3 \leq y < 4$



(2)

(Total for Question 1 is 3 marks)

13



On the grid, shade the region **R** that satisfies all the following inequalities.

$$x \leq 2$$

$$y \geq -3$$

$$y \leq 2x + 1$$

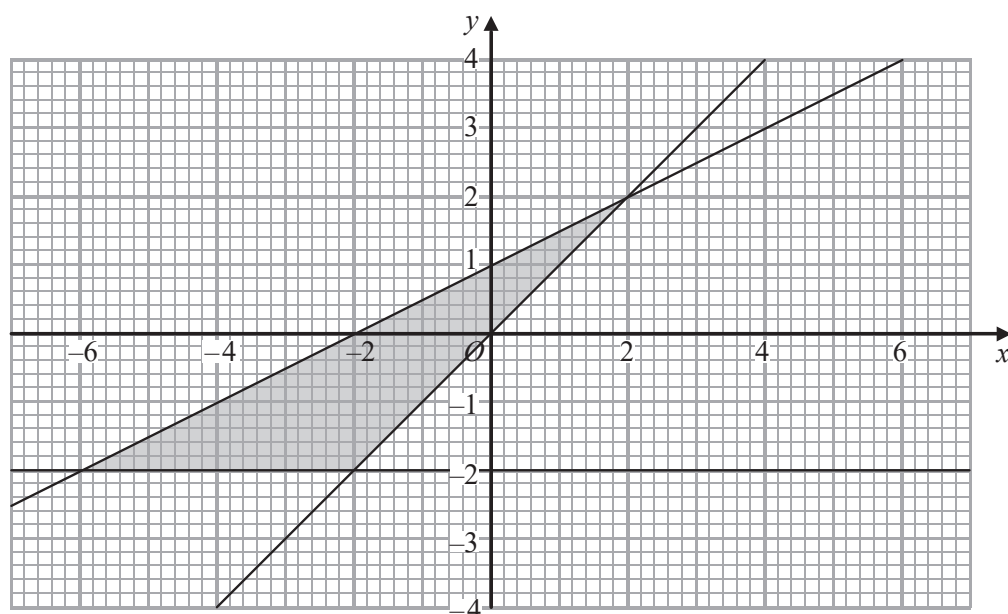
$$3x + 2y \leq 6$$

Label the region **R**.

(Total for Question 13 is 3 marks)



13



Write down the three inequalities that define the shaded region.

.....  
.....  
.....

(Total for Question 13 is 4 marks)

20 The table shows some values of  $x$  and  $y$  that satisfy the equation  $y = a \cos x^\circ + b$

|     |   |                |    |    |     |                |     |
|-----|---|----------------|----|----|-----|----------------|-----|
| $x$ | 0 | 30             | 60 | 90 | 120 | 150            | 180 |
| $y$ | 3 | $1 + \sqrt{3}$ | 2  | 1  | 0   | $1 - \sqrt{3}$ | -1  |

Find the value of  $y$  when  $x = 45$

(Total for Question 20 is 4 marks)

21 Show that  $\frac{6 - \sqrt{8}}{\sqrt{2} - 1}$  can be written in the form  $a + b\sqrt{2}$  where  $a$  and  $b$  are integers.

(Total for Question 21 is 3 marks)



10 (a) Solve  $\frac{9+x}{7} = 11-x$

$x = \dots\dots\dots$   
(3)

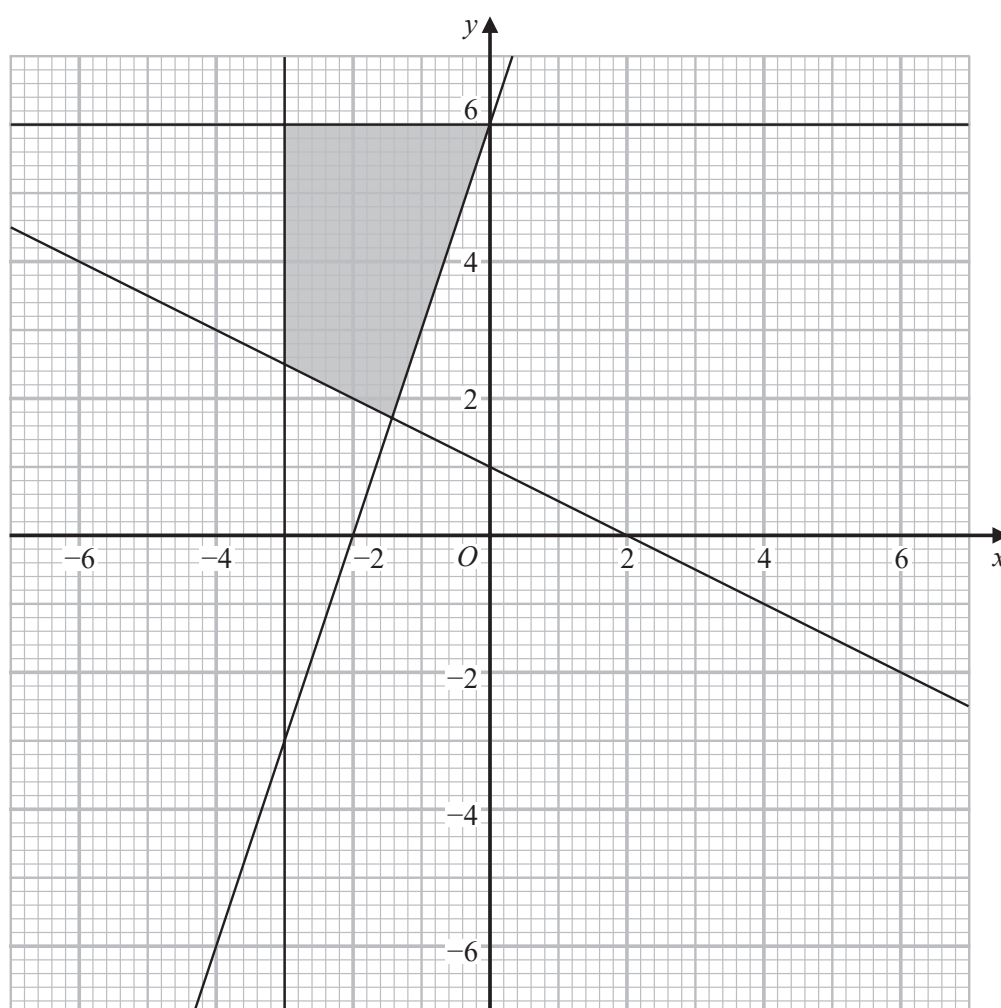
(b) Simplify  $\frac{4(y+3)^3}{(y+3)^2}$

$\dots\dots\dots$   
(1)

(Total for Question 10 is 4 marks)



16 The shaded region shown on the grid is bounded by four straight lines.



Find the four inequalities that define the shaded region.

.....

.....

.....

.....

(Total for Question 16 is 4 marks)

17 (a) Factorise  $6x^2 - 5x - 4$

.....  
(2)

(b) Hence, or otherwise, solve  $6x^2 - 5x - 4 < 0$

.....  
(2)

(Total for Question 17 is 4 marks)



- 4 Jenna is asked to show the inequality  $-3 < x \leq 4$  on a number line.

Here is her answer.



- (a) Write down two mistakes Jenna has made.

1.....

.....

2.....

.....

(2)

- (b) Work out the greatest integer that satisfies the inequality

$$5y - 7 < 16$$

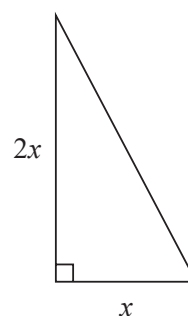
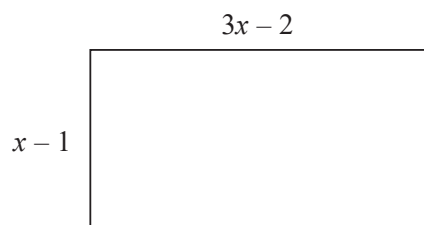
.....

(2)

(Total for Question 4 is 4 marks)



23 Here is a rectangle and a right-angled triangle.



All measurements are in centimetres.

The area of the rectangle is greater than the area of the triangle.

Find the set of possible values of  $x$ .

(Total for Question 23 is 5 marks)

**TOTAL FOR PAPER IS 80 MARKS**



**20**  $n$  is an integer such that  $3n + 2 \leq 14$  and  $\frac{6n}{n^2 + 5} > 1$

Find all the possible values of  $n$ .

(Total for Question 20 is 5 marks)

**TOTAL FOR PAPER IS 80 MARKS**



Answer ALL questions.

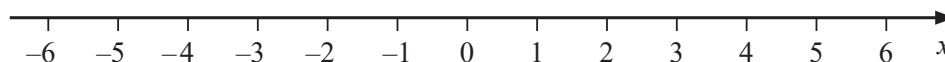
Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Solve  $14n > 11n + 6$

(2)

(b) On the number line below, show the set of values of  $x$  for which  $-2 < x + 3 \leq 4$



(3)

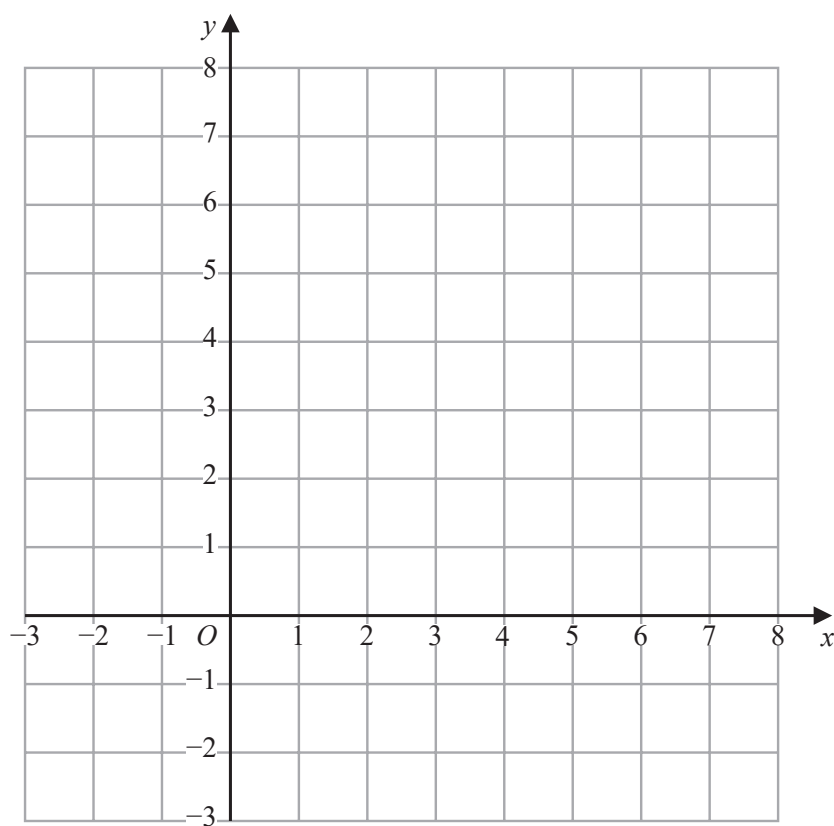
(Total for Question 1 is 5 marks)



13 (a) On the grid show, by shading, the region that satisfies all these inequalities.

$$x \geq 0 \quad x \leq 2 \quad y \leq x + 3 \quad 2x + 3y \geq 6$$

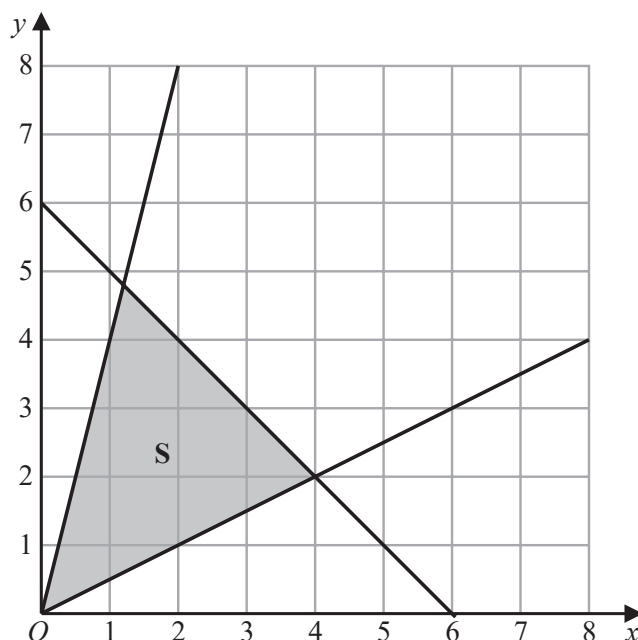
Label the region **R**.



(4)

(b) The diagram below shows the region S that satisfies the inequalities

$$y \leq 4x \quad y \geq \frac{1}{2}x \quad x + y \leq 6$$



Geoffrey says that the point with coordinates (2, 4) does not satisfy all the inequalities because it does not lie in the shaded region.

Is Geoffrey correct?

You must give a reason for your answer.

.....

.....

.....

(1)

(Total for Question 13 is 5 marks)

22 Find algebraically the set of values of  $x$  for which

$$x^2 - 49 > 0 \quad \text{and} \quad 5x^2 - 31x - 72 > 0$$

(Total for Question 22 is 5 marks)

**TOTAL FOR PAPER IS 80 MARKS**



24 Find the set of possible values of  $x$  for which

$$4x^2 - 25 < 0 \quad \text{and} \quad 12 - 5x - 3x^2 > 0$$

You must show all your working.

(Total for Question 24 is 5 marks)

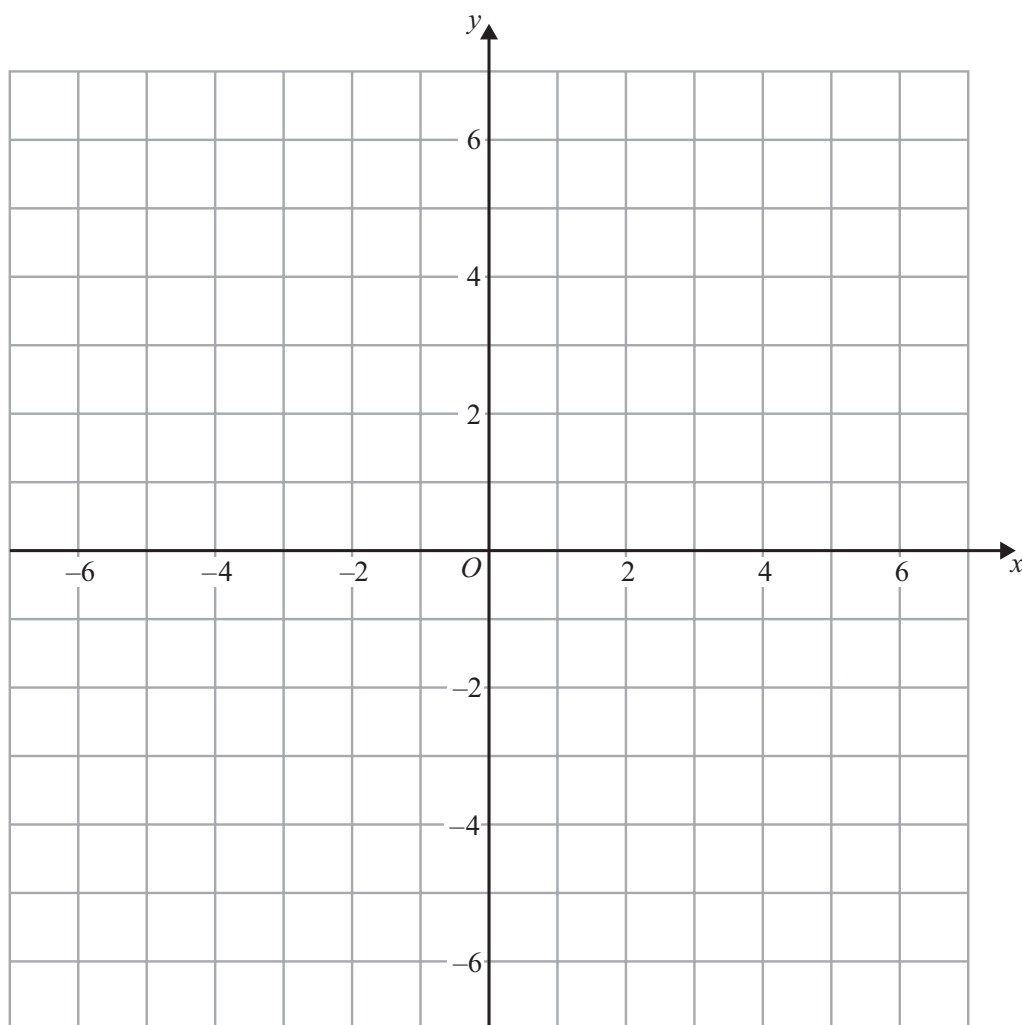
**TOTAL FOR PAPER IS 80 MARKS**



15 (a) On the grid, show by shading, the region that satisfies all of these inequalities.

$$x + y < 5 \quad y > 1 \quad x > 2 \quad y < 3x - 2$$

Label the region **R**.



(4)

Ron says,

“I can remove one of the four inequalities from the grid so that the region **R** will not change.”

Ron is correct.

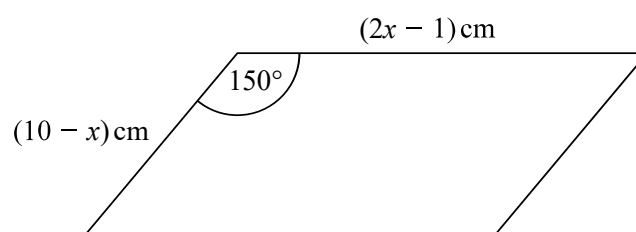
(b) Which inequality can be removed so that the region **R** will not change?

(1)

(Total for Question 15 is 5 marks)



23 The diagram shows a parallelogram.



The area of the parallelogram is greater than  $15 \text{ cm}^2$

(a) Show that  $2x^2 - 21x + 40 < 0$

(3)

(b) Find the range of possible values of  $x$ .

(3)

(Total for Question 23 is 6 marks)

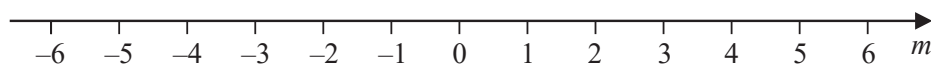
4  $-2 \leq n < 5$

$n$  is an integer.

(a) Write down the greatest possible value of  $n$ .

.....  
(1)

(b) On the number line below, show the inequality  $-4 \leq m < 1$



(2)

(c) Solve  $\frac{2}{5}g - 4 < 6$

.....  
(3)

(Total for Question 4 is 6 marks)

7 (a) Simplify  $\frac{3(2-m)^2}{2-m}$

.....  
(1)

(b) Solve  $7 + x \leq \frac{5x}{2} - 8$

.....  
(3)

(c) Solve  $9 < 2y + 4 < 12$

.....  
(2)

.....  
(Total for Question 7 is 6 marks)



SUB-TOPIC A2e

# ITERATION & NUMERICAL METHODS

Sub-topic A2e · 6 questions · 34 marks · lowest tariff first



- 16 (a) Use the iteration formula  $x_{n+1} = \sqrt[3]{10 - 2x_n}$  to find the values of  $x_1$ ,  $x_2$  and  $x_3$   
Start with  $x_0 = 2$

$$x_1 = \dots\dots\dots$$

$$x_2 = \dots\dots\dots$$

$$x_3 = \dots\dots\dots$$

(3)

The values of  $x_1$ ,  $x_2$  and  $x_3$  found in part (a) are estimates of the solution of an equation of the form  $x^3 + ax + b = 0$  where  $a$  and  $b$  are integers.

- (b) Find the value of  $a$  and the value of  $b$ .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

(1)

(Total for Question 16 is 4 marks)



17 (a) Show that the equation  $x^4 - x^2 - 5 = 0$  can be written in the form  $x = \sqrt[4]{x^2 + 5}$

(1)

(b) Starting with  $x_0 = 1.5$

use the iteration formula  $x_{n+1} = \sqrt[4]{x_n^2 + 5}$  three times to find an estimate for a solution of  $x^4 - x^2 - 5 = 0$

(3)

(Total for Question 17 is 4 marks)



16 Using  $x_{n+1} = -2 - \frac{4}{x_n^2}$   
with  $x_0 = -2.5$

(a) find the values of  $x_1$ ,  $x_2$  and  $x_3$

$$x_1 = \dots\dots\dots$$

$$x_2 = \dots\dots\dots$$

$$x_3 = \dots\dots\dots$$

(3)

(b) Explain the relationship between the values of  $x_1$ ,  $x_2$  and  $x_3$  and the equation  $x^3 + 2x^2 + 4 = 0$

.....  
.....  
.....  
.....

(2)

(Total for Question 16 is 5 marks)



18 (a) Show that the equation  $x^3 + x = 7$  has a solution between 1 and 2

(2)

(b) Show that the equation  $x^3 + x = 7$  can be rearranged to give  $x = \sqrt[3]{7 - x}$

(1)

(c) Starting with  $x_0 = 2$ ,  
use the iteration formula  $x_{n+1} = \sqrt[3]{7 - x_n}$  three times to find an estimate for a  
solution of  $x^3 + x = 7$

(3)

(Total for Question 18 is 6 marks)



17 (a) Show that the equation  $x^3 + 2x - 6 = 0$  has a solution between  $x = 1$  and  $x = 2$

(2)

(b) Show that the equation  $x^3 + 2x - 6 = 0$  can be rearranged to give  $x = \frac{6}{x^2 + 2}$

(1)

(c) Starting with  $x_0 = 1.45$

use the iteration formula  $x_{n+1} = \frac{6}{x_n^2 + 2}$  twice to find an estimate  
for the solution of  $x^3 + 2x - 6 = 0$

Give your answer correct to 4 decimal places.

(3)

(Total for Question 17 is 6 marks)



15 (a) Show that the equation  $x^3 + 7x - 5 = 0$  has a solution between  $x = 0$  and  $x = 1$

(2)

(b) Show that the equation  $x^3 + 7x - 5 = 0$  can be arranged to give  $x = \frac{5}{x^2 + 7}$

(2)

(c) Starting with  $x_0 = 1$ , use the iteration formula  $x_{n+1} = \frac{5}{x_n^2 + 7}$  three times to find an estimate for the solution of  $x^3 + 7x - 5 = 0$

(3)



- (d) By substituting your answer to part (c) into  $x^3 + 7x - 5$ ,  
comment on the accuracy of your estimate for the solution to  $x^3 + 7x - 5 = 0$

(2)

(Total for Question 15 is 9 marks)

- 16 The petrol consumption of a car, in litres per 100 kilometres, is given by the formula

$$\text{Petrol consumption} = \frac{100 \times \text{Number of litres of petrol used}}{\text{Number of kilometres travelled}}$$

Nathan's car travelled 148 kilometres, correct to 3 significant figures.  
The car used 11.8 litres of petrol, correct to 3 significant figures.

Nathan says,

“My car used less than 8 litres of petrol per 100 kilometres.”

Could Nathan be wrong?

You must show how you get your answer.

(Total for Question 16 is 3 marks)



# MARK SCHEMES

official mark schemes, in the same order as the questions





| Paper: 1MA1/2H |                                                                                                                |                |      |                                                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------|----------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                                                                                                        | Answer         | Mark | Notes                                                                                                                                                                                    |
| 1              |                                                                                                                | $1\frac{1}{2}$ | M1   | for correct expansion of the bracket or dividing all terms by 3 as a first step<br>eg $3x - 3$ or $(5x - 6)/3 = 3(x - 1)/3$                                                              |
|                |                                                                                                                |                | M1   | for isolating terms in $x$ on one side of an equation eg $5x - 6 - 3x = -3$<br>or both constants on one side of an equation, eg $5x = 3x - 3 + 6$ ,<br>ft $5x - 6 = 3x - 1$              |
|                |                                                                                                                |                | A1   | for $1\frac{1}{2}$ oe                                                                                                                                                                    |
| 2              | $\pounds 6 - \pounds 5.64 = 36\text{p}$ or<br>$50\text{p} - 47\text{p} = 3\text{p}$<br><br>$6.3829787\ldots\%$ | 6.4            | P1   | for a strategy to compare the same number of bottles<br>e.g. $\pounds 5.64 \div 12$ ( $= 47$ or $0.47$ ) or $12 \times 50\text{p}$ ( $= 6$ or $600$ ) or $36$ or $0.36$ or $3$ or $0.03$ |
|                |                                                                                                                |                | P1   | for start of process to find percentage profit e.g. $\frac{36}{564}$ or $\frac{3}{47}$ or $\frac{6}{5.64}$ or $\frac{50}{47}$ oe<br>with consistent units                                |
|                |                                                                                                                |                | A1   | for answer in the range 6.3 to 6.4                                                                                                                                                       |



| Paper: 1MA1/3H |        |      |                                                                                                                  |                                                                                                              |
|----------------|--------|------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Question       | Answer | Mark | Mark scheme                                                                                                      | Additional guidance                                                                                          |
| 7              | 3.8    | M1   | for a correct first step,<br>eg $5 - x = 2(2x - 7)$ or $5 - x = 4x - 14$ or $\frac{5}{2} - \frac{x}{2} = 2x - 7$ | Method must show LHS $\times 2$ and both terms on RHS $\times 2$ or $5 - x$ and both terms on RHS $\times 2$ |
|                |        | M1   | (dep) for isolating terms in $x$<br>eg $4x + x = 14 + 5$ or $-\frac{x}{2} - 2x = -7 - \frac{5}{2}$               | eg $-4x$ both sides with $-5$ both sides<br>or $+x$ both sides with $+14$ both sides                         |
|                |        | A1   | oe                                                                                                               | Accept $\frac{19}{5}$ , $3\frac{4}{5}$ oe but not $\frac{-19}{-5}$ oe                                        |



| Paper: 1MA1/2H |         |      |                                                                                                                                                                                                                 |                                                                                                                                            |
|----------------|---------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer  | Mark | Mark scheme                                                                                                                                                                                                     | Additional guidance                                                                                                                        |
| 3              | 4811.20 | M1   | for a full method for one year, eg $4500 \times 1.034$ (= 4653) oe<br><b>OR</b> for a full method for 2 years, eg $4500 \times 1.034^2$ oe                                                                      | Can be implied by 4806 or 9306                                                                                                             |
|                |         | A1   | for 4811.2(0)                                                                                                                                                                                                   | Accept 4811.202 and 4811.21                                                                                                                |
| 4              | 11      | M1   | for one correct step to isolate $x$ term or constant term on one side,<br>eg adds $x$ to both sides to get $5x - 14 + x = 52 - x + x$<br><b>or</b> adds 14 to both sides to get $5x - 14 + 14 = 52 - x + 14$ oe | May be seen in different equivalent forms but must be carried out, not just intention seen.<br>Can be implied by eg $4x = 66$ or $6x = 38$ |
|                |         | M1   | for both correct steps to isolate terms in $x$ on one side and constant term on one side,<br>eg " $6x$ " - $14 + 14 = 52 + 14$ , <b>or</b> $5x + x = "66" + x - x$                                              |                                                                                                                                            |
|                |         | A1   | cao                                                                                                                                                                                                             |                                                                                                                                            |
| 5              | 21      | P1   | for process to work correctly with initial ratio, eg $120 \div 4 \times 9$ (= 270)<br><b>or</b> $90 + 120 + 60$ (= 270)                                                                                         | Can be implied by $90 : 120 : 60$ or by a second ratio that totals 270                                                                     |
|                |         | P1   | for process to find the value of 1 part in the new ratio,<br>eg " $270$ " $\div (2 + 5 + 3)$ (= 27)                                                                                                             |                                                                                                                                            |
|                |         | P1   | for complete process to find both values for Errol,<br>eg " $27$ " $\times 3$ (= 81) <b>and</b> $120 \div 4 \times 2$ (= 60)                                                                                    |                                                                                                                                            |
|                |         | A1   | cao                                                                                                                                                                                                             |                                                                                                                                            |
| 6              | 327     | M1   | for $147 + 180$ or for $360 - (180 - 147)$ ,<br><b>or</b> for drawing a suitable diagram with 147 in the correct position and with the bearing of A from B indicated                                            | Diagram can be a sketch                                                                                                                    |
|                |         | A1   | cao                                                                                                                                                                                                             |                                                                                                                                            |



| Paper: 1MA1/3H |                |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       |
|----------------|----------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Question       | Answer         | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Additional guidance                                                                                   |
|                |                | P1   | (dep P2) for process to solve for $h$ or $H$ or $x$<br><br>eg $(h =) \frac{640\pi}{\frac{1}{3} \times \pi \times 8^2 + \frac{1}{3} \times \pi \times 8^2}$ oe eg $(h =) \frac{3 \times 640\pi}{\text{"64}\pi" + \text{"64}\pi"}$<br><br>or $(H =) \frac{640\pi}{\pi \times 8^2 + \frac{1}{3} \times \pi \times 8^2 \times 3} (= 5)$ oe eg $(h =) \frac{640\pi}{\text{"64}\pi" + \text{"64}\pi"} (= 5)$<br><br>or $(x =) \frac{640\pi}{\pi \times 8^2 \times \frac{1}{4} + \frac{1}{3} \times \pi \times 8^2 \times \frac{3}{4}} (= 20)$ oe eg $(x =) \frac{640\pi}{\text{"32}\pi"} (= 20)$ | Can be an equation in the form $ah = p$ or $bH = q$ or $cx = r$ where $a$ or $b$ or $c$ is an integer |
|                |                | A1   | cao                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Award 0 marks for a correct answer with no (or incorrect) supportive working                          |
| 17             | $-\frac{1}{7}$ | M1   | for using a common denominator<br>eg $\frac{5x(3x+1) - 2x(3x-1)}{(3x-1)(3x+1)} (= 1)$<br><b>or</b> for removing the fraction<br>eg $5x(3x+1) - 2x(3x-1) = (3x-1)(3x+1)$                                                                                                                                                                                                                                                                                                                                                                                                                    | Allow one error in total in all the expansions (may be a sign error)                                  |
|                |                | M1   | for correct methods to remove all fraction(s) <b>and</b> expand the brackets,<br>eg $15x^2 + 5x - 6x^2 + 2x = 9x^2 + 3x - 3x - 1$                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                       |
|                |                | A1   | for $-\frac{1}{7}$ oe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Allow $-0.14(2\dots)$ for $-\frac{1}{7}$                                                              |



| Paper: 1MA1/2H |         |                         |      |                                                                                                                                                                                                                                                                                                                      |
|----------------|---------|-------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working | Answer                  | Mark | Notes                                                                                                                                                                                                                                                                                                                |
| 10 (a)         |         | Jupiter                 | B1   | for Jupiter (accept $1.898 \times 10^{27}$ )                                                                                                                                                                                                                                                                         |
| (b)            |         | $4.5388 \times 10^{24}$ | B1   | for $4.5388 \times 10^{24}$ oe (e.g. $45.388 \times 10^{23}$ )                                                                                                                                                                                                                                                       |
| (c)            |         | Yes<br>(supported)      | M1   | for $(4.35 \times 10^9) \div (4.14 \times 10^7)$ (= 105(.07..))<br>or $(4.14 \times 10^7) \times 100$ (= $4.14 \times 10^9$ )<br>or $(4.35 \times 10^9) \div 100$ (= $4.35 \times 10^7$ )                                                                                                                            |
|                |         |                         | A1   | for Yes with correct supporting evidence                                                                                                                                                                                                                                                                             |
| 11             |         | $9\frac{1}{3}$          | M1   | for writing at least 2 fractions with a common denominator<br>eg. $\frac{3(3x-2)}{12}, \frac{4(2x+5)}{12}, \frac{2(1-x)}{12}$ with at least one correct numerator<br>or for $\frac{3x}{4} - \frac{2}{4} - \frac{2x}{3} - \frac{5}{3} = \frac{1}{6} - \frac{x}{6}$ (accept $+\frac{5}{3}$ instead of $-\frac{5}{3}$ ) |
|                |         |                         | M1   | (dep) for a method to eliminate all fractions in an equation, ignore errors in any expanded terms<br>eg. $3(3x - 2) - 4(2x + 5) = 2(1 - x)$<br>or $6 \times [3(3x - 2) - 4(2x + 5)] = 12 \times [1 - x]$<br>or $3 \times 3x - 3 \times 2 - 4 \times 2x - 4 \times 5 = 2 \times 1 - 2 \times x$                       |
|                |         |                         |      | OR for the correct expansion of brackets leading to $\frac{9x-6-8x-20}{12} = \frac{2-2x}{12}$                                                                                                                                                                                                                        |
|                |         |                         | M1   | (dep on M2) for correctly isolating terms in x and number terms of their linear equation<br>e.g. $9x - 8x + 2x = 2 + 6 + 20$                                                                                                                                                                                         |
|                |         |                         | A1   | for $9\frac{1}{3}$ oe                                                                                                                                                                                                                                                                                                |

| Paper: 1MA1/1H |         |                                   |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
|----------------|---------|-----------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working | Answer                            | Mark                             | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
| 4              |         | Daisy is wrong<br><br>(supported) | P1<br><br>P1<br><br>A1<br><br>C1 | for process to find area of any relevant circle ie $\pi \times 4^2 (=16\pi)$ , $\pi \times 7^2 (=49\pi)$ , $\pi \times 10^2 (=100\pi)$ <b>or</b> $7^2$ and $4^2$<br>for completed method to find shaded area eg “ $\pi \times 7^2$ ” – “ $\pi \times 4^2$ ” ( $=33\pi$ ) <b>or</b> use of radii eg $7^2 - 4^2 (=33)$<br>for 2 comparable figures, eg $33\pi$ and $100\pi$ <b>or</b> 33 and 100 <b>or</b> 103 to 103.7 and 314 to 314.2 <b>or</b> 103 to 103.7 and 104.6 to 104.8<br>statement eg No because it should be $\frac{33}{100}$ and their accurate figures<br>Allow use of $\pi = 3$ or better |                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
| 5              | (a)     | 365                               | M1                               | $\hat{f}x$ with $x$ consistent within intervals eg $200 \times 1$ , $300 \times 11$ , $400 \times 5$ , $500 \times 0$ , $600 \times 3$ , if 200, 3300, 2000, 0, 1800 are seen without working then condone 1 error (dep) $\Sigma \hat{f}x \div \Sigma f$ eg “7300” $\div 20$                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
|                | (b)     | Comment                           | M1<br>A1<br>C1                   | cao<br>for comment about outliers affecting mean                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
| 6              |         | Shows reasoning to reach $y=3$    | M1<br><br>M1<br><br>M1<br><br>A1 | forms equation eg $2x + 6 = 5x - 9$<br><br>isolates $x$ and number terms<br>$3x = 15$<br><br>substitutes “5” into side length eg $2 \times 5 + 6 (=16)$<br><br>$48 \div 16 = 3$ <b>or</b> $16 \div 3 = 48$                                                                                                                                                                                                                                                                                                                                                                                               | $48 \div 3 (=16)$<br><br>forms equation $2x + 6 = “16”$ <b>or</b> $5x - 9 = “16”$<br><br>isolates $x$ and number terms<br>$2x = “10”$ <b>or</b> $5x = “25”$<br><br>shows $x=5$ for both solutions | $3(2x + 6) = 48$ <b>or</b> $3(5x - 9) = 48$ , condone missing bracket<br>Isolates $x$ and number terms<br>$6x = “30”$ <b>or</b> $15x = “75”$<br><br>forms the second equation<br><br>$x=5$ from 2 different equations. |



| Paper: 1MA1/2H |                                         |                                  |                                                                                                                                                                                                                                                           |                                                                                                                                                                             |                                                                                                                                                                                  |
|----------------|-----------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                                  | Mark                             | Mark scheme                                                                                                                                                                                                                                               |                                                                                                                                                                             | Additional guidance                                                                                                                                                              |
| 13             | 15.4                                    | M1<br><br>M1<br><br>A1           | for $\frac{AB}{\sin 34} = \frac{23.8}{\sin "120"}$ or $\frac{\sin 34}{AB} = \frac{\sin "120"}{23.8}$<br><br>for $(AB) = \frac{23.8}{\sin "120"} \times \sin 34$<br><br>for answer in range 15.36 to 15.4                                                  |                                                                                                                                                                             | “120” comes from $180 - 26 - 34$<br><br><br>If an answer in the range 15.36 to 15.4 is given in the working space then incorrectly rounded, award full marks                     |
| 14             | 116                                     | P1<br><br>P1<br><br>A1<br><br>B1 | for setting up an equation,<br>eg $(x + 4)^2 = x^2 + 70$<br><br>for process to reduce equation down to a linear equation ready to solve eg $8x = 54$ oe<br><br>for 6.75 oe<br><br>ft (dep P2) for finding the area of B or for answer in range 115 to 116 | for setting up an equation,<br>eg $x^2 - (x - 4)^2 = 70$<br><br>for process to reduce equation down to a linear equation ready to solve eg $8x = 86$ oe<br><br>for 10.75 oe | Equation must be in a single variable.<br>If a candidate uses a trial and improvement method, it is either full marks or no marks.<br><br>Candidates must get as far as $ax = b$ |
| 15             | Enlargement<br>sf –1.5<br>centre (1, 1) | B2<br><br>(B1)                   | for enlargement scale factor –1.5 and centre (1, 1)<br><br>for enlargement scale factor –1.5 or enlargement centre (1, 1)                                                                                                                                 |                                                                                                                                                                             | Award no marks if more than one transformation is given                                                                                                                          |



| Paper: 1MA1/2H |        |      |                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                              |
|----------------|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer | Mark | Mark scheme                                                                                                                                                                                                                                                                                   | Additional guidance                                                                                                                                                                                                                                                                                                          |
| 5              | 1.25   | P1   | for finding an expression for the area of one shape,<br>eg $\frac{1}{2} \times 8 \times 6x$ (= 24x) or $5(4x - 1)$ (= 20x - 5) oe                                                                                                                                                             | Condone missing brackets for area of rectangle for all process marks                                                                                                                                                                                                                                                         |
|                |        | P1   | for finding an expression for the area of both shapes,<br>eg $\frac{1}{2} \times 8 \times 6x$ <b>and</b> $5(4x - 1)$ oe<br><b>or</b> [area of triangle] - 10 or [area of rectangle] + 10 oe<br>or [area of triangle] - [area of rectangle]                                                    |                                                                                                                                                                                                                                                                                                                              |
|                |        | P1   | for writing a correct equation, eg $\frac{1}{2} \times 8 \times 6x = 5(4x - 1) + 10$ oe<br><b>or</b> (dep on 1 <sup>st</sup> P1)<br>eg, [area of triangle] - 10 = [area of rectangle]<br>or [area of triangle] = [area of rectangle] + 10<br>or [area of triangle] - [area of rectangle] = 10 |                                                                                                                                                                                                                                                                                                                              |
|                |        | A1   | for 1.25 oe                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                              |
| 6              | 168    | P1   | for a start to the process, eg $\frac{57}{100} \times 800$ (= 456)<br>or $57 \div (12 + 7)$ (= 3)<br>or $800 \div (12 + 7)$ (= 42.1...) <b>or</b> [amount] $\times \frac{57}{100}$ or [amount] $\times \frac{7}{12 + 7}$                                                                      | May be seen as part of other calculations, eg<br>$\frac{7}{12 + 7} \times 57$ (= 21)<br>or $\frac{7}{12 + 7} \times 800$ (= 294.7...) <b>[amount]</b> can be any figure considered as being 57% of 800 or 43% of 800 calculated incorrectly or a figure calculated using a full or partial ratio incorrectly as a first step |
|                |        | P1   | for a complete process to find the weight of glass,<br>eg $\frac{57}{100} \times 800 \times \frac{7}{12 + 7}$ oe                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                              |
|                |        | A1   | for an answer in the range 167.9 to 168<br>SCB2 for an answer of 288                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                              |



| Paper: 1MA1/3H |                         |      |                                                                                                                                                                                                                                                                                            |                                                                                                                  |
|----------------|-------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                  | Mark | Mark scheme                                                                                                                                                                                                                                                                                | Additional guidance                                                                                              |
| 20             | Proof                   | M1   | for $(10x =) 1.2323\dots$ or $(100x =) 12.323\dots$ or $(1000x =) 123.23\dots$                                                                                                                                                                                                             | Any recurring notation acceptable throughout. Proofs with terminating decimals (at least 5 figures) score M1M1C0 |
|                |                         | M1   | (dep M1) for a method using two recurring decimals that leads to a terminating decimal difference, using correct multiples of $x$<br>eg $(1000x - 10x =) 123.23\dots - 1.23\dots (= 122)$ or $\frac{122}{990}$<br>or $(100x - x =) 12.323\dots - 0.123\dots (= 12.2)$ or $\frac{12.2}{99}$ |                                                                                                                  |
|                |                         | C1   | for completing algebra to $\frac{61}{495}$                                                                                                                                                                                                                                                 |                                                                                                                  |
| 21             | $-2$ and $-\frac{3}{2}$ | M1   | for writing a correct equation without fractions<br>eg $(2 - 2x) + 3(x + 4) = (2 - 2x)(x + 4)$ oe                                                                                                                                                                                          |                                                                                                                  |
|                |                         | M1   | for simplifying to a correct equation in the form $ax^2 + bx + c (= 0)$ ,<br>eg $2x^2 + 7x + 6 (= 0)$                                                                                                                                                                                      |                                                                                                                  |
|                |                         | M1   | for method to solve a correct quadratic equation,<br>eg $(2x + 3)(x + 2) (= 0)$ or correct substitution into the formula<br>or for correctly completing the square                                                                                                                         |                                                                                                                  |
|                |                         | A1   | for $-2$ and $-\frac{3}{2}$ oe                                                                                                                                                                                                                                                             |                                                                                                                  |



| Paper: 1MA1/2H |                                            |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                                     | Mark                           | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 18             | $\left(\frac{-16}{5}, \frac{48}{5}\right)$ | P1<br><br>P1<br><br>P1<br>A1   | for a method to find gradient of $L_1$ eg $\frac{6-2}{4-12}$ ( $= -\frac{1}{2}$ )<br>or states $L_2$ as $y = -3x$<br><br>(dep on P1) for a method to find equation of $L_1$<br>eg subs into $y = -\frac{1}{2}x + c$<br>OR states $L_1$ as $y = -\frac{1}{2}x + 8$<br><br>(dep on P2) complete method to equate both lines eg $-\frac{1}{2}x + 8 = -3x$<br>oe                                                                                                                                                                                                                                                                                                                                                     | Ignore sketches.<br><br><br><br>Accept equivalents eg $(-3.2, 9.6)$                                                                                                                                                                                                                                                                                                                                                                        |
| 19             | $9 < m < 11$<br>$-11 < m < -9$             | M1<br><br>M1<br>M1<br>M1<br>A1 | for a correct method to begin rearranging to solve for $m^2$<br>eg $88 < m^2 + 7$ or $m^2 + 7 < 128$ or $81 < m^2 < 121$<br><br>for a complete method to $m^2 = 81$ or $m^2 = 121$ or better<br><br>for a set of critical values: at least two out of $9, 11, -9, -11$<br><br>for selecting a correct inequality for one set of critical values<br>eg $9 < m$ and $m < -9$ or $m < 11$ and $-11 < m$ or $9 < m$ and $m < 11$<br>or a set of inequalities with some error<br>eg $9 ? m ? 11$ and $-11 ? m ? -9$ where ? is an incorrect inequality symbol like $9 < m \leq 11$ or $9 \geq m \geq 11$<br>or answer given as $\pm 9 < m < \pm 11$<br><br>$9 < m < 11$ and $-11 < m < -9$ given as boundaries of $m$ | It is insufficient to just multiply all three elements by 4; some rearrangement must occur such as showing as two separate inequalities or isolating $m^2$<br><br>Accept an inequality used in place of “=”.<br>$m^2$ must be isolated at this stage.<br><br>Do not award if other values are also given eg 10<br><br>Could be shown as $9 < m < 11$ or $-11 < m < -9$ or $-11 < m < 11$<br><br>Accept with an “and” or an “or” or neither |



| Paper: 1MA1/3H |                        |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                          |
|----------------|------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Question       | Answer                 | Mark                                       | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Additional guidance                                                                                      |
| 1              | 7.5                    | M1<br><br>A1                               | for correct use of Pythagoras, eg. $8.5^2 - 4^2 (= 56.25)$ or $4^2 + x^2 = 8.5^2$<br><br>for 7.5 or $7\frac{1}{2}$ or $\frac{15}{2}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Must have values substituted<br>Trigonometry may be used but M1 only awarded when complete method shown. |
| 2 (a)          | 25                     | M1<br><br>A1                               | for $(T =) 4 \times (-3)^2 - 11$ or $4 \times (-3)^2 = 36$<br><br>cao                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Can accept missing brackets.                                                                             |
| (b)            | $p = \frac{d-4}{3}$ oe | M1<br><br>A1                               | for a correct first step, eg. $d - 4 = 3p$ or $\frac{d}{3} = p + \frac{4}{3}$<br>or for $\frac{d-4}{3}$ as answer<br>for $p = \frac{d-4}{3}$ oe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | May be in unsimplified form,<br>eg $d - 4 = 3p + 4 - 4$                                                  |
| 3              | 1.5                    | P1<br><br>P1<br><br>P1<br><br>P1<br><br>A1 | for process to develop 3 algebraic expressions, eg. (R =) $n$ , (S =) $2n$ , (T =) $2n - 6$ , oe, at least two must be correct.<br><b>or</b> for selecting 3 values satisfying the given criteria, eg. (R =) 10, (S =) 20, (T =) 14<br><br>for process to sum 3 algebraic expressions and equating to 54, eg. $n + "2n" + "2n - 6" = 54$<br><b>or</b> for finding the correct sum of their values eg. $"10" + "20" + "14" = 44$<br><br>for start of process to solve the correct linear equation, eg. $5n = 54 + 6$ ( $n = 12$ )<br><b>or</b> for 12, 24, 18<br><br>for $"12" : 2 \times "12" - 6$ oe eg 12 : 18 oe or 18 : 12 linked to T, R<br><br>for 1.5 or $\frac{3}{2}$ or $1\frac{1}{2}$ | Accept 1 : 1.5 etc as answer                                                                             |

| Paper: 1MA1/1H |        |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                             |
|----------------|--------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Question       | Answer | Mark                               | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                      | Additional guidance                                                                         |
| 6              | 144    | P1<br><br>P1<br><br>P1<br>A1       | for using the ratio,<br>eg $x = 2y$ <b>or</b> $2y + 2y + y = 180$ <b>or</b> $2 + 2 + 1 = 5$ (parts))<br><br>for using angle facts to give an equation,<br>eg $x + x + y = 180$ <b>or</b> $2y + 2y + y = 180$ <b>or</b> $y + w = 180$<br><b>or</b> $5x \div 2 = 180$ <b>oe</b> <b>or</b> $w = 2x$<br><br><b>or</b> for $180 \div 5 (= 36)$<br><br>for a complete process, eg $180 - (180 \div 5)$<br><br>cao                      | The first two marks may be awarded in either order<br><br>Award P2 for $x = 72$ or $y = 36$ |
| 7              | 2400   | P1<br><br>P1<br><br>P1<br>P1<br>A1 | for setting up an equation in $x$ ,<br>eg $x + (3x + 1) + (2x - 5) = 44$ <b>or</b> $6x - 4 = 44$ <b>or</b> $x = 48 \div 6 (= 8)$<br><br>for substituting “8” into either $(3x + 1)$ or $(2x - 5)$<br>eg $3 \times “8” + 1 (= 25)$ <b>or</b> $2 \times “8” - 5 (= 11)$<br><br>for finding the mass of one book, eg $7500 \div “25” (= 300)$<br><br>for finding the mass of the books on shelf A, eg $“300” \times “8”$<br><br>cao |                                                                                             |
| 8              | 1100   | M1<br><br>A1                       | for a complete method to find the original cost,<br>eg $660 \div (100 - 40) \times 100$ or $660 \div 0.6$ <b>oe</b><br><br>cao                                                                                                                                                                                                                                                                                                   |                                                                                             |

| Paper: 1MA1/2H |        |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 7              | 240    | P1   | for forming an appropriate equation,<br>eg $2x + 11 = 4x - 4$ <b>or</b> $2x + 11 + 4x - 4 + 2x + 5 = 72$ <b>or</b> $8x + 12 = 72$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $8x = 60$ <b>or</b> $2x = 15$ implies P2<br>A correct length stated or shown on diagram implies P2<br>Eg $AB = 20$ , $AC = 26$ , $CB = 26$<br>$[AC]$ $[BC]$ $[AB]$ $[ACB]$ $[CAB]$ and $[BAC]$ must be clearly identified if incorrect. May be on diagram.<br>$AB = 2 \times "7.5" + 5 (= 20)$<br>$AC = 2 \times "7.5" + 11 (= 26)$<br>$CB = 4 \times "7.5" - 4 (= 26)$<br>Alternative scheme not expected on Foundation tier but may be seen. |
|                |        | P1   | (dep P1) for process to isolate terms in $x$ for their equation,<br>eg $4x - 2x = 11 + 4$ <b>or</b> $2x + 4x + 2x = 72 - 11 + 4 - 5$ <b>or</b> $x = 7.5$ oe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                |        | P1   | for correct application of Pythagoras,<br>eg $(26)^2 - \left(\frac{20}{2}\right)^2$ <b>or</b><br>$[AC]^2 - \left(\frac{[AB]}{2}\right)^2$ <b>or</b> height = 24<br><b>or</b> a complete method to find the height                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                |        | P1   | for process to find area of triangle, eg $20 \times 24 \div 2$<br><b>or</b> $[AB] \times [\text{height}] \div 2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                |        | A1   | cao                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                |        |      | for a correct trig statement to find $CAB$ or $CBA$ or $ACB$ , eg<br>$\cos CAB = \cos CBA = \frac{20 \div 2}{26}$ <b>or</b><br>$\cos CAB = \cos CBA = \frac{20^2 + 26^2 - 26^2}{2 \times 20 \times 26}$<br><b>or</b> $\cos ACB = \frac{26^2 + 26^2 - 20^2}{2 \times 26 \times 26}$<br><b>or</b> $CAB = 67.3 \dots$ <b>or</b> $CBA = 67.3 \dots$ <b>or</b> $ACB = 45.2 \dots$<br><br>for process to find area of triangle, eg<br>$\frac{1}{2} \times 26 \times 20 \times \sin 67.3 \dots$<br><b>or</b> $\frac{1}{2} \times 26 \times 26 \times \sin 45.2 \dots$<br><b>or</b> $\frac{1}{2} \times [AB] \times [AC] \times \sin [BAC]$<br><b>or</b> $\frac{1}{2} \times [BC] \times [AC] \times \sin [ACB]$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                |



| Paper: 1MA1/2H |                                                                    |                          |                |                                                                                                                                                                                   |
|----------------|--------------------------------------------------------------------|--------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                                                            | Answer                   | Mark           | Notes                                                                                                                                                                             |
| 14             |                                                                    | Region R shaded          | M1<br>M1<br>A1 | for two of the lines $y = 1$ , $x + y = 5$ , $y = 2x$ correctly drawn<br>for three lines correctly drawn<br>for fully correct region indicated with all lines correct             |
| 15 (a)<br>(b)  |                                                                    | No with reason<br><br>66 | C1<br>M1<br>A1 | for “no” with reason, eg Tracey should multiply 8 and 7<br>for starting a method to find number of games played, eg $12 \times 11 (= 132)$ or sum of integers from 1 to 11<br>cao |
| 16             | $\frac{- - 4 \pm \sqrt{(-4)^2 - 4 \times 1 \times 1}}{2 \times 1}$ | 0.268, 3.73              | M1<br>A1       | for $x - 2 = \pm\sqrt{3}$ oe or one solution or use of $x^2 - 4x + 1 = 0$ to substitute into formula (allow one error in substitution)<br><br>0.267 – 0.27, 3.7 – 3.74            |



| Paper: 1MA1/3H |         |                     |      |                                                                                                                                          |
|----------------|---------|---------------------|------|------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working | Answer              | Mark | Notes                                                                                                                                    |
| 11 (a)         |         | 57                  | B1   | cao                                                                                                                                      |
| (b)            |         | Decision and reason | C1   | Jamil might not be correct and reason, eg the maximum weight could be less than 80 or the minimum weight could be less than 40           |
| (c)            |         | Shown               | C1   | for evidence of reading from the graph at weight 65 (= 48 to 49) or at cf 45 (= 63)                                                      |
|                |         |                     | C1   | eg 25% of 60 is 15 but only 11 potatoes have a weight greater than 65g or 25% of potatoes have a weight greater than 63g                 |
| 12             |         | 48                  | M1   | for $0.25 \times 0.6 (= 0.15)$ or $0.75 \times 0.4 (= 0.3)$                                                                              |
|                |         |                     | M1   | for $0.25 \times 0.6 (= 0.15)$ and $0.75 \times 0.4 (= 0.3)$ or for $24 \div "0.15" (= 160)$                                             |
|                |         |                     | A1   | cao                                                                                                                                      |
| 13             |         | $(x + 3)^2 - 16$    | M1   | for $(x + 3)^2$ or $(x^2 + 6x - 7) x^2 + 2ax + a^2 + b$                                                                                  |
|                |         |                     | A1   | cao                                                                                                                                      |
| 14             |         | Shown               | M1   | for $\sqrt[3]{\frac{8}{27}} (= \frac{2}{3})$ or $\sqrt[3]{\frac{27}{8}} (= \frac{3}{2})$ or 2 : 3 or 3 : 2                               |
|                |         |                     | M1   | for $\left(\sqrt[3]{\frac{8}{27}}\right)^2 (= \frac{4}{9})$ or $\left(\sqrt[3]{\frac{27}{8}}\right)^2 (= \frac{9}{4})$ or 4 : 9 or 9 : 4 |
|                |         |                     | A1   | 132 from correct arithmetic                                                                                                              |



| Paper: IMA1/1H |                       |      |                                                                                                                  |                                          |
|----------------|-----------------------|------|------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Question       | Answer                | Mark | Mark scheme                                                                                                      | Additional guidance                      |
| 18 (a)         | $3\sqrt{3}$           | M1   | for working unambiguously with $\sqrt{12}$ , eg $\sqrt{4 \times 3}$ or $\sqrt{4} \times \sqrt{3}$ or $2\sqrt{3}$ |                                          |
|                |                       | A1   | cao                                                                                                              |                                          |
|                |                       | M1   | for simplifying the power eg $(\sqrt{3})^7 = 27\sqrt{3}$                                                         |                                          |
|                |                       | M1   | for method to rationalise the denominator eg multiplying by $\frac{\sqrt{3}}{\sqrt{3}}$                          |                                          |
| 18 (b)         | $\frac{\sqrt{3}}{81}$ | M1   | for simplifying the power eg $(\sqrt{3})^7 = 27\sqrt{3}$                                                         | May be seen as the first step            |
|                |                       | M1   | for method to rationalise the denominator eg multiplying by $\frac{\sqrt{3}}{\sqrt{3}}$                          |                                          |
|                |                       | A1   | for $\frac{\sqrt{3}}{81}$ or equivalent fraction in form $\frac{\sqrt{b}}{c}$ , eg $\frac{\sqrt{2187}}{2187}$    |                                          |
|                |                       | A1   | for $\frac{\sqrt{3}}{81}$ or equivalent fraction in form $\frac{\sqrt{b}}{c}$ , eg $\frac{\sqrt{2187}}{2187}$    |                                          |
| 19 (i)         | 3, 8                  | M1   | for $a = 3$ , may be seen in working or as part of an expression, eg $(x - 3)^2 - 9$                             | 9 does not have to be seen for this mark |
|                |                       | A1   | for $a = 3, b = 8$                                                                                               |                                          |
|                |                       | B1   | for 3, -8 or ft (i)                                                                                              |                                          |
|                |                       | B1   | for 3, -8 or ft (i)                                                                                              |                                          |
| 19 (ii)        | 3, -8                 | M1   | for $a = 3$ , may be seen in working or as part of an expression, eg $(x - 3)^2 - 9$                             | 9 does not have to be seen for this mark |
|                |                       | A1   | for $a = 3, b = 8$                                                                                               |                                          |
|                |                       | B1   | for 3, -8 or ft (i)                                                                                              |                                          |
|                |                       | B1   | for 3, -8 or ft (i)                                                                                              |                                          |

| Paper: 1MA1/1H |                |      |                                                                                                                                                                                                                                       |                                                            |
|----------------|----------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Question       | Answer         | Mark | Mark scheme                                                                                                                                                                                                                           | Additional guidance                                        |
| 8              | 8 and -3       | M1   | for rearranging to get $x^2 - 5x - 24 (= 0)$ <b>or</b> $-x^2 + 5x + 24 (= 0)$                                                                                                                                                         | Can be implied by $(x - 8)(x + 3)$<br>or $(-x + 8)(x + 3)$ |
|                |                | M1   | for $(x \pm 8)(x \pm 3)$ <b>or</b> $(x + a)(x + b)$ where $ab = -24$ or $a + b = -5$<br><b>or</b> substitution into formula, condoning one sign error<br>eg $(x =) \frac{- -5 \pm \sqrt{(-5)^2 - 4 \times 1 \times -24}}{2 \times 1}$ |                                                            |
|                |                | A1   | for 8 <b>and</b> -3                                                                                                                                                                                                                   |                                                            |
| 9 (a)          | 1              | B1   | cao                                                                                                                                                                                                                                   |                                                            |
| (b)            | 3              | B1   | cao                                                                                                                                                                                                                                   |                                                            |
| (c)            | $\frac{1}{16}$ | B1   | oe                                                                                                                                                                                                                                    |                                                            |
| (d)            | 3              | B1   | cao                                                                                                                                                                                                                                   |                                                            |
| 10 (a)         | 30             | P1   | for a start to the process,<br>eg $5406 \div 6 (= 901)$ <b>or</b> $5400 \div 6 (= 900)$ <b>or</b> $5000 \div 6 (= 833.33..)$<br><b>or</b> $5410 \div 6 (= 901.66..)$                                                                  |                                                            |
|                |                | P1   | for a process to find the length of one side,<br>eg $\sqrt{901}$ <b>or</b> $\sqrt{900}$ <b>or</b> $\sqrt{833.33..}$ <b>or</b> $\sqrt{901.66..}$                                                                                       |                                                            |
|                |                | A1   | for 30                                                                                                                                                                                                                                |                                                            |
| (b)            | Explanation    | C1   | for a correct explanation based on their working in (a),<br>eg underestimate because I rounded the total area down                                                                                                                    |                                                            |

| Paper: 1MA1/2H |                                  |      |                                                                                                                                                                                                                                                 |                                                                                                   |
|----------------|----------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Question       | Answer                           | Mark | Mark scheme                                                                                                                                                                                                                                     | Additional guidance                                                                               |
| 17             | 3.6                              | P1   | process to find the volume scale factor,<br>eg $1587.762 \div 58.806 (= 27)$<br><b>or</b> $58.806 \div 1587.762 (= 0.037\dots)$                                                                                                                 |                                                                                                   |
|                |                                  | P1   | process to find the height of <b>B</b> , eg $2 \times 43.74 \div 8.1 (= 10.8)$<br><b>or</b><br>process to find the area of <b>A</b> , eg $43.74 \div (\sqrt[3]{27})^2 (= 4.86)$<br><b>or</b> $43.74 \times (\sqrt[3]{0.037\dots})^2 (= 4.86)$   |                                                                                                   |
|                |                                  | P1   | complete process to find height of <b>A</b> ,<br>eg “ $10.8 \div \sqrt[3]{27}$ ” <b>or</b> “ $4.86 \times 2 \div (8.1 \div \sqrt[3]{27})$ ”                                                                                                     |                                                                                                   |
|                |                                  | A1   | cao                                                                                                                                                                                                                                             |                                                                                                   |
| 18             | 21.3                             | P1   | for $\frac{1}{2} \times 11.2 \times 4.3 \times \sin(118)$                                                                                                                                                                                       | If a correct answer within the range is shown in working but incorrectly rounded award full marks |
|                |                                  | A1   | answer in the range 21.26 to 21.3                                                                                                                                                                                                               |                                                                                                   |
| 19             | $-\frac{3}{2}$ and $\frac{2}{3}$ | M1   | for $(2x \pm 3)(3x \pm 2)$ <b>or</b> $(6x \pm 4)(x \pm \frac{9}{6})$ <b>or</b> $(6x \pm 4)(x \pm \frac{3}{2})$ <b>or</b> correct substitution into the quadratic formula,<br>eg $\frac{-5 \pm \sqrt{5^2 - 4 \times 6 \times (-6)}}{2 \times 6}$ |                                                                                                   |
|                |                                  | M1   | $(2x + 3)(3x - 2)$ $(6x - 4)(x + \frac{9}{6})$ <b>or</b> $(6x - 4)(x + \frac{3}{2})$ <b>or</b> $\frac{-5 \pm \sqrt{169}}{12}$<br><b>or</b> one correct answer                                                                                   |                                                                                                   |
|                |                                  | A1   | oe accept answers of $-1.5$ and in the range 0.66 to 0.67                                                                                                                                                                                       |                                                                                                   |

| Paper: 1MA1/3H |                                   |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                 |
|----------------|-----------------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Question       | Answer                            | Mark                               | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Additional guidance                                                                                             |
| 21             | (7, -196)<br>supported            | P1<br><br>P1<br><br>A1             | for process as far as $4(x^2 - 14x)$ or $(2x - 14)^2 + c$<br>or for $(x - 7)^2 - 49$<br><br>for full process to complete the square<br>eg $4((x - 7)^2 - 49)$ or $(2x - 14)^2 - 196$<br><br>for conclusion from correct use of completing the square                                                                                                                                                                                                                    | $c$ may be 0                                                                                                    |
| 22             | $a = 4$<br>$b = 110$              | M1<br><br>M1<br><br><br><br><br>A1 | for writing at least one of the 3 terms with a denominator<br>of $(x^2 - 25)$ or $(x - 5)(x + 5)$<br>eg, $\frac{(2x+3)(x+5)}{x^2-25}$ oe or $\frac{(x-4)(x-5)}{x^2-25}$ oe or $\frac{3(x^2-25)}{x^2-25}$ oe<br><br>for $\frac{(2x+3)(x+5)}{x^2-25} + \frac{(x-4)(x-5)}{x^2-25} - \frac{3(x^2-25)}{x^2-25}$ oe<br><br>or for $\frac{3x^2+4x+35}{x^2-25} (-3)$<br><br>or for $\frac{[3x^2+4x+35]}{x^2-25} - \frac{3(x^2-25)}{x^2-25}$ oe<br><br>for $a = 4$ and $b = 110$ | Students may work with a denominator of $(x - 5)(x + 5)$ for the award of the first 2 marks.                    |
| 23             | (a) Sketch<br><br>(b) $y = -g(x)$ | B1<br><br>B1                       | for appropriate sketch which crosses the x axis at $(-3, 0)$ , $(-1, 0)$ , $(0, 0)$ and passes through $(-2, 2)$ with end points in the correct square<br><br>oe                                                                                                                                                                                                                                                                                                        | Allow some tolerance on the points and in drawing the curve if the intention is clear<br><br>Accept $-y = g(x)$ |

| Paper: IMA1/1H |         |      |                                                                                                                                                                              |                     |
|----------------|---------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Question       | Answer  | Mark | Mark scheme                                                                                                                                                                  | Additional guidance |
| 16 (a)         | 125     | M1   | for method to find the number of 3 digit combinations, eg $5^3$ <b>or</b> $5^3 - 1$                                                                                          |                     |
|                |         | A1   | for 125 <b>or</b> 124                                                                                                                                                        |                     |
|                | 60      | M1   | for method to find the number of combinations with 3 different digits eg $5 \times 4 \times 3$ <b>or</b> finds there are 65 combinations that do not have 3 different digits |                     |
|                |         | A1   | cao                                                                                                                                                                          |                     |
| 17             | -1, 2.5 | P1   | for process to form an equation, eg $\frac{x^2}{3x+5} = \frac{1}{2}$ <b>or</b> $2x^2 = 3x + 5$                                                                               |                     |
|                |         | P1   | for writing in a suitable form ready for solution, eg $2x^2 - 3x - 5 (= 0)$ <b>or</b> $-2x^2 + 3x + 5 (= 0)$                                                                 |                     |
|                |         | P1   | (dep 1st P1) for process to solve quadratic equation of form $ax^2 + bx + c (= 0)$                                                                                           |                     |
|                |         |      | eg $(2x - 5)(x + 1) (= 0)$                                                                                                                                                   |                     |
|                |         |      | <b>or</b> $\frac{- -3 \pm \sqrt{(-3)^2 - 4 \times 2 \times -5}}{2 \times 2}$                                                                                                 |                     |
|                |         | A1   | for -1, 2.5 oe                                                                                                                                                               |                     |



| Paper: 1MA1/1H |        |      |                                                                                                                                                                                                                      |                                                                                                                                        |
|----------------|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer | Mark | Mark scheme                                                                                                                                                                                                          | Additional guidance                                                                                                                    |
| 14             | 5      | P1   | for process to find the area of the triangle,<br>eg. $0.5 \times (x + 4)(x - 2)$ oe<br>OR for process to find the area of rectangle and $27.5 \times 2$ ,<br>eg. $(x + 4)(x - 2)$ and 55                             | Trial and improvement methods must be fully correct identifying the value of $x$ as 7 (3 marks)<br>or the shortest side as 5 (4 marks) |
|                |        | P1   | (dep P1) for process to expand the brackets and derive a quadratic equation,<br>eg. $x^2 + 4x - 2x - 8 = 55$ or $0.5(x^2 + 4x - 2x - 8) = 27.5$ oe                                                                   |                                                                                                                                        |
|                |        | P1   | (dep P2) for complete process to solve the quadratic equation<br>$x^2 + 2x - 63 = 0$<br>eg $(x - 7)(x + 9) (= 0)$ or $\frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -63}}{2 \times 1}$<br>or $(x + 1)^2 - 1 - 63 (= 0)$ |                                                                                                                                        |
|                |        | A1   | cao<br><br>SC: B1 for $x^2 + 4x - 2x - 8 = 27.5$                                                                                                                                                                     |                                                                                                                                        |



| Paper: 1MA1/1H |                             |      |                                                                                                                                                                                                                                                                              |                                                                                                                                                                                        |
|----------------|-----------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                      | Mark | Mark scheme                                                                                                                                                                                                                                                                  | Additional guidance                                                                                                                                                                    |
| 19             | $\frac{5 \pm \sqrt{15}}{2}$ | M1   | for using a common denominator<br>eg $\frac{x-1}{(2x-1)(x-1)} + \frac{3(2x-1)}{(2x-1)(x-1)} (= 1)$<br><br>or $(x-1) + 3(2x-1) = (2x-1)(x-1)$                                                                                                                                 | Note we don't need to see "= 0"; just the LHS is sufficient<br>Accept other forms of the 3 term quadratic, eg $2x^2 - 10x = -5$<br><br>Correct use of formula or completing the square |
|                |                             | M1   | for expanding and rearranging to get $2x^2 - 10x + 5 (= 0)$                                                                                                                                                                                                                  |                                                                                                                                                                                        |
|                |                             | M1   | (dep M1) ft for a method to solve their 3 term quadratic equation<br>eg $\frac{10 \pm \sqrt{(-10)^2 - 4 \times 2 \times 5}}{2 \times 2}$ or $\frac{10 \pm \sqrt{60}}{4}$<br>or $2 \left[ \left( x - \frac{5}{2} \right)^2 - \left( \frac{5}{2} \right)^2 \right] + 5 = 0$ oe |                                                                                                                                                                                        |
|                |                             | A1   | cao                                                                                                                                                                                                                                                                          |                                                                                                                                                                                        |



| Paper: 1MA1/1H |                                        |      |                                                                                                                                                                                                                                            |                                                                                                                                  |
|----------------|----------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                                 | Mark | Mark scheme                                                                                                                                                                                                                                | Additional guidance                                                                                                              |
| 19             | $-\frac{1}{2} \pm \frac{1}{2}\sqrt{2}$ | P1   | for using a common denominator,<br>eg $\frac{x+1}{x(x+1)} - \frac{x}{x(x+1)} (=4)$ or $\frac{x+1-x}{x(x+1)} (=4)$<br><br>or $x+1-x = 4x(x+1)$                                                                                              |                                                                                                                                  |
|                |                                        | P1   | for expanding and rearranging to get $4x^2 + 4x - 1 (=0)$                                                                                                                                                                                  | Note we don't need to see " $=0$ "; just the LHS is sufficient<br>Accept other forms of the 3 term quadratic, eg $4x^2 + 4x = 1$ |
|                |                                        | P1   | (dep P1) ft for a method to solve their 3 term quadratic equation,<br>eg $\frac{-4 \pm \sqrt{4^2 - 4 \times 4 \times -1}}{2 \times 4}$<br>or $4 \left[ \left( x + \frac{1}{2} \right)^2 - \left( \frac{1}{2} \right)^2 \right] - 1 = 0$ oe | Correct use of formula or completing the square                                                                                  |
|                |                                        | A1   | for values of $x$ , eg $\frac{-4 \pm \sqrt{32}}{8}$ or $\pm \sqrt{\frac{1}{2}} - \frac{1}{2}$ oe                                                                                                                                           |                                                                                                                                  |
|                |                                        | A1   | for $-\frac{1}{2} \pm \frac{1}{2}\sqrt{2}$ oe in the form $a \pm b\sqrt{2}$ where $a$ and $b$ are fractions                                                                                                                                | Accept $a = -\frac{1}{2}, b = \frac{1}{2}$<br>or $a = -\frac{1}{2}, b = -\frac{1}{2}$                                            |



| Paper: 1MA1/1H |        |      |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                |
|----------------|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                  | Additional guidance                                                                                                            |
| 13             | 7      | P1   | for setting up an equation using volumes,<br><br>eg $(x + 2)(2x - 1)(x - 1) = 2x(x + 3)(x - 3) + 142$                                                                                                                                                                                                                                                                                        | May occur later in the process<br>Must use expressions for volumes but these may have been incorrectly expanded and simplified |
|                |        | P1   | for process to find an expanded expression for the area of <b>one</b> face,<br><br>eg $(x + 2)(2x - 1) = 2x^2 - x + 4x - 2$ or $2x^2 + 3x - 2$<br>or $(x + 2)(x - 1) = x^2 - x + 2x - 2$ or $x^2 + x - 2$<br>or $(2x - 1)(x - 1) = 2x^2 - 2x - x + 1$ or $2x^2 - 3x + 1$<br>or $2x(x + 3) = 2x^2 + 6x$<br>or $2x(x - 3) = 2x^2 - 6x$<br>or $(x + 3)(x - 3) = x^2 - 3x + 3x - 9$ or $x^2 - 9$ | Condone one incorrect term in expansion of two brackets                                                                        |
|                |        | P1   | for a complete process to find a fully expanded expression for the volume of <b>one</b> cuboid,<br><br>eg $2x^3 + 3x^2 - 2x - 2x^2 - 3x + 2$ or $2x^3 + x^2 - 5x + 2$<br><b>or</b> $2x^3 + 6x^2 - 6x^2 - 18x$ or $2x^3 - 18x$                                                                                                                                                                | Expression need not be fully simplified, but must be correct                                                                   |
|                |        | P1   | (dep P3) for correct rearrangement of the expanded terms in their equation leading to a 3-term quadratic<br><br>eg $x^2 + 13x - 140 (= 0)$ or $x^2 + 13x = 140$                                                                                                                                                                                                                              |                                                                                                                                |
|                |        | A1   | cao                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                |

| Paper: 1MA1/3H |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                        |
|----------------|-------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer            | Mark     | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Additional guidance                                                                                                                                                                                                                                                                                    |
| 17 (a)(i)      | $(x-4)^2 - 13$    | M1       | for start to method of completing the square, eg $(x-4)^2...$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>This mark is dependent on a completed square form given in (a)(i)</p> <p>Condone one sign error</p> <p>One correct solution in the required form out of two solutions given scores 2 marks.</p> <p>If an answer is shown in the range in working and then incorrectly rounded award full marks.</p> |
| (ii)           | $(4, -13)$        | A1<br>B1 | cao<br>ft from answer of form $(x-a)^2 - b$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                        |
| (b)            | 0.449 and $-1.59$ | M1       | for substitution into quadratic formula,<br>eg $\frac{-8 \pm \sqrt{8^2 - 4 \times 7 \times -5}}{2 \times 7}$ oe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                        |
|                |                   | M1       | for simplification to $\frac{-8 \pm \sqrt{204}}{14}$ or $\frac{-4 \pm \sqrt{51}}{7}$ oe<br>or for one correct solution in decimal form.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                        |
|                |                   | A1       | for 0.448 to 0.449 and $-1.59$ to $-1.6(0)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                        |
| (c)            | Explanation       | C1       | <p>for explanation</p> <p><b>Acceptable</b><br/>           He hasn't considered the coefficient of 3<br/>           He forgot about the 3<br/>           The answer <math>x = 2</math> should be <math>x = \frac{2}{3}</math><br/>           The first bracket was not <math>k - 2</math><br/> <math>k = 2</math> is wrong, he should have divided by 3</p> <p><b>Not acceptable</b><br/>           One of the answers is wrong<br/>           The solutions are not correct<br/>           He should have written <math>3(k-2)(k+4)</math><br/>           The <math>3k</math> should not be inside the bracket<br/>           2 added to <math>-4</math> does not give 10<br/> <math>k = 2</math> is wrong</p> |                                                                                                                                                                                                                                                                                                        |

| Paper: 1MA1/3H |                       |      |                                                                                                                                               |                                                                                                                                                                                                |
|----------------|-----------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                | Mark | Mark scheme                                                                                                                                   | Additional guidance                                                                                                                                                                            |
| 9 (a)          | $2x^3 + x^2 - 7x - 6$ | M1   | for a method to find the product of two linear expressions eg 3 correct terms out of 4 terms or 4 terms ignoring signs                        | Note that (eg) $-x - 6$ in expansion of $(x - 2)(2x + 3)$ is to be regarded as 3 correct terms.<br>First product must be quadratic but need not be simplified or may be simplified incorrectly |
|                |                       | M1   | for a complete method to obtain all terms, half of which are correct (ft their first product) eg $2x^3 - x^2 - 6x + 2x^2 - x - 6$             |                                                                                                                                                                                                |
|                |                       | A1   | cao                                                                                                                                           |                                                                                                                                                                                                |
|                | -5                    | M1   | for beginning to combine indices eg $4+n$ or $y^{3+2}$                                                                                        | Condone one sign error in the substitution<br>Accept $-4^2$ or $(-4)^2$                                                                                                                        |
|                |                       | A1   | cao                                                                                                                                           |                                                                                                                                                                                                |
|                | 1.27 and -0.472       | M1   | for substitution into the formula                                                                                                             |                                                                                                                                                                                                |
|                |                       | M1   | for simplifying to the form $\frac{-b \pm \sqrt{N}}{k}$ eg $\frac{4 \pm \sqrt{76}}{10}$<br><b>or</b> 1.27 to 1.28<br><b>or</b> -0.48 to -0.47 |                                                                                                                                                                                                |
|                |                       | A1   | for 1.27 to 1.28 <b>and</b> -0.48 to -0.47                                                                                                    |                                                                                                                                                                                                |

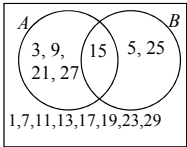


| Paper: 1MA1/1H |                     |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                      |
|----------------|---------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer              | Mark                                    | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Additional guidance                                                                                                                                                                                                                                                                                  |
| 9              | $x = 6$<br>$y = -2$ | B1                                      | cao                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                      |
| 10             | 140                 | <p>P1</p> <p>P1</p> <p>P1</p> <p>A1</p> | <p>for process to find sum of the interior angles of a pentagon<br/>eg <math>180 \times (5 - 2) (= 540)</math> oe</p> <p>(dep P1) for process to use ratio 4 : 1,<br/>eg labels as <math>4x</math> and <math>x</math> or as <math>x</math> and <math>\frac{1}{4}x</math><br/>or <math>110 + 135 + 120 + 4x + x = "540"</math><br/><b>or</b> for <math>"540" - 110 - 135 - 120 (= 175)</math></p> <p>for process to find angle <math>ABC</math> or angle <math>AED</math><br/>eg <math>"175" \div (4 + 1) (= 35)</math> <b>or</b> <math>"175" \div (4 + 1) \times 4</math></p> <p>cao</p> | <p>Angles must be clearly labelled on the diagram or otherwise identified. Correct method can be implied from angles on the diagram if no ambiguity or contradiction.</p> <p>Ratio must be used correctly if awarded for diagram</p> <p>A correct answer with no supportive working gets 0 marks</p> |



| Paper: 1MA1/1H |                                            |                |             |                                                                                                                                  |
|----------------|--------------------------------------------|----------------|-------------|----------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                                     | Mark           | Mark scheme | Additional guidance                                                                                                              |
| 8              | (a)                                        | 75 to 81       | B2          | for answer in the range 75 to 81                                                                                                 |
|                |                                            |                | (B1         | for 60 or 100 or 6000 or 6400 or $\sqrt{64 \times 100}$ )                                                                        |
|                | (b)                                        | 0.000 148      | B1          | for 0.000 148 oe                                                                                                                 |
|                | (c)                                        | $\frac{1}{25}$ | B1          | for $\frac{1}{25}$ or 0.04                                                                                                       |
| 9              |                                            | $5\frac{3}{5}$ | M1          | for writing as improper fractions with at least one correct, eg $\frac{7}{2} \times \frac{8}{5}$ oe                              |
|                |                                            |                | M1          | (dep) for multiplying improper fractions,<br>eg " $\frac{56}{10}$ " or $5\frac{6}{10}$ or $\frac{28}{5}$ oe                      |
|                |                                            |                | A1          | cao                                                                                                                              |
| 10             | $x = 2.2$ to $2.3$<br>$y = -1.3$ to $-1.4$ |                | M1          | for recognition of use of intersection point, one of the solutions given, solutions reversed or solutions given as a coordinate. |
|                |                                            |                | A1          | $x$ given in the range 2.2 to 2.3, $y$ given in the range $-1.3$ to $-1.4$                                                       |



| Paper 1MA1: 3H |                                                                                   |                                |                      |                                                                                                                                                                                                                                                                                                                              |
|----------------|-----------------------------------------------------------------------------------|--------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                                                                           | Answer                         | Mark                 | Notes                                                                                                                                                                                                                                                                                                                        |
| 1 (a)          |  | Venn Diagram                   | B1<br>M1<br>M1<br>C1 | for labels on diagram<br>for just 15 in the intersection<br>for just 5 and 25 in only set B or just 3, 9, 21 and 27 in only set A or just 1, 7, 11, 13, 17, 19, 23, 29 in $(A \cup B)'$<br>for all numbers correctly placed in the Venn Diagram<br>Ignore all entries except the region you are marking for each method mark |
| (b)            |                                                                                   | $\frac{7}{15}$                 | P1<br>A1             | fit for $\frac{7}{a}$ where $a \geq 7$ or $\frac{b}{15}$ where $b \leq 15$<br>fit $\frac{7}{15}$ oe                                                                                                                                                                                                                          |
| 2              |                                                                                   | $x = -\frac{2}{3}$<br>$y = -2$ | M1<br>M1<br>A1       | for a method to eliminate one variable (condone one arithmetic error)<br>(dep) for substituting found value in one of the equations or appropriate method after starting again (condone one arithmetic error)<br>$x = -\frac{2}{3}$ oe and $y = -2$                                                                          |
| 3 (a)          |                                                                                   | 12                             | B1                   | cao                                                                                                                                                                                                                                                                                                                          |
| (b)            |                                                                                   | Explanation                    | C1                   | No with statement about not being mutually exclusive events eg a person could be in both categories                                                                                                                                                                                                                          |



| Paper: IMA1/1H |                     |                                  |                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                        |
|----------------|---------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer              | Mark                             | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                        | Additional guidance                                                                                                                    |
| 6              | $x = 4.5, y = -1.5$ | M1<br><br>M1<br><br>A1           | correct process to eliminate one variable (condone one arithmetic error)<br><br>(dep) for substituting found value in one of the equations<br><b>OR</b> correct process after starting again (condone one arithmetic error)<br><br>for $x = 4.5, y = -1.5$ oe                                                                                                                                      | Fractions do not need to be in simplest form                                                                                           |
| 7              | shown               | C1<br><br>C1<br><br>C1<br><br>C1 | for method to find area of semicircle,<br>eg $\pi \times 10^2 \div 2 (= 50\pi)$<br><br>for method to find area of quarter circle,<br>for $\pi \times 20^2 \div 4 (= 100\pi)$<br><br>for a complete method to find area shaded <b>and</b> area of square,<br>eg $\pi \times 20^2 \div 4 - \pi \times 10^2 \div 2$ <b>and</b> $20 \times 20$<br><br>fully correct working leading to $\frac{\pi}{8}$ | Can award first 3 marks if a value for $\pi$ is used<br><br><br>Working out to find the area of the shaded region <b>must</b> be shown |
| 8              | (a) 1<br><br>(b) 8  | B1<br><br>M1<br><br>A1           | cao<br><br>starts process, eg $\cos(60) = \frac{4}{x}$ or $0.5 = \frac{4}{x}$ oe or $\sin 30 = \frac{4}{x}$<br><br>or $\frac{\sin 30}{4} = \frac{\sin 90}{x}$ oe<br>cao                                                                                                                                                                                                                            | All three elements of cos, 4, x must be present in an equation. eg $\cos = 4/x$ is acceptable but $\cos(4/x)$ is insufficient          |

| Paper: IMA1/3H |        |      |             |                     |
|----------------|--------|------|-------------|---------------------|
| Question       | Answer | Mark | Mark scheme | Additional guidance |
| 5              | (a)    |      |             |                     |
|                |        |      |             |                     |
|                | (b)    |      |             |                     |
| 6              | (a)    |      |             |                     |
|                |        |      |             |                     |
|                | (b)    |      |             |                     |
| 7              |        |      |             |                     |
|                |        |      |             |                     |
|                |        |      |             |                     |

| Paper: 1MA1/1H |                                                     |                           |      |                                                                                                                                                                                            |
|----------------|-----------------------------------------------------|---------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                                             | Answer                    | Mark | Notes                                                                                                                                                                                      |
| 11             |                                                     | Tea £1.40<br>Coffee £1.80 | P1   | for setting up two appropriate equations eg $3t + 2c = 7.80$ , $5t + 4c = 14.20$                                                                                                           |
|                |                                                     |                           | M1   | for method to eliminate one variable, condone one arithmetic error                                                                                                                         |
|                |                                                     |                           | M1   | for method to substitute found variable or start again                                                                                                                                     |
|                |                                                     |                           | A1   | Tea £1.4(0) and Coffee £1.8(0) with amounts linked to correct drinks                                                                                                                       |
| 12 (a)         | 161 + 7<br>154 + 20                                 | Box plot                  | M1   | for method to find UQ (168) <b>or</b> highest value (174), may be implied by correct values plotted                                                                                        |
|                |                                                     |                           | M1   | for showing a box and at least 3 correctly plotted values from 154, 161, 165, 168, 174                                                                                                     |
|                |                                                     |                           | A1   | for fully correct box plot                                                                                                                                                                 |
|                |                                                     |                           |      |                                                                                                                                                                                            |
| (b)            | Med IQR Range<br>Y11 165 7 20<br>Y7 157.5 10.5 24.5 | Comparison                | C1   | (ft) for comparison of the median                                                                                                                                                          |
|                |                                                     |                           | C1   | (ft) for comparison of the spread<br>NB: for award of both marks, at least one comparison must be in context.<br>NB: figures need not be stated, but if they are they must be correct (ft) |
| 13 (a)         |                                                     | 120                       | P1   | for $\frac{4 \times 450}{15}$ <b>or</b> $\frac{4}{15} = \frac{x}{450}$ oe                                                                                                                  |
|                |                                                     |                           | A1   | cao                                                                                                                                                                                        |
|                |                                                     |                           | P1   | 5.5 <b>or</b> 6.5 <b>or</b> 165 <b>or</b> $\frac{5 \times 450}{15}$ (=150) and $\frac{6 \times 450}{15}$ (=180)                                                                            |
|                |                                                     |                           | A1   | for $\frac{165}{450}$ oe                                                                                                                                                                   |
| (b)            |                                                     | $\frac{165}{450}$         |      |                                                                                                                                                                                            |

| Paper: 1MA1/3H |                      |      |                                                                                                                               |                                                                                                                   |
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| Question       | Answer               | Mark | Mark scheme                                                                                                                   | Additional guidance                                                                                               |
| 16             | Shown (supported)    | M1   | for eliminating $y$ or $x$ , eg $x^2 + 3x - 3 = 5x - 4$                                                                       | There must be a statement in words for the award of this mark                                                     |
|                |                      | M1   | for rearranging, collecting terms and setting to 0 eg $x^2 - 2x + 1 (= 0)$                                                    |                                                                                                                   |
|                |                      | M1   | for factorising or solving eg $(x - 1)^2 (= 0)$                                                                               |                                                                                                                   |
|                |                      | C1   | for statement confirming only 1 point in common eg only 1 root <b>or</b> only 1 value of $x$ so only 1 set of coordinates     |                                                                                                                   |
| 17             | $x = \frac{1}{2}z^6$ | M1   | for setting up an equation eg $x = ky^2$ <b>oe</b> <b>or</b> $y = cz^3$ <b>oe</b>                                             | Accept use of proportionality sign, eg $x \propto y^2$ or $y \propto z^3$ or $x \propto ky^2$ or $y \propto cz^3$ |
|                |                      | M1   | for eliminating $y$ eg $x = k(cz^3)^2$ <b>oe</b><br>OR<br>substitutes values in both equations, eg $32 = ky^2$ and $y = cz^3$ | Accept use of proportionality sign, eg $32 \propto ky^2$ and $y \propto cz^3$                                     |
|                |                      | M1   | for substituting in 32 and 2 to find the constant, eg $32 = m2^6$<br>OR<br>combines equations, eg $32 = k c^2 2^6$            |                                                                                                                   |
|                |                      | A1   | <b>oe</b>                                                                                                                     |                                                                                                                   |



| Paper: 1MA1/1H |                                                            |                                  |                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                          |
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| Question       | Answer                                                     | Mark                             | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                        | Additional guidance                                                                                                                                                                      |
| 10 (a)         | $\frac{1}{16}$                                             | M1                               | for method to find probability of getting a score of 5,<br>eg $\frac{10}{6+8+9+7+10} (= \frac{10}{40})$ oe                                                                                                                                                                                                                                                                                         | Accept any equivalent fraction, decimal form 0.06(25) or 0.063, percentage form 6(.25)% or 6.3%<br>Ignore subsequent incorrect attempts to write the correct answer in a different form. |
|                |                                                            | A1                               | for $\frac{1}{16}$ oe                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                          |
|                | 15                                                         | M1                               | for method to find the proportion of 1s, eg $\frac{6}{40}$ oe                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                          |
|                |                                                            | A1                               | cao                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                          |
| 11             | Enlargement<br>scale factor $\frac{1}{3}$<br>centre (0, 2) | B2<br><br>(B1)                   | for enlargement scale factor $\frac{1}{3}$ centre (0, 2)<br><br>for any 2 aspects)                                                                                                                                                                                                                                                                                                                 | No marks if more than one transformation is given                                                                                                                                        |
| 12             | $x = 3, y = -2$                                            | M1<br><br>A1<br><br>M1<br><br>A1 | for a correct method to eliminate either variable or rearrangement of one equation leading to substitution (condone one arithmetic error)<br><br>for either correct value of $x$ or correct value of $y$<br><br>(dep M1) for a correct substitution of found value into one of the equations or a correct method leading to the second value (condone one arithmetic error)<br><br>$x = 3, y = -2$ | Trial and improvement methods score 0 marks unless both $x$ and $y$ are correct                                                                                                          |

| Paper: 1MA1/2H |                   |                      |                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                        |
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| Question       | Answer            | Mark                 | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                               | Additional guidance                                                                                                                                    |
| 11             | $x = -2, y = 1.5$ | M1<br>A1<br>M1<br>A1 | for a correct process to eliminate one variable (condone one arithmetic error)<br>for either $x = -2$ or $y = 1.5$ oe<br>(dep M1) for substituting found value in one of the equations<br><b>or</b><br>correct process after starting again (condone one arithmetic error)<br>for $x = -2, y = 1.5$ oe<br>SCB2 for both correct answers if no more than 1 mark awarded<br>SCB1 for one correct answer if no marks awarded | Fractions do not need to be in simplest form<br><br>Fractions do not need to be in simplest form                                                       |
| 12             | 40.2              | P1<br>P1<br>P1<br>A1 | for start of process to find the diameter or the radius of the circle, eg $8^2 + 10^2 (= d^2)$ oe or $4^2 + 5^2 (= r^2)$ oe<br>for complete process to find diameter, eg $\sqrt{8^2 + 10^2}$ (= 12.8...) or complete process to find radius, eg $\sqrt{4^2 + 5^2}$ (= 6.40...) or<br>for process to find circumference, eg $\pi \times "12.8..."$ or $2 \times \pi \times "6.40..."$<br>answer in the range 40.2 to 40.24 | Accept $\sqrt{164}$ or $2\sqrt{41}$ or $\sqrt{41}$<br><br>If an answer is given in the range in working and then rounded incorrectly award full marks. |

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| Question       | Answer              | Mark | Mark scheme                                                                                                                                                 | Additional guidance |
| 8              | 2.8                 | M1   | for $8 \times 2.5 (= 20)$ <b>or</b> $3 \times 2 (= 6)$                                                                                                      |                     |
|                |                     | M1   | for a complete method<br>eg $(^{-}20)^{-} - (^{-}6)^{-} \div 5$                                                                                             |                     |
|                |                     | A1   | for 2.8 or $2\frac{4}{5}$ oe mixed number                                                                                                                   |                     |
| 9              | 30                  | B1   | cao                                                                                                                                                         |                     |
| 10             | $x = 3$<br>$y = -4$ | M1   | for a correct method to eliminate either variable or rearrangement of one equation leading to substitution (condone one arithmetic error)                   |                     |
|                |                     | A1   | for either $x = 3$ <b>or</b> $y = -4$                                                                                                                       |                     |
|                |                     | M1   | (dep M1) for a correct substitution of found value into one of the equations or a correct method leading to the second value (condone one arithmetic error) |                     |
|                |                     | A1   | for $x = 3$ and $y = -4$<br><br>NB Trial and improvement methods score 0 marks unless both $x$ and $y$ are correct                                          |                     |

| Paper: 1MA1/2H |                     |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                              |
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| Question       | Answer              | Mark                             | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Additional guidance                                                                                                          |
| 8              | $3.125 \times 10^7$ | M1<br><br>A1                     | for $(k =) (1.25 \times 10^{-12}) \div (4 \times 10^{-20})$<br><b>or</b> for the digits 3125<br><br>cao                                                                                                                                                                                                                                                                                                                                                                                                    | Can condone missing brackets on division<br>$3.1 \times 10^7$ or $3.12 \times 10^7$<br>or $3.13 \times 10^7$ will score M1A0 |
| 9              | shown               | M1<br><br>M1<br><br>A1           | for method to find the interior angle eg $(9 - 2) \times 180 \div 9 (= 140)$ <b>or</b> exterior angle eg $360 \div 9 (= 40)$ of a regular nonagon<br><br>for a complete method to find the interior angle $ABC$ , eg $360 - "140" - "140" (= 80)$ <b>or</b> $"40" \times 2 (= 80)$ or finds the angle sum assuming a square, eg $90 + "140" + "140" (= 370)$<br><br>for complete solution with correct conclusion, eg interior angle of a square is 90, not 80 or angles around a point sum to 360 not 370 | Angles may be shown on the diagram<br>Any angle labelled correctly as 140 or 40 and not contradicted scores this mark        |
| 10             | $x = -2.5, y = -6$  | M1<br><br>A1<br><br>M1<br><br>A1 | for a correct method to eliminate one variable (condone one arithmetic error)<br><br>for either $x = -2.5$ <b>or</b> $y = -6$ oe<br><br>(dep M1) for substituting found value into one of the equations <b>or</b> correct method after starting again (condone one arithmetic error)<br><br>for either $x = -2.5$ <b>and</b> $y = -6$ oe<br>SCB2 for both correct answers if no more than 1 mark awarded<br>SCB1 for one correct answer if no marks awarded                                                | Fractions do not need to be in simplest form<br><br><br><br>Fractions do not need to be in simplest form                     |



| Paper: 1MA1/1H |         |                                                                   |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| Question       | Working | Answer                                                            | Mark                                              | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 19             |         | $\frac{2}{5}$                                                     | <p>P1</p> <p>P1</p> <p>P1</p> <p>A1</p>           | <p>for first step to solve the problem e.g. <math>\overrightarrow{AC} = -\mathbf{a} + \mathbf{c}</math> or <math>\overrightarrow{OX} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}</math> or demonstrates the location of <math>D</math> and <math>X</math> on the diagram</p> <p>for a correct vector statement using <math>\overrightarrow{CD}</math> eg <math>\overrightarrow{CD} = \overrightarrow{CX} + \overrightarrow{XD}</math> or <math>\overrightarrow{CD} = \overrightarrow{OD} - \overrightarrow{OC}</math> or <math>\overrightarrow{OD} = \frac{7}{2}\mathbf{c}</math> or <math>\overrightarrow{CD} = 2.5\mathbf{c}</math> oe</p> <p>for a correct equation or ratio using <math>k</math> eg equating <math>\overrightarrow{XD} = 3\mathbf{c} - \frac{1}{2}\mathbf{a} = \frac{1}{2}(-\mathbf{a} + \mathbf{c}) + \frac{1}{k}\mathbf{c}</math> or <math>\frac{\overrightarrow{OD}}{\overrightarrow{OC}} = \frac{k+1}{k}</math> or <math>k = \frac{1}{2.5}</math> or using a ratio approach eg <math>(\overrightarrow{OC} : \overrightarrow{CD}) = k : 1 = 1 : 2.5</math></p> <p>cao</p> |
| 20             |         | $x = -\frac{24}{5}$<br>$y = -\frac{7}{5}$<br>$x = -3,$<br>$y = 4$ | <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> | <p>for substitution of a rearrangement of <math>y - 3x = 13</math> e.g. <math>(3x + 13)^2 + x^2 = 25</math></p> <p>(dep M1) for expansion of bracket after substitution (at least 3 terms correct out of the 4 terms) e.g. <math>9x^2 + 39x + 39x + 169</math></p> <p>for forming quadratic ready for solving e.g. <math>10x^2 + 78x + 144 (= 0)</math></p> <p>for factorising e.g. <math>(5x + 24)(x + 3) (= 0)</math> oe</p> <p><math>x = -\frac{24}{5}, y = -\frac{7}{5}</math> and <math>x = -3, y = 4</math></p> <p>SC: B1 (if M0) for all 4 values mis-associated or one correct pair of values or values given as coordinates.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| Paper: 1MA1/3H |                                                              |                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| Question       | Answer                                                       | Mark                                       | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 19             | $x = -\frac{23}{7}, y = \frac{15}{7}$<br><br>$x = 3, y = -1$ | M1<br><br>M1<br><br>A1<br><br>M1<br><br>A1 | for substitution of a rearrangement eg for $2(1-2y)^2 - y^2 = 17$<br><b>or</b> $2x^2 - \left(\frac{1-x}{2}\right)^2 = 17$<br><b>or</b> expansion of $(1-2y)^2 = 1 - 4y + 4y^2$ <b>or</b> $\left(\frac{1-x}{2}\right)^2 = \frac{1-2x+x^2}{4}$<br>for expansion of bracket <b>and</b> substitution<br>eg $2(1-4y+4y^2) - y^2 (= 17)$<br><b>or</b> $8x^2 - (1-2x+x^2) (= 68)$<br>for forming quadratic ready for solving eg $7y^2 - 8y - 15 (= 0)$<br><b>or</b> $7x^2 + 2x - 69 (= 0)$<br>ft a 3 term quadratic, factorising<br>eg $(7y-15)(y+1) (= 0)$ <b>or</b> $(7x+23)(x-3) (= 0)$<br><b>or</b> correct use of formula eg $\frac{8 \pm \sqrt{64+420}}{14}$ or $\frac{-2 \pm \sqrt{4+1932}}{14}$<br><b>or</b> completing the square<br>$x = -\frac{23}{7}$ oe, $y = \frac{15}{7}$ oe <b>and</b> $x = 3, y = -1$ |
|                |                                                              |                                            | Can be implied by both x values correct or both y values correct.<br><br>Answers must be correctly paired.<br>(Maybe in the body of the working)<br>Accept for x between -3.29 and -3.28 and for y between 2.14 and 2.15<br><br>Answers only award 0 marks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 20             | (-3.5, 1)                                                    | M1<br><br>A1                               | for a complete method to show the transformations<br><br>cao                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                |                                                              |                                            | Image at (-4,1), (-3,1) and (-3.5, -2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Paper: 1MA1/3H |                                                             |      |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                 |
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| Question       | Answer                                                      | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                     | Additional guidance                                                                                                                                                                                             |
| 20             | $x = 3\frac{2}{5}, y = -\frac{4}{5}$<br><br>$x = 5, y = -2$ | M1   | for substitution of a rearrangement<br>eg $x = \frac{7-4y}{3}$ or $y = \frac{7-3x}{4}$ into $x^2 - 4y^2 = 9$<br><b>or</b> expansion of $\left(\frac{7-4y}{3}\right)^2 = \frac{49-56y+16y^2}{9}$ or $\left(\frac{7-3x}{4}\right)^2 = \frac{49-42x+9x^2}{16}$                                                                                                                                                                     | Expansion may not be in simplest form but must be correct<br><br><br><br>Note we do not need to see “= 0”; just the LHS is sufficient.<br><br>Can be implied by both x values correct or both y values correct. |
|                |                                                             | M1   | for correct expansion <b>and</b> substitution<br>eg $\frac{49-56y+16y^2}{9} - 4y^2 = 9$<br><b>or</b> $x^2 - 4\left(\frac{49-42x+9x^2}{16}\right) = 9$                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                 |
|                |                                                             | A1   | for forming quadratic ready for solving<br>eg $-20y^2 - 56y - 32 (= 0)$ or $5y^2 + 14y + 8 (= 0)$ oe<br><b>or</b> $5x^2 - 42x + 85 (= 0)$ oe                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                 |
|                |                                                             | M1   | fit a 3 term quadratic , factorising<br>eg $(5y + 4)(y + 2) (= 0)$ <b>or</b> $(5x - 17)(x - 5) (= 0)$<br>or correct use of formula eg $(y =) \frac{-14 \pm \sqrt{14^2 - 4 \times 5 \times 8}}{2 \times 5}$<br><b>or</b> $(x =) \frac{-42 \pm \sqrt{42^2 - 4 \times 5 \times 85}}{2 \times 5}$<br><b>or</b> completing the square, eg $(y + \frac{7}{5})^2 - \frac{9}{25} (= 0)$ or $(x - \frac{21}{5})^2 - \frac{16}{25} (= 0)$ |                                                                                                                                                                                                                 |
|                |                                                             | A1   | correctly pairs x and y values: $x = 3\frac{2}{5}, y = -\frac{4}{5}$ oe , $x = 5, y = -2$                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                 |
|                |                                                             |      | Answers must be correctly paired.<br>Accept coordinate pairs                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                 |



| Paper: 1MA1/3H |                            |      |                                                                                                                                                                                                                                                                                                                                                                        |                     |
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| Question       | Answer                     | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                            | Additional guidance |
| 22             | $(-3, -11)$ and $(5.5, 6)$ | M1   | for method to eliminate one variable, eg $(2x - 5)^2 = 6x^2 - 25x - 8$<br>or<br>$y^2 = 6\left(\frac{y+5}{2}\right)^2 - 25\left(\frac{y+5}{2}\right) - 8$                                                                                                                                                                                                               |                     |
|                |                            | M1   | for expanding the square to give,<br>eg. $4x^2 - 20x + 25 = 6x^2 - 25x - 8$<br>or<br>$y^2 = 6\left(\frac{y^2+10y+25}{4}\right) - 25\left(\frac{y+5}{2}\right) - 8$                                                                                                                                                                                                     |                     |
|                |                            | M1   | for method to solve equation $2x^2 - 5x - 33 (= 0)$ ,<br>eg $(2x - 11)(x + 3) (= 0)$ or $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 2 \times -33}}{2 \times 2}$ or $-3, 5.5$ oe<br>or<br>for method to solve equation $2y^2 + 10y - 132 (= 0)$ ,<br>eg. $(2y + 22)(y - 6) (= 0)$ or $y = \frac{-10 \pm \sqrt{10^2 - 4 \times 2 \times -132}}{2 \times 2}$ or $-11, 6$ |                     |
|                |                            | A1   | for $(-3, -11)$                                                                                                                                                                                                                                                                                                                                                        |                     |
|                |                            | A1   | for $(5.5, 6)$ oe                                                                                                                                                                                                                                                                                                                                                      |                     |



| Paper: 1MA1/3H |                                                         |      |                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| Question       | Answer                                                  | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                   | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 21             | $x = -\frac{6}{7}, y = \frac{32}{7}$<br>$x = 2, y = -4$ | M1   | for substitution of a rearranged equation into a correct equation to form an equation in one variable.<br>eg $3x^2 + 2(2 - 3x)^2 = 44$ or $3\left(\frac{2-y}{3}\right)^2 + 2y^2 = 44$                                                                                                                                                                                                                                         | Allow $(\pm 2 \pm 3x)$ for $(2 - 3x)$<br>(or $\left(\frac{\pm 2 \pm y}{3}\right)$ for $\left(\frac{2-y}{3}\right)$ )<br>Implied by a correct equation (simplified or unsimplified) in terms of $x$ or $y$<br>eg $3x^2 + 2(4 - 12x + 9x^2) = 44$<br>or $3x^2 + 8 - 24x + 18x^2 = 44$<br>or $21x^2 - 24x = 36$                                                                                                                                                                           |
|                |                                                         | M1   | (dep on first M1) for multiplying out all brackets and collecting terms to form a simplified three term quadratic in any form of $ax^2 + bx + c (= 0)$ where at least 2 coefficients ( $a, b, c$ ) are correct<br>eg $21x^2 - 24x - 36 (= 0)$ or $7x^2 - 8x - 12 (= 0)$<br>or $7y^2 - 4y - 128 (= 0)$                                                                                                                         | Look out for signs reversed<br>The quadratic does not have to equal 0, ie accept $21x^2 - 24x = 36$                                                                                                                                                                                                                                                                                                                                                                                    |
|                |                                                         | M1   | (dep on first M1) for a suitable method to solve <b>their</b> 3 term quadratic using any correct method,<br>for factorising, eg $(7x + 6)(x - 2)$ or $(7x + 6)(3x - 6)$<br>or $(21x + 18)(x - 2)$ or $(7y - 32)(y + 4)$<br>or correct use of formula,<br>eg $\frac{8 \pm \sqrt{(-8)^2 - 4 \times 7 \times -12}}{2 \times 7}$ or $\frac{4 \pm \sqrt{(-4)^2 - 4 \times 7 \times -128}}{2 \times 7}$<br>or completing the square | Can be implied by both $x$ values or both $y$ values correct (condone incorrect labelling) if the quadratic is correct<br>If using the quadratic formula (condone one sign error, omission of brackets around the $b$ in the $b^2 - 4ac$ and the fraction line not being under the $-$ in the $-b$ . Allow some simplification – as far as eg $\frac{8 \pm \sqrt{64 + 336}}{14}$<br>or if factorising allow brackets which expand to give 2 out of 3 terms correct for their quadratic |

| Paper: 1MA1/3H |        |      |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| Question       | Answer | Mark | Mark scheme                                                                                                                                                                            | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                    |
|                |        | M1   | (dep on first M1) for substituting their 2 found values of $x$ or $y$ in a suitable equation<br>or (dep on first M1) for one correct pair of values following from a correct quadratic | Condone substitution into their<br>$(\pm 2 \pm 3x)$ or $\left(\frac{\pm 2 \pm y}{3}\right)$<br><br>Allow $-0.85(7\dots)$ or $-0.86$ for $-\frac{6}{7}$<br><br>Allow $4.57(1\dots)$ for $\frac{32}{7}$<br><br>If values of $x$ or $y$ are incorrect then working must be shown                                                                                                                                          |
|                |        | A1   | for $x = -\frac{6}{7}$ oe, $y = \frac{32}{7}$ oe <b>and</b> $x = 2, y = -4$                                                                                                            | Accept as coordinates<br>Assume correct pairing unless clearly incorrect eg $\left(-\frac{6}{7}, -4\right), \left(2, \frac{32}{7}\right)$<br><br>Allow $-0.85(7\dots)$ or $-0.86$ for $-\frac{6}{7}$<br><br>Allow $4.57(1\dots)$ for $\frac{32}{7}$<br><br>If an answer is shown in the range in working and then incorrectly rounded award full marks<br><br>A correct answer with no supportive working gets 0 marks |



| Paper: 1MA1/1H |                        |              |                                                                                                                                                                                                                                                |                                                                        |
|----------------|------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Question       | Answer                 | Mark         | Mark scheme                                                                                                                                                                                                                                    | Additional guidance                                                    |
| 1              | $x < 5$                | M1<br><br>A1 | for adding 27 to both sides or dividing throughout by 7 (in an inequality or an equation) as a first step<br><br>or showing 5 as the critical value<br><br>cao                                                                                 | Can be written as $x = 5$                                              |
| 2              | $2 \times 2 \times 31$ | M1<br><br>A1 | for a complete method to find prime factors; could be shown on a complete factor tree with no more than one error or by division by prime factors with no more than one error<br><br>or for 2, 2, 31, (1)<br><br>for $2 \times 2 \times 31$ oe | Condone the inclusion of 1 for this mark<br><br>Accept $2^2 \times 31$ |

| Paper: 1MA1/2H |                          |              |                                                                                                                                                                                                                                                    |                                                                                              |
|----------------|--------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Question       | Answer                   | Mark         | Mark scheme                                                                                                                                                                                                                                        | Additional guidance                                                                          |
| 15             | $\frac{\sqrt{a}-1}{a-1}$ | M1<br><br>A1 | for a correct method to rationalise the denominator,<br>eg, $\frac{1}{\sqrt{a}+1} \times \frac{\sqrt{a}-1}{\sqrt{a}-1}$ or $\frac{1}{\sqrt{a}+1} \times \frac{1-\sqrt{a}}{1-\sqrt{a}}$<br>for $\frac{\sqrt{a}-1}{a-1}$ or $\frac{1-\sqrt{a}}{1-a}$ | Condone use of a prime number in place of $a$ for the M1<br><br>Do not ISW                   |
| 16             | $-5 < x < \frac{3}{4}$   | M1<br><br>A1 | for critical values $-5$ <b>and</b> $\frac{3}{4}$ oe<br><br>oe                                                                                                                                                                                     | Could be written as two separate expressions,<br>eg $x > -5$ <b>and</b> $x < \frac{3}{4}$ oe |

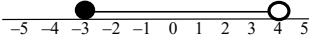
| Paper: 1MA1/2H |                                                                               |      |                                                                                                                                                         |                                                                                                            |
|----------------|-------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Question       | Answer                                                                        | Mark | Mark scheme                                                                                                                                             | Additional guidance                                                                                        |
| 21             | $-\frac{2}{5} < x < \frac{1}{3}$                                              | B2   | for $-\frac{2}{5} < x < \frac{1}{3}$ oe                                                                                                                 | May be given as two separate inequalities                                                                  |
|                |                                                                               | (B1) | For correct critical values of $-\frac{2}{5}$ <b>and</b> $\frac{1}{3}$ oe)                                                                              | Accept $-0.4$ and $0.33$ (or better)                                                                       |
| 22             | Circle radius 5<br>centre $(0, -2)$ and<br>$(0, 3)$ and $(0, -7)$<br>labelled | B3   | for a correct sketch of a circle with centre $(0, -2)$ <b>and</b> intercepts $(0, 3)$ and $(0, -7)$ labelled                                            | See diagram at end of scheme<br>Allow freehand circles<br>Ignore intersections with $x$ axis for all marks |
|                |                                                                               | (B2) | for a sketch of a circle with two of the 3 points indicated, or for a sketch of a circle with correct centre <b>and</b> radius of 5 labelled or stated) | Accepts points marked with correct $y$ -coordinate, eg $-2$ on $y$ -axis for centre                        |
|                |                                                                               | (B1) | for a sketch of a circle with the correct centre <b>or</b> states correct centre <b>and</b> radius, but does not sketch)                                |                                                                                                            |



| Paper 1MA1: 3H |                               |                                                                                  |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|-------------------------------|----------------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                       | Answer                                                                           | Mark                       | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 18             | Note $DOC=DOA$ ,<br>$ADO=CDO$ | 21.6                                                                             | P1<br>P1<br>P1<br>P1<br>A1 | Recognises that $OAD$ or $OCD$ is $90^\circ$ or right angle<br>for using trigonometry to set up an equation in $DOA$ or $ADO$<br>eg $\cos DOA = \frac{5}{9}$<br>for using inverse trigonometry to find $DOA$ or $ADO$<br>eg $DOA = \cos^{-1} \frac{5}{9}$ ( $= 56.25\dots$ )<br>for a complete process to find arc length $ABC$ or $AC$<br>eg $\frac{360-2 \times 56.25}{360} \times 2 \times \pi \times 5$ ( $= 21.598\dots$ ) or $\frac{2 \times 56.25}{360} \times 2 \times \pi \times 5$ ( $= 9.8174\dots$ )<br>for answer in the range 21.5 to 21.65 |
| 19             |                               | $x < -2, x > \frac{1}{2}$                                                        | M1<br>A1<br>A1             | for a first step to solve the quadratic e.g. factorisation: $(2x + 4)(x - \frac{1}{2})$ or $(2x - 1)(x + 2)$ or using the formula $\frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times (-2)}}{2 \times 2}$<br>for $-2$ and $\frac{1}{2}$                                                                                                                                                                                                                                                                                                                           |
| 20             | (a)<br><br>(b)                | (0,1)<br><br>Circle radius 4<br>Centre (3,0) and<br>(-1,0) and (7,0)<br>labelled | B1<br>M1<br>M1<br>A1       | (0,1)<br>For centre (3,0) implied by drawing or label<br>or a circle of radius 4<br>or intersections on the x-axis at $-1$ or $7$ implied by drawing or labels<br>for 2 of<br>centre (3,0) implied by drawing or label<br>intersections on the x-axis at $-1$ and $7$ implied by drawing or label<br>circle drawn with radius 4<br>for a fully correct answer                                                                                                                                                                                             |

| Paper: 1MA1/1H |               |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                     |
|----------------|---------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer        | Mark                               | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                   | Additional guidance                                                                                                                 |
| 17             | Region shaded | M1<br>M1<br>A1                     | for two of the lines $2y + 4 = x$ , $x = 3$ , $y = 6 - 3x$ correctly drawn<br>for all three correct lines correctly drawn<br>for a fully correct region indicated with all lines correct                                                                                                                                                                                                                                                      | Accept full or broken lines for all marks<br><br>Award for clear intention, shading not needed<br><br>Diagram at end of mark scheme |
| 18             | 17.6          | P1<br>P1<br>P1<br><br>P1<br><br>A1 | for correct trig statement, eg $\sin 30 = \frac{h}{6}$<br>for complete process to find $h$ , eg $6 \times \frac{1}{2} (= 3)$<br>for correct substitution into the area of a trapezium formula,<br>eg $\frac{1}{2}(a + b) \times "3" = 66$ or $a + b = 44$<br>or $\frac{1}{2}(2x + 3x) \times h = 66$<br>for complete correct process to find the length of $AB$ ,<br>eg $\left[ \frac{66 \times 2}{3} \div (2 + "3") \right] \times 2$<br>cao | An answer of $\frac{88}{5}$ gets P4 A0                                                                                              |



| Paper: 1MA1/2H |               |      |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                |
|----------------|---------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer        | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                             | Additional guidance                                                                                                                                                                                            |
| 1 (a)          | $x > -1$      | B1   | cao                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                |
| (b)            | Diagram drawn | C2   | for a fully correct diagram,<br><br>eg                                                                                                                                                                                                                 |                                                                                                                                                                                                                |
|                |               | (C1) | for drawing a line from -3 to 4<br><b>or</b> (indep) for an open circle at 4<br><b>or</b> (indep) for a closed circle at -3 )                                                                                                                                                                                                           | Condone arrow heads or line ending to denote the 'end' of the line                                                                                                                                             |
| 2 (a)          | 12            | M1   | for a correct factor tree for either 60 <b>or</b> 84 with no more than one arithmetic error<br><b>or</b> for listing factors of 60 <b>or</b> 84, at least 4 correct for either (with no more than 1 incorrect in either list), could be in factor pairs<br><b>or</b> for the prime factors of 60 (2, 2, 3, 5) <b>or</b> 84 (2, 2, 3, 7) | Condone the use of 1 in any factor tree<br>60: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60<br>84: 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84                                                                        |
|                |               | A1   | for 12 or $2 \times 2 \times 3$ oe<br>SC B1 for answer of 4 or 6, if M0 scored                                                                                                                                                                                                                                                          | 2,2,3 is not enough, it must be a product                                                                                                                                                                      |
| (b)            | 120           | M1   | for a correct factor tree for either 24 <b>or</b> 40 with no more than one arithmetic error<br><b>or</b> for at least 3 multiples of both 24 and 40 (can include 24 and 40)<br><b>or</b> for the prime factors of either 24 (2, 2, 2, 3 ) <b>or</b> 40 (2, 2, 2, 5) <b>or</b> for a common multiple from their lists ( $\neq 120$ )     | Condone the use of 1 in any factor tree<br>24: 24, 48, 72, 96, 120, ...<br>40: 40, 80, 120, ...<br>For the list not containing 120, accept the first 3 correct multiples or one error in the first 4 multiples |
|                |               | A1   | for 120 or $2 \times 2 \times 2 \times 3 \times 5$ oe                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                |



| Paper: 1MA1/2H |                         |      |                                                                                                                                                        |                                       |
|----------------|-------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Question       | Answer                  | Mark | Mark scheme                                                                                                                                            | Additional guidance                   |
| 12 (a)         | $f = \frac{224}{d^2}$   | M1   | for $3.5 = \frac{k}{8^2}$ oe ( $k = 224$ )                                                                                                             | Accept use of $\infty$ for the M mark |
|                |                         | A1   | for $f = \frac{224}{d^2}$ oe                                                                                                                           |                                       |
|                |                         | M1   | for $10 = \frac{"224"}{d^2}$ or $d^2 = "224" \div 10$                                                                                                  |                                       |
|                |                         | A1   | or ft their value for $k$ provided $f = \frac{k}{d^2}$ is used<br>for answer in range 4.73 to 4.733                                                    |                                       |
| 13             | Correct region <b>R</b> | M1   | for at least two correct boundaries,<br>eg $y = -3$ or $x = 2$ or $y = 2x + 1$ or $3x + 2y = 6$                                                        |                                       |
|                |                         | M1   | for the remaining two correct boundaries<br>or a third correct boundary with shading correct with the inequalities for at least two correct boundaries |                                       |
|                |                         | C1   | for a correct region ( <b>R</b> ) clearly identified                                                                                                   |                                       |



| Paper 1MA1: 3H |         |                                                |                        |                                                                                                                                                                                                                                                                                                                                                      |
|----------------|---------|------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working | Answer                                         | Mark                   | Notes                                                                                                                                                                                                                                                                                                                                                |
| 10             |         | 6 (%)                                          | P1<br>P1<br>A1         | for $y^5$ oe or $8029.35 \div 6000$<br>for a process to find $1+x$ e.g. $\sqrt[5]{(8029.35 \div 6000)}$ or 1.06 or 1.0599..<br>5.99 to 6                                                                                                                                                                                                             |
| 11             |         | No<br>(supported)                              | P1<br><br>C1           | Process to find number of rose trees e.g. $215 \div 17 (=12.647\dots)$ or show number of choices with 12 and 13 eg $17 \times 12 = 204$ and $17 \times 13 = 221$<br>No with interpretation that 12.6.. is not a whole number or a whole number of plants must be bought or number of plants would have to be between 12 and 13 which is not possible |
| 12             |         | 3 : 4 : 11                                     | P1<br><br>P1<br><br>A1 | Makes a start e.g. by using multipliers e.g. $1 + 5 = 6$ and $7 + 11 = 18$ and $6 \times 3 = 18$ or $AB:BD = 3:15$ or $x=3y$ (appropriate $x$ and $y$ shown) or $\frac{1}{6} = \frac{3}{18}$<br>Complete process to find ratios e.g. $(7 + 11) \div (1 + 5) = 3$ and $1 \times "3" : 7 - ("3" \times 1) : 11$<br>oe                                  |
| 13             |         | $y \geq -2, y \geq x$<br>and $y \leq 0.5x + 1$ | M1<br>M1<br>M1<br>A1   | $y = -2$ indicated; accept any inequality for " $\geq$ "<br>$y = x$ oe indicated; accept any inequality for " $\geq$ "<br>$y = 0.5x + 1$ oe indicated; accept any inequality for " $\geq$ "<br>$y \geq -2, y \geq x$ and $y \leq 0.5x + 1$                                                                                                           |
| 14 (a)         |         | $\frac{x+4}{2x+3}$                             | M1<br><br>M1<br>A1     | Factorising the denominator $(2x \pm 3)(x \pm 4)$ or $2(x \pm 1\frac{1}{2})(x \pm 4)$<br>Factorising the numerator $(x - 4)(x + 4)$<br>oe                                                                                                                                                                                                            |
| (b)            |         | $v = \frac{15t}{w+30}$                         | M1<br><br>M1<br>A1     | A correct step towards solution e.g. expanding brackets to get $15t - 30v$ or multiply both sides by $v$<br>For a method to rearrange the formula to isolate terms in $v$ eg $vw + 30v = 15t$<br>oe                                                                                                                                                  |

| Paper: 1MA1/1H |         |                     |                          |                                                                                                                                                                                                                                                                                                                |
|----------------|---------|---------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working | Answer              | Mark                     | Notes                                                                                                                                                                                                                                                                                                          |
| 18             |         | Correct enlargement | B2<br>(B1)               | Correct enlargement $(-1,-1.5)$ , $(-1,-3.5)$ $(-2,-1.5)$<br>correct size, correct orientation in incorrect position <b>or</b> 2 out of 3 vertices correctly placed                                                                                                                                            |
| 19             |         | $y = 2x + 36$       | P1<br><br>P1<br>P1<br>A1 | starts process, eg by rearranging to find gradient, eg $y = 6 - \frac{x}{2}$ <b>or</b> $\frac{-1}{2}$ <b>or</b> positions of $B$ and $E$<br>complete process to find position of $A$ <b>or</b> uses $\frac{-1}{m}$ to find the gradient of $M$<br>complete process to find equation of $M$<br>$y = 2x + 36$ oe |
| 20             |         | $1+\sqrt{2}$        | B1<br>P1<br>P1<br>A1     | for a value for a known trigonometric ratio stated<br>for process to form 2 equations in $a$ and $b$ <b>or</b> one correct value stated<br>for complete process to solve to reach $a = 2$ and $b = 1$<br>for $1+\sqrt{2}$ oe                                                                                   |

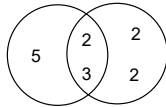


| Paper: 1MA1/3H |             |      |                                                                                                                                                                                                                    |                                                                          |
|----------------|-------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Question       | Answer      | Mark | Mark scheme                                                                                                                                                                                                        | Additional guidance                                                      |
| 8              | 45          | P1   | for $180 - 117 (=63)$<br><b>or</b> states, or uses, exterior angle $+ x = 117$                                                                                                                                     | Angles may be shown on the diagram.                                      |
|                |             | P1   | for process to find the exterior or the interior angle of the pentagon,<br>eg $360 \div 5 (=72)$ <b>or</b> $180 - (360 \div 5) (=108)$ <b>or</b> $((5-2) \times 180) \div 5$<br>$(=108)$                           | Any angle labelled correctly as 63 and not contradicted scores this mark |
|                |             | P1   | for a complete process to find $x$ ,<br>eg $180 - "72" - "63"$ <b>or</b> $"108" - "63"$ <b>or</b> $117 - "72"$                                                                                                     | Exterior = 108 or interior = 72 does not score the mark                  |
|                |             | A1   | cao                                                                                                                                                                                                                | An answer of 45 with no supporting working scores 0                      |
| 9              | Enlargement | B2   | vertices at (2.5, 1) (2.5, 6) (5, 6)                                                                                                                                                                               |                                                                          |
|                |             | (B1  | for triangle of the correct size and orientation in the wrong position<br><b>or</b> a correct enlargement of a different scale factor centre (0, 1)<br><b>or</b> correct orientation with 2 of 3 vertices correct) |                                                                          |
| 10             | (a)         | M1   | for multiplying both sides by 7 as a first step eg $9 + x = 7(11 - x)$ <b>or</b><br>dividing each term on the left hand side by 7 eg $\frac{9}{7} + \frac{x}{7} = 11 - x$                                          | $\times 7$ written near the equation is not enough for this mark         |
|                |             | M1   | (dep M1) for method to isolate the $x$ terms on one side                                                                                                                                                           |                                                                          |
|                |             | A1   | oe                                                                                                                                                                                                                 |                                                                          |
|                | (b)         | B1   | $4(y + 3)$ <b>or</b> $4y + 12$                                                                                                                                                                                     |                                                                          |

| Paper: 1MA1/2H |                           |      |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                     |
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| Question       | Answer                    | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                       | Additional guidance                                                                                                 |
| 15 (a)         | 70                        | P1   | for $\frac{20}{12}$ (= 1.66..) or $\frac{12}{20}$ (= 0.6) or $\frac{12}{42}$ (= 0.2857..) or $\frac{42}{12}$ (= 3.5)                                                                                                                                                                                                                              | Decimal values truncated or rounded to 2 dp or more                                                                 |
|                |                           | P1   | for $\frac{20}{n} = \frac{12}{42}$ or $\frac{12}{20} = \frac{42}{n}$ or $\frac{20 \times 42}{12}$                                                                                                                                                                                                                                                 |                                                                                                                     |
|                |                           | A1   | cao                                                                                                                                                                                                                                                                                                                                               |                                                                                                                     |
|                | (b) Explanation           | C1   | for explanation<br><b>Acceptable examples</b><br>the sample size cannot be greater than the population<br>the population is greater than the sample size<br>there are more than 50 rabbits<br>he catches 55 rabbits<br><b>Not acceptable examples</b><br>the sample size is too small<br>some of the tags could fall off<br>he has underestimated |                                                                                                                     |
| 16             | $y \geq 3x + 6$           | M1   | for $y = 6$ indicated or $x = -3$ indicated                                                                                                                                                                                                                                                                                                       | Accept any inequality in place of “=” for all method marks<br><br>Equations/inequalities may be seen on the diagram |
|                | $x \geq -3$               | M1   | for $y = 3x + 6$ oe indicated                                                                                                                                                                                                                                                                                                                     |                                                                                                                     |
|                | $y \geq -\frac{x}{2} + 1$ | M1   | for $y = -\frac{x}{2} + 1$ oe indicated                                                                                                                                                                                                                                                                                                           |                                                                                                                     |
|                | $y \leq 6$                | A1   | for $y \geq 3x + 6$ oe, $x \geq -3$ , $y \geq -\frac{x}{2} + 1$ oe and $y \leq 6$                                                                                                                                                                                                                                                                 |                                                                                                                     |

| Paper: 1MA1/1H |                                  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                   |
|----------------|----------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Question       | Answer                           | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Additional guidance                                                               |
| 16 (a)         | 4.5                              | P1   | for initial use of formula, eg $6 = 8k$                                                                                                                                                                                                                                                                                                                                                                                                                                 | If figures are given as part of the answer they must be correct, but can allow ft |
|                |                                  | P1   | for a full process to find $P_3$ eg " $\frac{6}{8}$ " $\times 6$                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                   |
|                |                                  | A1   | oe                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                   |
| (b)            | Explanation                      | C1   | for explanation<br><b>Acceptable examples</b><br>Yes, the population will increase as $k$ is over 1<br>She is correct because $1.05 > 1$<br>Yes, each year the population will increase by 5%<br>Yes, because $0.75 + 0.3 = 1.05$<br>Yes, a 0.3 increase is greater than the current 0.25 decrease<br><br><b>Not acceptable examples</b><br>Yes, the population will increase each year<br>Yes, because there is an increase in $k$<br>No because 0.3 is less than 0.75 |                                                                                   |
| 17 (a)         | $(2x + 1)(3x - 4)$               | M1   | for $(2x \pm 1)(3x \pm 4)$ oe or for brackets which when expanded give 2 out of 3 terms correct                                                                                                                                                                                                                                                                                                                                                                         |                                                                                   |
|                |                                  | A1   | cao                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                   |
| (b)            | $-\frac{1}{2} < x < \frac{4}{3}$ | M1   | for two critical values with at least one correct, $-\frac{1}{2}$ or $\frac{4}{3}$<br>or ft their critical values from (a)                                                                                                                                                                                                                                                                                                                                              |                                                                                   |
|                |                                  | A1   | for $-\frac{1}{2} < x < \frac{4}{3}$ oe eg $x < \frac{4}{3}, x > -\frac{1}{2}$                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                   |

| Paper: 1MA1/3H |                 |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                           |
|----------------|-----------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Question       | Answer          | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Additional guidance                                                                                       |
| (b)            | No, with reason | C1   | <p>for No <b>and</b> reason</p> <p><b>Acceptable examples</b><br/>           No, the median is in the interval <math>25 &lt; T \leq 30</math><br/>           No, the median is in the group containing the 25(.5)th temperature<br/>           No, she did not take into account frequency<br/>           No, the frequencies are not the same for each group.</p> <p><b>Not acceptable examples</b><br/>           No, the median is 27.5<br/>           No, the median is higher than 22.5<br/> <math>25 &lt; T \leq 30</math><br/>           Yes, ...</p>                                                                                                                                                     | Any incorrect statement as part of a correct response can be ignored unless it contradicts the statement. |
| 4 (a)          | Explanations    | C2   | <p>for two different correct explanations</p> <p><b>Acceptable examples</b><br/>           She should have a solid/full/shaded/coloured circle at 4<br/>           It does not show that <math>x</math> could be equal to 4<br/>           She should have marked/drawn a (clear/empty) circle at <math>-3</math><br/>           The line should be drawn to <math>-3</math><br/>           Jenna started from <math>-2</math> not <math>-3</math></p> <p><b>Not acceptable examples</b><br/>           Both circles should be black<br/>           One circle should be filled in (needs to say which circle)<br/>           She shouldn't have to reach number 4<br/>           Jenna has made no mistakes</p> | Any incorrect statement as part of a correct response can be ignored unless it contradicts the statement, |
|                |                 | (C1  | for one correct mistake described)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                           |

| Paper: 1MA1/3H |                      |      |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                |
|----------------|----------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer               | Mark | Mark scheme                                                                                                                                                                                                                                                                     | Additional guidance                                                                                                                                                                                                                                                            |
| (b)            | 4                    | M1   | for a correct first step,<br>eg for adding 7 to both sides $5y - 7 + 7 < 16 + 7$<br>or for dividing throughout by 5 eg $\frac{5y - 7}{5} < \frac{16}{5}$<br><b>or</b> for showing 4.6 (oe) as the critical value<br><b>or</b> for $5 \times 4 - 7$ with 13 seen as answer       | Allow use of any inequality or as an equation for the first mark<br><br>Award 1 mark for 4.6 oe, eg $y = \frac{23}{5}$ or $y < 4.6$                                                                                                                                            |
|                |                      | A1   | for 4 or $y = 4$ with no incorrect working                                                                                                                                                                                                                                      | An answer of 4 from incorrect working can score 1 mark at most.                                                                                                                                                                                                                |
| 5              | 4 packs and 5 boxes, | P1   | for start of a process to find common multiples of 30 and 24,<br>eg writes down at least 3 multiples of 30 and at least 3 multiples of 24<br><b>or</b><br>draws factor trees for both 30 and 24 with no more than 1 error in total<br><b>or</b><br>draws a correct Venn diagram | 30, 60, 90, 120, 150, 180, 210, 240 ...<br><br>24, 48, 72, 96, 120, 144, 168, 192, 216, 240, ...<br><br>Condone the inclusion of 1 in factor trees or Venn diagrams for this mark<br><br> |
|                |                      | P1   | for identifying a common multiple<br>eg 120 or 240 or $5 \times 3 \times 2 \times 2 \times 2$ oe                                                                                                                                                                                | May use any common multiple, 120, 240, 360...                                                                                                                                                                                                                                  |
|                |                      | A1   | for 4 packs and 5 boxes or any multiple of this pairing eg 8, 10                                                                                                                                                                                                                | Award 0 marks for a correct answer without correct supportive working.                                                                                                                                                                                                         |

| Paper: 1MA1/1H |                                                                                                                                                     |               |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                                                                                                                                             | Answer        | Mark                               | Notes                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 21             | $\frac{6-\sqrt{8}}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$ $\frac{6\sqrt{2}+6-\sqrt{8}\sqrt{2}-\sqrt{8}}{2-1}$ $=6\sqrt{2}+6-4-2\sqrt{2}$ | $2+4\sqrt{2}$ | M1<br><br>M1<br><br>A1             | for correct first step eg multiplies numerator and denominator by $\sqrt{2}+1$ condone missing brackets<br><br>(dep) for expansion of numerator with 4 terms correct with or without signs <b>or</b> 3 out of exactly 4 terms correct<br><br>for $2+4\sqrt{2}$ <b>oe or</b> for stating $a=2$ and $b=4$                                                                                                                    |
| 22             |                                                                                                                                                     | 2, 14.5       | P1<br><br>A1<br>P1<br>A1<br>C1     | for scale factor of $\frac{12}{3}$ <b>or</b> $\frac{3}{12}$ <b>or</b> $\frac{15}{12}$ <b>or</b> $\frac{12}{15}$ <b>or</b> $\frac{8}{12}$ <b>or</b> $\frac{12}{8}$ <b>or</b> $\frac{15}{8}$ <b>oe or</b> correctly identifies 2 pairs of corresponding sides<br>for $x=2$<br>for complete method to find other value for $x$ eg $\frac{15}{8} \times 12 = 8$<br>for $x = 14.5$<br>Describes both assumptions for similarity |
| 23             |                                                                                                                                                     | $x > 2$       | P1<br><br>M1<br><br>M1<br>M1<br>A1 | for process to derive algebraic expressions for area of both rectangle and triangle eg $(x-1)(3x-2)$ and $(2x \times x) \div 2$ (condone missing brackets)<br>for method to rearrange inequality to $2x^2-5x+2 > 0$ <b>oe</b> providing in the form $ax^2+bx+c > 0$<br>for a correct method to solve $2x^2-5x+2 > 0$<br>for establishing critical values 2 and $\frac{1}{2}$<br>$x > 2$                                    |



| Paper: 1MA1/1H |         |      |                                                                                                               |                                                                                                                                        |
|----------------|---------|------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer  | Mark | Mark scheme                                                                                                   | Additional guidance                                                                                                                    |
| 20             | 2, 3, 4 | M1   | for method to solve $3n + 2 \leq 14$<br>eg $n \leq (14 - 2) \div 3$ oe                                        | This could be shown within an equation rather than an inequality at this stage                                                         |
|                |         | M1   | for complete method to rearrange $\frac{6n}{n^2 + 5} > 1$ to the form<br>$an^2 + bn + c (< 0)$                | For the 2rd and 3rd M marks condone no '< 0' and condone use of incorrect inequality signs or '='                                      |
|                |         | M1   | for method to begin to solve $n^2 - 6n + 5 (< 0)$<br>eg $(n \pm 5)(n \pm 1) (< 0)$                            | Accept $\frac{-6 \pm \sqrt{(-6)^2 - 4 \times 1 \times 5}}{2 \times 1}$<br>(condone one sign error)                                     |
|                |         | M1   | (dep on previous M2) for $n > 1$ and $n \leq 4$ <b>or</b> $1 < n < 5$                                         | Must come from correct working                                                                                                         |
|                |         | A1   | (dep M4) cao                                                                                                  | Could be shown on a number line                                                                                                        |
|                |         |      | <b>Alternative method</b>                                                                                     |                                                                                                                                        |
|                |         | M1   | for method to solve $3n + 2 \leq 14$<br>eg $n \leq (14 - 2) \div 3$ oe<br><b>OR</b> for $3 \times 4 + 2 = 14$ | This could be shown within an equation rather than an inequality at this stage                                                         |
|                |         | M3   | for trials with 1, 2, 3 and 4 in the quadratic inequality, correctly evaluated                                | The values from the trials may be given as improper fractions<br>eg $\frac{24}{21}$ , $\frac{18}{14}$ , $\frac{12}{9}$ , $\frac{6}{6}$ |
|                |         | (M2  | for trials with three of 1, 2, 3 and 4, correctly evaluated)                                                  |                                                                                                                                        |
|                |         | (M1  | for trials with two of 1, 2, 3 and 4, correctly evaluated)                                                    |                                                                                                                                        |
|                |         | A1   | (dep M4) cao                                                                                                  |                                                                                                                                        |

| Paper: 1MA1/2H |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                            |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                        |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|----|---|---|---|---|---|-----|----|----|----|----|---|---|---|
| Question       | Answer                                                                                                                                                                                                                                                                                                                                                                                                            | Mark                                                                       | Mark scheme                                                                                                                                               | Additional guidance                                                                                                                                                                                                                                                                                                                                    |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
| 1 (a)          | $n > 2$                                                                                                                                                                                                                                                                                                                                                                                                           | M1                                                                         | for a method to isolate terms in $n$ in any inequality or equation<br>eg $14n - 11n > 6$ or $n = 2$                                                       | Ignore incorrect inequality sign and accept “=” sign                                                                                                                                                                                                                                                                                                   |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                   | A1                                                                         | cao                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                        |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                   | M1                                                                         | for $-2 - 3 < x \leq 4 - 3$ ( $-5 < x \leq 1$ )                                                                                                           | A circle around $-5$ and $1$ implies M1                                                                                                                                                                                                                                                                                                                |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                   | M1                                                                         | for drawing a line from $-5$ to $1$<br><b>or</b> (indep) for an open circle at either $-2$ or $-5$<br><b>or</b> (indep) for a closed circle at $4$ or $1$ | A line from $-5$ to $1$ implies M2 if no working shown                                                                                                                                                                                                                                                                                                 |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                   | A1                                                                         | cao                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                        |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
| 2              | Graph                                                                                                                                                                                                                                                                                                                                                                                                             | B3                                                                         | for a correct line between $x = -2$ and $x = 4$                                                                                                           | Ignore any incorrect points. Points need not be plotted for a correct line (segment) drawn<br><br>Table of values<br><table><tr><td><math>x</math></td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td><math>y</math></td><td>-7</td><td>-5</td><td>-3</td><td>-1</td><td>1</td><td>3</td><td>5</td></tr></table> | $x$ | -2 | -1 | 0 | 1 | 2 | 3 | 4 | $y$ | -7 | -5 | -3 | -1 | 1 | 3 | 5 |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                   | $x$                                                                        | -2                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                        | -1  | 0  | 1  | 2 | 3 | 4 |   |   |     |    |    |    |    |   |   |   |
|                |                                                                                                                                                                                                                                                                                                                                                                                                                   | $y$                                                                        | -7                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                        | -5  | -3 | -1 | 1 | 3 | 5 |   |   |     |    |    |    |    |   |   |   |
| (B2            | for a correct straight line segment through at least 3 of<br>$(-2, -7)$ , $(-1, -5)$ , $(0, -3)$ , $(1, -1)$ , $(2, 1)$ , $(3, 3)$ , $(4, 5)$<br><br><b>or</b> for all of these points plotted but not joined<br><br><b>OR</b> for a line drawn with a positive gradient through $(0, -3)$ <b>and</b> clear intention to use a gradient of 2, eg line through $(0, -3)$ going across 2 squares and up 4 squares ) |                                                                            |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                        |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |
| (B1            | for at least 2 correct points stated or plotted<br><br><b>OR</b> for a line drawn with a positive gradient through $(0, -3)$<br><br><b>OR</b> a line with gradient 2)                                                                                                                                                                                                                                             | Ignore any incorrect points<br>Coordinates may be in a table or in working |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                        |     |    |    |   |   |   |   |   |     |    |    |    |    |   |   |   |



| Paper: IMA1/3H |                              |      |                                                                                                                                          |                                                                                                                                                                                                                                |
|----------------|------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                       | Mark | Mark scheme                                                                                                                              | Additional guidance                                                                                                                                                                                                            |
| 12 (a)         | $\frac{3x^2}{(x-4)(x+2)}$    | M1   | for method to identify a common denominator, eg $(x-4)(x+2)$                                                                             | Accept $\frac{2x(x+2)}{(x-4)(x+2)} + \frac{x(x-4)}{(x-4)(x+2)}$                                                                                                                                                                |
|                |                              | M1   | for method to combine the fractions, eg $\frac{2x(x+2) + x(x-4)}{(x-4)(x+2)}$                                                            |                                                                                                                                                                                                                                |
|                |                              | A1   | for $\frac{3x^2}{(x-4)(x+2)}$ or $\frac{3x^2}{x^2-2x-8}$                                                                                 |                                                                                                                                                                                                                                |
|                | (b) $8x^3 - 2x^2 - 51x - 45$ | M1   | for method to find the product of two linear expressions, eg 3 correct terms out of 4 terms or 4 terms ignoring signs                    | Note that, for example, $-3x - 9$ in expansion of $(x-3)(2x+3)$ is to be regarded as 3 correct terms.<br><br>First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly |
|                |                              | M1   | for a complete method to obtain all terms, half of which are correct (ft their first product) eg $8x^3 - 12x^2 - 15x + 10x^2 - 36x - 45$ |                                                                                                                                                                                                                                |
|                |                              | A1   | cao.                                                                                                                                     |                                                                                                                                                                                                                                |
| 13 (a)         | region identified            | M1   | for 2 of lines $x=2$ , $y=x+3$ , $2x+3y=6$ correctly drawn                                                                               | Accept use of full or broken lines for all marks<br><br>Award for clear intention, shading not needed.<br><br>Award for clear intention, shading not needed.                                                                   |
|                |                              | M1   | for all 3 lines $x=2$ , $y=x+3$ , $2x+3y=6$ correctly drawn                                                                              |                                                                                                                                                                                                                                |
|                |                              | M1   | for region which satisfies at least 2 of the inequalities $x \leq 2$ , $y \leq x+3$ , $2x+3y \geq 6$                                     |                                                                                                                                                                                                                                |
|                |                              | A1   | for correct region identified                                                                                                            |                                                                                                                                                                                                                                |
|                | (b) no supported with reason | B1   | for no and reason, eg $(2, 4)$ does satisfy $x+y \leq 6$                                                                                 |                                                                                                                                                                                                                                |
|                |                              |      | or $(2, 4)$ lies on the boundary of the region satisfying the equality sign.                                                             |                                                                                                                                                                                                                                |

| Paper: 1MA1/2H |                           |      |                                                                                                                                                                                |                                                                                                                                                                               |
|----------------|---------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                    | Mark | Mark scheme                                                                                                                                                                    | Additional guidance                                                                                                                                                           |
| 21 (a)         | Sketch                    | B1   | for an appropriate sketch, ie reflection in y axis                                                                                                                             | Must go through $(-2, -4)$ $(0, 0)$ $(1, 1)$ $(3, 0)$ $(5, 4)$<br><br>Condone missing degree symbol                                                                           |
|                | $\tan(x + 270)^\circ - 5$ | M1   | for describing one part of the translation,<br>eg $360 - 90 (= 270)$ or $\tan(x + 270)$<br><br><b>or</b> $(y =) \tan(kx + a) - 5$ where $k$ and $a$ are numbers and $k \neq 0$ |                                                                                                                                                                               |
|                |                           | A1   | cao                                                                                                                                                                            |                                                                                                                                                                               |
| 22             | $x < -7, x > 8$           | M1   | for method to solve $x^2 - 49 > 0$ eg $(x + 7)(x - 7)$<br><b>or 7 and -7</b>                                                                                                   | accept use of = or incorrect inequality symbol for both the M marks<br><br>This may be implied by a suitable diagram<br><br><br><br>This may be implied by a suitable diagram |
|                |                           | A1   | for $x < -7$ <b>and</b> $x > 7$                                                                                                                                                |                                                                                                                                                                               |
|                |                           | M1   | for method to solve $5x^2 - 31x - 72 > 0$<br><br>eg $(5x \pm 9)(x \pm 8)$ <b>or</b> $\frac{- -31 \pm \sqrt{(-31)^2 - 4 \times 5 \times (-72)}}{2 \times 5}$                    |                                                                                                                                                                               |
|                |                           |      | <b>or 8 and -1.8</b> oe                                                                                                                                                        |                                                                                                                                                                               |
|                |                           | A1   | for $x < -1.8$ <b>and</b> $x > 8$                                                                                                                                              |                                                                                                                                                                               |
|                |                           | A1   | cao                                                                                                                                                                            |                                                                                                                                                                               |

## QUESTION 7 – Additional information NOT Exhaustive

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b><u>Cost per litre in £:</u></b><br/> <math>27 \times 0.85 (=22.95)</math><br/> <math>"22.95" \div 18 (=1.275)</math><br/> <math>8 \times 4.5 (=36)</math><br/> <b>No and</b> <math>40.8 \div "36" = 1.133..</math> (cost per litre in £ in Wales) compared to 1.275 (cost per litre in £ in Spain).</p>                                                                                                                                                                                                                             | <p><b><u>Cost per litre in euros:</u></b><br/> <math>27 \div 18 (=1.5)</math><br/> <math>8 \times 4.5 (=36)</math><br/> <math>40.8 \div 0.85 (=48)</math><br/> <b>No and</b> <math>"48" \div "36" = 1.333..</math> (cost per litre in euros in Wales) compared to 1.5 (cost per litre in euros in Spain).</p>                                                                                                                                                                                                                                           |
| <p><b><u>Cost per gallon in £:</u></b><br/> <math>40.8 \div 8 (=5.1)</math><br/> <math>27 \times 0.85 (=22.95)</math><br/> <math>18 \div 4.5 (=4)</math><br/> <b>No and</b> <math>"22.95" \div "4" = 5.7375</math> (cost per gallon in £ in Spain) compared to 5.1(0) (cost per gallon in £ in Wales).</p>                                                                                                                                                                                                                                | <p><b><u>Cost per gallon in euros:</u></b><br/> <math>40.8 \div 0.85 (=48)</math><br/> <math>"48" \div 8 (=6)</math><br/> <math>18 \div 4.5 (=4)</math><br/> <b>No and</b> <math>27 \div "4" = 6.75</math> (cost per gallon in euros in Spain) compared to 6 (cost per gallon in euros in Wales).</p> <p><b><u>Note:</u></b><br/> <math>"2"</math> comes from <math>8 \div "4"</math> or <math>"36" \div 18</math></p>                                                                                                                                  |
| <p><b><u>Cost of 8 gallons in £:</u></b><br/> <math>18 \div 4.5 (=4)</math><br/> <math>27 \times 0.85 (=22.95)</math><br/> <math>"22.95" \times "2" (=45.90)</math><br/> <b>No and</b> 45.90 (total cost in £ in Spain) compared to 40.80 (total cost in £ in Wales given).</p>                                                                                                                                                                                                                                                           | <p><b><u>Cost of 8 gallons in euros:</u></b><br/> <math>18 \div 4.5 (=4)</math><br/> <math>40.8 \div 0.85 (=48)</math><br/> <math>27 \times "2" (=54)</math><br/> <b>No and</b> 54 (cost for 8 gallons in euros in Spain) compared to 48 (cost of 8 gallons in euros in Wales).</p>                                                                                                                                                                                                                                                                     |
| <p><b><u>Cost of 18 litres in £:</u></b><br/> <math>8 \times 4.5 (=36)</math><br/> <math>40.8 \div "2" (=20.4)</math><br/> <math>27 \times 0.85 (=22.95)</math><br/> <b>No and</b> 22.95 (cost for 18 litres in £ in Spain) compared to 20.40 (cost of 18 litres in £ in Wales).<br/> <b>OR</b><br/> <math>18 \div 4.5 (=4)</math><br/> <math>27 \times 0.85 (=22.95)</math><br/> <math>40.8 \div "2" (=20.4)</math><br/> <b>No and</b> 22.95 (cost for 18 litres in £ in Spain) compared to 20.40 (cost of 18 litres in £ in Wales).</p> | <p><b><u>Cost of 18 litres in euros:</u></b><br/> <math>18 \div 4.5 (=4)</math><br/> <math>40.8 \div 0.85 (=48)</math><br/> <math>"48" \div "2" (=24)</math><br/> <b>No and</b> 24 (cost for 18 litres in euros in Wales) compared to 27 (cost of 18 litres in euros in Spain given).<br/> <b>OR</b><br/> <math>8 \times 4.5 (=36)</math><br/> <math>40.8 \div "2" (=20.4)</math><br/> <math>"20.4" \div 0.85 (=24)</math><br/> <b>No and</b> 24 (cost for 18 litres in euros in Wales) compared to 27 (cost of 18 litres in euros in Spain given).</p> |



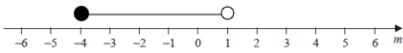
| Paper: 1MA1/1H |                          |      |                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                        |
|----------------|--------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Question       | Answer                   | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                                                                                                                                  | Additional guidance                                                    |
| 24             | $-2.5 < x < \frac{4}{3}$ | M1   | for method to find the critical values of $4x^2 - 25 < 0$<br>eg $(2x + 5)(2x - 5)$<br>or critical values $-2.5$ and $2.5$ oe                                                                                                                                                                                                                                                                                                                 | accept use of = or incorrect inequality symbol for 1st and 3rd M marks |
|                |                          | M1   | (dep on M1) for $x > -2.5$ <b>and</b> $x < 2.5$<br>or $x > a$ <b>and</b> $x < b$ where $a$ and $b$ are their critical values and $a < b$                                                                                                                                                                                                                                                                                                     | This may be implied by a suitable diagram                              |
|                |                          | M1   | for method to find the critical values of $12 - 5x - 3x^2 > 0$ or $3x^2 + 5x - 12 < 0$<br>eg $(4 - 3x)(x + 3)$ or $(3x - 4)(x + 3)$<br>$\frac{- -5 \pm \sqrt{(-5)^2 - 4 \times (-3) \times 12}}{2 \times (-3)} \text{ or } \frac{-5 \pm \sqrt{5^2 - 4 \times 3 \times (-12)}}{2 \times 3}$<br>$3 \left[ \left( x + \frac{5}{6} \right)^2 - \left( \frac{5}{6} \right)^2 \right] - 12 = 0$ oe<br>or critical values $-3$ and $\frac{4}{3}$ oe |                                                                        |
|                |                          | M1   | (dep on previous M1) for $x > -3$ <b>and</b> $x < \frac{4}{3}$<br>or $x > c$ <b>and</b> $x < d$ where $c$ and $d$ are their critical values and $c < d$                                                                                                                                                                                                                                                                                      | This may be implied by a suitable diagram                              |
|                |                          | A1   | for $-2.5 < x < \frac{4}{3}$ oe eg $x < \frac{4}{3}, x > -2.5$                                                                                                                                                                                                                                                                                                                                                                               | A correct answer with no supportive working gets 0 marks               |



| Paper: 1MA1/2H |        |              |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                          |
|----------------|--------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer | Mark         | Mark scheme                                                                                                                                                                                                                                                                                                                        | Additional guidance                                                                                                                                                                                                      |
| 15             | (a)    | Region shown | B4 for a fully correct region identified<br>(B3 for drawing three correct lines)<br>(B2 for drawing two correct lines, must include at least one of $x + y = 5$ or $y = 3x - 2$ )<br>(B1 for drawing $x = 2$ and $y = 1$ correctly<br><b>OR</b> for drawing $x + y = 5$ correctly<br><b>OR</b> for drawing $y = 3x - 2$ correctly) | See diagram at end of mark scheme<br>Can exclude $y = 3x - 2$ for B4<br>Condone solid lines for all marks<br>Region can be identified by shading in or shading out<br>Lines need to be long enough to enclose the region |
|                | (b)    | $y < 3x - 2$ | B1 (dep on B1 in (a)) for $y < 3x - 2$ or ft their diagram if 1 line is redundant                                                                                                                                                                                                                                                  | Condone use of '=' or ' $\leq$ ' and $3x - 2$                                                                                                                                                                            |

| Paper: 1MA1/2H |                   |      |                                                                                                                                                                                                                                                                             |                     |                       |
|----------------|-------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------|
| Question       | Answer            | Mark | Mark scheme                                                                                                                                                                                                                                                                 | Additional guidance |                       |
| 22 (a)         | 163 or 164        | P1   | uses formula eg $1.2 \times 200 - 50 (= 190)$                                                                                                                                                                                                                               |                     |                       |
|                |                   | P1   | for complete process,<br>eg May: $1.2 \times "190" - 50 (= 178)$ <b>and</b><br>June: $1.2 \times "178" - 50 (= 163.6)$                                                                                                                                                      |                     |                       |
|                |                   | A1   | for 163 or 164                                                                                                                                                                                                                                                              |                     |                       |
|                | (b) Statement     | C1   | (dep P1) ft statement,<br>eg there won't be any rabbits, fewer rabbits, decrease                                                                                                                                                                                            |                     |                       |
| 23 (a)         | Shown             | C1   | for a method to find the area of half of the parallelogram or of the whole parallelogram,<br>eg $\frac{1}{2}(2x - 1)(10 - x) \sin 150$ or $\frac{1}{2}(2x - 1)(10 - x) \times \frac{1}{2}$ oe<br>or $(2x - 1)(10 - x) \sin 150$ or $(2x - 1)(10 - x) \times \frac{1}{2}$ oe |                     |                       |
|                |                   | C1   | for a correct expansion of the whole area<br>eg $\frac{1}{2}(20x - 10 - 2x^2 + x)$ or $\frac{1}{2}(-2x^2 + 21x - 10)$ or $-x^2 + 10.5x - 5$                                                                                                                                 |                     |                       |
|                |                   | C1   | complete chain of reasoning with fully correct algebra dealing with the inequality eg<br>$x^2 - 10.5x + 5 < -15$ or $x^2 - 10.5x + 20 < 0$ or $2x^2 - 21x + 10 < -30$<br>which lead to $2x^2 - 21x + 40 < 0$                                                                |                     |                       |
|                | (b) $2.5 < x < 8$ | M1   | for factorising, $(2x - 5)(x - 8)$                                                                                                                                                                                                                                          |                     | Could use the formula |
|                |                   | A1   | for critical values, 2.5, 8                                                                                                                                                                                                                                                 |                     |                       |
|                |                   | A1   | for any statement that x is greater than 2.5 and x is less than 8                                                                                                                                                                                                           |                     |                       |



| Paper: 1MA1/2H |                 |      |                                                                                                                                                                                                                                                                                    |                                                                                                                                       |
|----------------|-----------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer          | Mark | Mark scheme                                                                                                                                                                                                                                                                        | Additional guidance                                                                                                                   |
| 4 (a)          | 4               | B1   | cao                                                                                                                                                                                                                                                                                |                                                                                                                                       |
| (b)            | correct diagram | C2   | for a fully correct diagram, eg<br>                                                                                                                                                               |                                                                                                                                       |
|                |                 | (C1  | for drawing a line from -4 to 1<br><b>or</b> (indep) for an open circle at 1<br><b>or</b> (indep) for a closed circle at -4)                                                                                                                                                       | Condone arrow heads or line ending to denote the 'end' of the line                                                                    |
| (c)            | $g < 25$        | M1   | for a correct first step,<br>eg adding 4 to both sides, eg $\frac{2}{5}g < 6 + 4$<br><b>or</b> multiplying throughout by 5, eg $2g - 4 \times 5 < 6 \times 5$<br><b>or</b> dividing throughout by 2, eg $\frac{1}{5}g - 4 \div 2 < 6 \div 2$                                       | Allow use of any inequality or as an equation for both method marks<br>$\frac{2}{5}g < 10$<br>$2g - 20 < 30$<br>$\frac{g}{5} - 2 < 3$ |
|                |                 | M1   | for a correct second step, eg $2g < "10" \times 5$ or $\frac{1}{5}g < "10" \div 2$<br><b>or</b> $2g < "30" + "20"$ or $g - "20" \div 2 < "30" \div 2$<br><b>or</b> $\frac{g}{5} < "3" + "2"$ or $g - "2" \times 5 < "3" \times 5$<br><b>or</b> showing 25 oe as the critical value | $2g < 50$<br>$\frac{g}{5} < 5$<br>$g - 10 < 15$<br>Can be written as $g = 25$                                                         |
|                |                 | A1   | for $g < 25$ oe                                                                                                                                                                                                                                                                    |                                                                                                                                       |



| Paper: 1MA1/1H |             |      |                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|-------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer      | Mark | Mark scheme                                                                                                                                                                                                                                                                                                                      | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 7 (a)          | $6 - 3m$    | B1   | for $6 - 3m$ oe                                                                                                                                                                                                                                                                                                                  | Accept $3(2 - m)$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| (b)            | $x \geq 10$ | M1   | for a correct first step working with an inequality or an equation,<br>eg $7 + x + 8 \leq \frac{5x}{2} - 8 + 8$ or $15 + x \leq \frac{5x}{2}$<br><br>or $7 + x - x \leq \frac{5x}{2} - 8 - x$ or $7 \leq \frac{3x}{2} - 8$<br><br>or $7 \times 2 + x \times 2 \leq \frac{5x}{2} \times 2 - 8 \times 2$ or $14 + 2x \leq 5x - 16$ | Can work with an equation or incorrect inequality symbol for both M marks<br><br>For M marks step must be carried out not just intention shown.<br>For example, if you see<br>$7 + x \leq \frac{5x}{2} - 8$ $\begin{array}{cc} +8 & +8 \end{array}$ award M1 for $k + x \leq \frac{5x}{2}$ where $k > 7$<br>or indicating $-x$ and reaching<br>$7 \leq kx - 8$ where $k < \frac{5}{2}$<br>or indicating multiplying by 2 and obtaining an equation or inequality with no more than one term incorrect and no term unchanged. |
|                |             | M1   | (dep M1) for a correct second step,<br>eg subtracts $x$ from both sides or adds 8 to both sides or subtracts $2x$ from both sides or multiplies both sides by 2<br><br>or gives the critical value of 10                                                                                                                         | The first 2 marks can be awarded for critical value of 10, eg $x = 10$                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                |             | A1   | for $x \geq 10$ as final answer                                                                                                                                                                                                                                                                                                  | Accept $10 \leq x$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |



| Paper: 1MA1/1H |               |      |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|---------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer        | Mark | Mark scheme                                                                                                                                                                                | Additional guidance                                                                                                                                                                                                                                                                                                                                                                                            |
| 7 (c)          | $2.5 < y < 4$ | M1   | for a correct first step,<br><br>eg $9 - 4 < 2y < 12 - 4$ or $5 < 2y < 8$<br><br>or $9 \div 2 < y + 2 < 12 \div 2$ or $4.5 < y + 2 < 6$<br><br>or showing 2.5 and 4 as the critical values | For M mark condone use of “=” and incorrect inequality signs<br><br>For M mark step must be carried out not just intention shown.<br>For example, if you see<br>$9 < 2y + 4 < 12$<br>$-4 \quad -4 \quad -4$<br>award M1 for $a < 2y < b$ where $a < 9$ and $b < 12$<br><br>or if you see<br>$9 < 2y + 4 < 12$<br>$\div 2 \quad \div 2 \quad \div 2$<br>award M1 for $a < y + 2 < b$ where $a < 9$ and $b < 12$ |
|                |               | A1   | for $2.5 < y < 4$ oe as final answer                                                                                                                                                       | Accept $y > 2.5$ and $y < 4$ oe                                                                                                                                                                                                                                                                                                                                                                                |



| Paper: 1MA1/2H |                                                 |      |                                                                                                       |                                                                                                                                             |
|----------------|-------------------------------------------------|------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                                          | Mark | Mark scheme                                                                                           | Additional guidance                                                                                                                         |
| 15 (a)         | 11.4                                            | M1   | for start to method to find the length of $BC$ eg. $8^2 + 11^2 - 2 \times 8 \times 11 \times \cos 72$ | If an answer within the given range is seen in working and rounded incorrectly award full marks.<br>Any alternative method must be complete |
|                |                                                 | M1   | (dep on M1) for method to use correct order of operations, eg. $64 + 121 - 54.38..... (= 130.61...)$  |                                                                                                                                             |
|                |                                                 | A1   | for answer in the range 11.4 to 11.5                                                                  |                                                                                                                                             |
|                | 41.8                                            | M1   | for $0.5 \times 8 \times 11 \times \sin 72 (= 41.8...)$                                               |                                                                                                                                             |
|                |                                                 | A1   | for answer in the range 41.5 to 41.9                                                                  |                                                                                                                                             |
|                |                                                 |      |                                                                                                       |                                                                                                                                             |
| 16 (a)         | $x_1 = 1.817$<br>$x_2 = 1.853$<br>$x_3 = 1.846$ | M1   | for a correct method to find $x_1$ eg $\sqrt[3]{10-2 \times 2} (= 1.8171.....)$                       | Accept an accuracy of 2dp or more rounded or truncated                                                                                      |
|                |                                                 | M1   | (dep on M1) for substitution of $x_1$ to give $x_2$ <b>and</b> $x_2$ to give $x_3$                    |                                                                                                                                             |
|                |                                                 | A1   | for $x_1 = 1.81(71...)$ , $x_2 = 1.85(33...)$ and $x_3 = 1.84(62....)$                                |                                                                                                                                             |
|                | $a = 2$ , $b = -10$                             | C1   | cao                                                                                                   |                                                                                                                                             |
|                |                                                 |      |                                                                                                       |                                                                                                                                             |
|                |                                                 |      |                                                                                                       |                                                                                                                                             |

| Paper: 1MA1/2H |                      |      |                                                                                                                                                                                                                                           |                                                                                                                                                       |
|----------------|----------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer               | Mark | Mark scheme                                                                                                                                                                                                                               | Additional guidance                                                                                                                                   |
| 17 (a)         | Shows re-arrangement | C1   | for showing rearrangement, must see $x^4 = x^2 + 5$ leading to $x = \sqrt[4]{x^2 + 5}$                                                                                                                                                    | Can work backwards                                                                                                                                    |
|                |                      | M1   | for substitution to find $x_1$ eg $\sqrt[4]{1.5^2 + 5}$ (= 1.64...)                                                                                                                                                                       |                                                                                                                                                       |
|                |                      | M1   | for substitution to find $x_2$ eg $\sqrt[4]{1.64\dots^2 + 5}$ (= 1.66...)                                                                                                                                                                 |                                                                                                                                                       |
|                |                      | A1   | for answer in the range 1.6697 to 1.6698 or 1.67(0)                                                                                                                                                                                       |                                                                                                                                                       |
| 18             | Shown                | M1   | for start to method to find a ratio connecting 2 of $a$ , $b$ and $c$ , eg $a : c = 3 : 5$ oe or $b : c = 5 : 3$ oe<br><b>or</b> for start to method to combine ratios, eg $14a : 35c$ (= 126 : 525) <b>and</b> $20b : 35c$ (= 500 : 525) | May be expressed in fractional form<br>Any ratios must be clearly assigned to variables                                                               |
|                |                      | M1   | for method to find $a : b : c$ , eg 9 : 25 : 15 oe<br><b>or</b> for method to write $a + b : b + c$ in terms of one variable<br>eg $\frac{3c}{5} + \frac{5c}{3} : \frac{5c}{3} + c$                                                       |                                                                                                                                                       |
|                |                      | A1   | for $a + b : b + c = 34 : 40$ oe leading to result                                                                                                                                                                                        |                                                                                                                                                       |
|                |                      |      |                                                                                                                                                                                                                                           |                                                                                                                                                       |
| 19             | 46.989...            | B1   | for stating at least one bound, 9.25 or 9.35 or 12.55 or 12.65                                                                                                                                                                            | Accept 9.349 or 9.3499(...) or 12.649 or 12.6499(...)<br><br>$9.25 \leq \text{LB} < 9.3$<br>$12.6 < \text{UB} \leq 12.65$<br>$\sin(x) = 0.731(\dots)$ |
|                |                      | P1   | for correct use of LB and UB, eg $\sin x = \frac{[\text{LB of } AB]}{[\text{UB of } AC]}$                                                                                                                                                 |                                                                                                                                                       |
|                |                      | A1   | for answer in the range 46.98 to 47 from correct working                                                                                                                                                                                  |                                                                                                                                                       |



| Paper 1MA1: 3H |         |                                                           |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|---------|-----------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working | Answer                                                    | Mark                       | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 15             |         | 2.63                                                      | P1<br>P1<br>P1<br>P1<br>A1 | for setting up the expression $\frac{1}{2}(x+3)(2x-1)\sin 45$ (may be seen in an equation)<br>(dep) for expanding the brackets in the expression or for the equation $\frac{1}{2}(x+3)(2x-1)\sin 45 = 6\sqrt{2}$ oe<br>(dep) for the process to set up the equation and rearrange to the form $ax^2 + bx + c = d$ e.g. to $2x^2 + 5x - 27 = 0$ or $24 = 2x^2 + 5x - 3$<br>(dep) for substitution into the quadratic formula e.g. $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -27}}{4}$<br>for 2.63(10436...) |
| 16 (a)         |         | $x_1 = -2.64$<br>$x_2 = -2.57392$<br>$x_3 = -2.603767255$ | M1<br>M1<br>A1             | for substitution of -2.5 into the equation (to get $x_1 = -2.64$ )<br>for substitution of " $x_1 = -2.64$ " and " $x_2 = -2.57392$ " to give $x_2$ and $x_3$<br>for $x_1 = -2.64$ oe, $x_2 = -2.57(392)$ and $x_3 = -2.6(03767255)$<br>Condone $x_3 = -2.61$ if $x_2 = -2.57$ is used in the substitution                                                                                                                                                                                                    |
| (b)            |         | Statements                                                | C1<br>C1                   | Connection between equation and iterative form in (a) e.g. rearrangement<br>Statement e.g. iteration is an estimation of a solution                                                                                                                                                                                                                                                                                                                                                                          |
| 17 (a)         |         | No<br>(supported)                                         | P1<br>P1<br>P1<br>C1       | for 265 or 275 or 274.999... or 107.5 or 112.5 or 112.4999...<br>process to find $\frac{d}{t}$ where $270 < d \leq 275$ and $107.5 \leq t < 110$ oe<br>for process to work in consistent units of time<br>eg $\frac{d}{t} \times 60$ or $t \div 60$ where $265 \leq d \leq 275$ and $107.5 \leq t < 110$ oe<br>or $160 \div 60 (= 2.666...)$<br>Conclusion supported with correct figure(s) given eg No and 153(.488...) or<br>No and 2.66 to 2.7 and 2.5(581...) from correct working                       |
| (b)            |         | Statement                                                 | C1                         | e.g. Less distance in the same time so (max) speed would drop                                                                                                                                                                                                                                                                                                                                                                                                                                                |



| Paper: 1MA1/3H |                               |      |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Answer                        | Mark | Mark scheme                                                                                                                                                                                  | Additional guidance                                                                                                                                                                                                                                                     |
| 18 (a)         | Correct statement             | C1   | for substituting both 1 and 2 into $x^3 + x$ or into $x^3 + x - 7$                                                                                                                           | All arithmetic shown must be correct.<br>Ignore any additional trials shown.                                                                                                                                                                                            |
|                |                               | C1   | for values 2 and 10 plus explanation that these are above and below 7, or for values -5 and 3 plus explanation that there is a change of sign, thus implying a solution lies between 1 and 2 |                                                                                                                                                                                                                                                                         |
|                | Correct rearrangement<br>1.74 | C1   | for correct algebraic rearrangement                                                                                                                                                          | $x_1 = 1.70997\dots$<br>$x_2 = 1.74241\dots$<br>$x_3 = 1.73884\dots$<br>Accept an accuracy of 2 dp or more rounded or truncated for values of $x_1$ and $x_2$<br>Award the marks for 1.7 on the answer line provided correct iterations are shown in the working space. |
|                |                               | M1   | for substitution of 2 into the formula eg $\sqrt[3]{7-2}$ ( $= 1.70997\dots$ )                                                                                                               |                                                                                                                                                                                                                                                                         |
|                |                               | M1   | for a substitution of $x_1$ to give $x_2$ ( $= 1.74241\dots$ )                                                                                                                               |                                                                                                                                                                                                                                                                         |
|                |                               | A1   | for answer in the range 1.738 to 1.74                                                                                                                                                        |                                                                                                                                                                                                                                                                         |



| Paper: IMA1/2H |                      |      |                                                                                                                                                                            |                                                                                       |
|----------------|----------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Question       | Answer               | Mark | Mark scheme                                                                                                                                                                | Additional guidance                                                                   |
| 17 (a)         | Shown                | M1   | For a start to establish at least one root in $[1,2]$ , eg substitutes $x = 1$ or $x = 2$ into LHS, eg $1^3 + 2 \times 1 - 6$ , or $2^3 + 2 \times 2 - 6$                  | $f(x) = x^3 + 2x - 6$<br>$f(1) = -3$<br>$f(2) = 6$                                    |
|                |                      | C1   | For a complete argument, eg evaluates for both values of $x$ and states since there is a sign change there must be at least one root in $1 < x < 2$ (as $f$ is continuous) |                                                                                       |
|                | Shows re-arrangement | C1   | for showing re-arrangement; must see $x^3 + 2x - 6 = 0$ leading to $x(x^2 + 2) - 6 = 0$ or $x(x^2 + 2) = 6$<br>or $x = \frac{6}{x^2 + 2}$ leading to $x^3 + 2x = 6$        | If a correct value is given and then rounded or rounded incorrectly award full marks. |
|                |                      | M1   | for $x_1 = \frac{6}{1.45^2 + 2}$ ( $=1.462(522851\dots)$ )                                                                                                                 |                                                                                       |
|                | 1.4496               | M1   | for $x_2 = \frac{6}{1.462(52\dots)^2 + 2}$ ( $=1.449634937$ )                                                                                                              |                                                                                       |
|                |                      | A1   | for answer in the range 1.4496 to 1.4497                                                                                                                                   |                                                                                       |



| Paper: 1MA1/3H |                                                               |                         |                            |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|---------------------------------------------------------------|-------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question       | Working                                                       | Answer                  | Mark                       | Notes                                                                                                                                                                                                                                                                                                                                                                                                               |
| 15 (a)         |                                                               | Shown                   | M1<br>C1                   | for method to establish at least one root between $x = 0$ and $x = 1$ ,<br>eg $f(0) = -5$ and $f(1) = 3$<br>for correct values and a deduction about the roots eg as there is a sign change there must be at least one root between $x = 0$ and $x = 1$ (as $f$ is continuous)                                                                                                                                      |
| (b)            |                                                               | Shown                   | C1<br>C1                   | for a correct first step in rearrangement, eg $x(x^2 + 7) - 5 = 0$ or $x^3 + 7x = 5$<br>for clear and correct steps showing complete rearrangement                                                                                                                                                                                                                                                                  |
| (c)            | $x_1 = 0.625$<br>$x_2 = 0.6765327696$<br>$x_3 = 0.6704483001$ | 0.6704(483001)          | M1<br>M1<br>A1             | for substitution of 1 into the formula (to get 0.625)<br>for substitution of " $x_1 = 0.625$ " and " $x_2 = 0.6765327696$ " to give $x_2$ and $x_3$<br>0.6704(483001)                                                                                                                                                                                                                                               |
| (d)            |                                                               | Comment                 | M1<br>C1                   | substitutes answer to (c) into expression (to get $-0.00549\dots$ )<br>appropriate comment, eg accurate as answer is close to 0                                                                                                                                                                                                                                                                                     |
| 16             |                                                               | Yes and correct working | B1<br>P1<br>A1             | for 147.5 or 148.5 or 148.4999... or 11.75 or 11.85 or 11.84999...<br>substitutes $11.8 < UB \leq 11.85$ and $147.5 \leq LB < 148$ in the formula to work out petrol consumption<br>for 'Yes' and 8.03(3898305...) from correct working                                                                                                                                                                             |
| 17             |                                                               | 14.4                    | P1<br>P1<br>P1<br>P1<br>A1 | for start of process, eg $0.5 \times 11 \times CD \times \sin 105 = 56$<br>for complete process to find $CD$ , eg $(CD =) \frac{56}{0.5 \times 11 \times \sin 105}$ oe (= 10.54)<br>for process to find $AC$ , eg $(AC^2 =) 11^2 + [CD]^2 - 2 \times 11 \times [CD] \times \cos 105$ ( $AC = 17.09$ )<br>for process to find $AB$ , eg $\frac{AB}{\sin 48} = \frac{[AC]}{\sin 118}$<br>answer in range 14.3 to 14.4 |

