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EDEXCEL INTERNATIONAL GCSE MATHS: QUESTIONS BY TOPIC

Equations & Inequalities (A2)

International GCSE Mathematics A (4MA1) · Higher tier

126 questions · 547 marks · Mark schemes included

Past papers June 2018 - 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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A2e ITERATION & NUMERICAL METHODS

No questions on this sub-topic in the available past papers.

QUESTIONS

126 questions · 547 marks · 4 sub-topics

SUB-TOPIC A2a

LINEAR EQUATIONS

Sub-topic A2a · 11 questions · 55 marks · lowest tariff first

3 $\mathscr{E} = \{11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$
$A = \{\text{even numbers}\}$
$B = \{\text{multiples of 3}\}$

List the members of the set

(i) $A \cap B$

.....

(ii) $A \cup B$

.....

(iii) A'

.....

(Total for Question 3 is 3 marks)

4 Solve $4x - 13 = 17 + 8x$

$x =$ .....

(Total for Question 4 is 2 marks)

8 The table gives the length of the coastline, in kilometres, of each of five oceans.

Ocean	Length of coastline (km)
Arctic	4.539×10^4
Atlantic	1.119×10^5
Pacific	1.357×10^5
Indian	6.653×10^4
Southern	1.797×10^4

(a) Which ocean has the greatest length of coastline?

.....

(1)

(b) Calculate the difference between the length of the Atlantic Ocean's coastline and the length of the Southern Ocean's coastline.
Give your answer in standard form.

..... km

(2)

(Total for Question 8 is 3 marks)

9 Solve $x^2 - 21x + 20 = 0$
Show your working clearly.

.....

(Total for Question 9 is 3 marks)

2 Solve $3(2 - 4x) = 5 - 8x$
Show clear algebraic working.

$x =$ .....

(Total for Question 2 is 3 marks)

(c) Use the graph to complete the frequency table to give information about the time, in minutes, each of the 60 people took to shop in the market.

Time taken to shop in the market (m minutes)	Frequency
$0 < m \leqslant 10$	3
$10 < m \leqslant 20$	5
$20 < m \leqslant 30$	
$30 < m \leqslant 40$	
$40 < m \leqslant 50$	
$50 < m \leqslant 60$	
$60 < m \leqslant 70$	

(2)

(Total for Question 12 is 5 marks)

13 Solve $\frac{x+3}{4} - \frac{7-x}{5} = 4.3$

Show clear algebraic working.

$x =$ .....

(Total for Question 13 is 3 marks)

18 Solve the equation

$$\frac{5}{x+2} + \frac{3}{x^2+2x} = 2$$

Show clear algebraic working.

.....

(Total for Question 18 is 5 marks)

24 Solve $\frac{45x^3 - 80x}{3x^2 + x - 4} \times \left(\frac{1}{3x - 4} + \frac{1}{x} \right) = \frac{4(x + 2)}{5x - 8}$

Show clear algebraic working.

$x =$ .....

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 100 MARKS

3 (a) Simplify $h^7 \times h^2$

.....

(1)

$G = c^2 - 4c$

(b) Find the value of G when $c = -5$

$G =$ .....

(2)

(c) Solve $\frac{5x - 3}{4} = 2x + 3$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 3 is 6 marks)

15 (a) Solve $\frac{5a+8}{3} - \frac{2a+5}{4} = 23$

Show clear algebraic working.

$a =$ .....

(4)

(b) Express $\left(\frac{\sqrt{y}}{3}\right)^{-1}$ in the form cy^n where c and n are numbers to be found.

.....

(2)

(Total for Question 15 is 6 marks)

15 (a) Simplify fully $\left(32a^{15}\right)^{\frac{3}{5}}$

.....

(2)

(b) Express $\left(\frac{1}{10x}\right)^{-3}$ in the form px^n where p and n are integers.

.....

(2)

(c) Solve $\frac{1-2y}{3} = \frac{4}{5} - \frac{2y-1}{2}$

Show clear algebraic working.

$y =$ .....

(3)

(Total for Question 15 is 7 marks)

14 (a) Show that $3y(2y + 5)(y + 7)$ can be written in the form $ay^3 + by^2 + cy$ where a, b and c are integers.

(3)

(b) Solve $\frac{2x + 3}{5} + \frac{6x - 5}{4} = \frac{163}{100}$

Show clear algebraic working.

$x =$ .....

(4)

(Total for Question 14 is 7 marks)

4 (a) Solve $\frac{2x+5}{6} = 2x - 5$

Show clear algebraic working.

$x =$ .....

(3)

(b) Simplify $h^{15} \div h^3$

.....

(1)

(c) Simplify fully $\left(2g^3k^5\right)^4$

.....

(2)

(d) Given that $\frac{y^5 \times y^n}{y^7} = y^{12}$

work out the value of n

$n =$ .....

(2)

(Total for Question 4 is 8 marks)

SUB-TOPIC A2b

QUADRATIC EQUATIONS

Sub-topic A2b · 27 questions · 122 marks · lowest tariff first

6 Solve $x^2 - 5x - 36 = 0$
Show clear algebraic working.

.....

(Total for Question 6 is 3 marks)

7 In a sale, the normal price of a hat is reduced by 15%
The sale price of the hat is 20.40 euros.

Work out the normal price of the hat.

..... euros

(Total for Question 7 is 3 marks)

22 The first term of an arithmetic series S is -6
The sum of the first 30 terms of S is 2865

Find the 9th term of S.

.....

(Total for Question 22 is 4 marks)

23 Express $7 - 12x - 2x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

.....

(Total for Question 23 is 3 marks)

8 Solve the simultaneous equations

$$5a + 2c = 10$$
$$2a - 4c = 7$$

Show clear algebraic working.

$a =$ .....

$c =$ .....

(Total for Question 8 is 3 marks)

9 (i) Factorise $x^2 + 2x - 24$

.....

(2)

(ii) Hence solve $x^2 + 2x - 24 = 0$

.....

(1)

(Total for Question 9 is 3 marks)

19 Given that $\left(\sqrt[3]{\frac{1}{x}}\right)^4 = x^m$

(a) find the value of m

$m =$ .....

(1)

Given that a, b and c are integers,

(b) express $3x^2 + 12x + 19$ in the form $a(x + b)^2 + c$

.....

(2)

(Total for Question 19 is 3 marks)

10 Solve the simultaneous equations

$$7x + 3y = 3$$
$$3x - y = 7$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

11 (i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(Total for Question 11 is 3 marks)

19 Express $3x^2 - 6x + 5$ in the form $a(x - b)^2 + c$

.....

(Total for Question 19 is 3 marks)

10 Solve the simultaneous equations

$$6x + 4y = 1$$
$$3x + 5y = 8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

11 (i) Factorise $x^2 + 9x - 22$

.....

(2)

(ii) Hence, solve $x^2 + 9x - 22 = 0$

.....

(1)

(Total for Question 11 is 3 marks)

20 (a) Write $3x^2 - 12x + 7$ in the form $a(x + b)^2 + c$

(3)

The line **L** is the line of symmetry of the curve with equation $y = 3x^2 - 12x + 7$

(b) Using your answer to part (a) or otherwise, write down an equation of **L**.

(1)

(Total for Question 20 is 4 marks)

22 Write $5 + 12x - 2x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

.....

(Total for Question 22 is 4 marks)

8 (a) Simplify $(3x^2y)^0$

.....

(1)

(b) (i) Factorise $x^2 - 5x - 36$

.....

(2)

(ii) Hence solve $x^2 - 5x - 36 = 0$

.....

(1)

(Total for Question 8 is 4 marks)

20 (a) Express $7 + 12x - 3x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

.....

(3)

C is the curve with equation $y = 7 + 12x - 3x^2$
The point A is the maximum point on **C**

(b) Use your answer to part (a) to write down the coordinates of A

(..... , ...)

(1)

(Total for Question 20 is 4 marks)

24 Express each of a, b and c in terms of q so that

$$q + 12x - qx^2$$

can be written as $a - b(x - c)^2$

$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 24 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

25 $f(x) = 17 - 3x^2 + 12x$

Write $f(x)$ in the form $a - b(x - c)^2$ where a, b and c are constants.

$f(x) =$ .....

(Total for Question 25 is 4 marks)

TOTAL FOR PAPER IS 100 MARKS

7 (a) Solve the inequality $2x + 7 > 4$

.....

(2)

(b) Solve $x^2 - 3x - 40 = 0$
Show clear algebraic working.

.....

(3)

(Total for Question 7 is 5 marks)

24 (a) Write $7 + 12x - 3x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

.....

(4)

The curve **C** has equation $y = 7 + 12x - 3x^2$
The point A is the turning point on **C**.

(b) Using your answer to part (a), write down the coordinates of A.

(..... , ...)

(1)

(Total for Question 24 is 5 marks)

9 (a) Simplify $(2x^3y^5)^4$

.....

(2)

(b) (i) Factorise $x^2 + 5x - 36$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 36 = 0$

.....

(1)

(Total for Question 9 is 5 marks)

16 (a) Expand and simplify $(x + 4)(x – 2)(x + 1)$

.....

(3)

(b) Express $x^2 – 10x + 40$ in the form $(x + a)^2 + b$, where a and b are integers.

.....

(2)

(Total for Question 16 is 5 marks)

6 (a) Solve the inequality $5x - 7 \leqslant 2$

.....

(2)

(b) (i) Factorise $y^2 - 2y - 35$

.....

(2)

(ii) Hence, solve $y^2 - 2y - 35 = 0$

.....

(1)

(Total for Question 6 is 5 marks)

5 (a) Expand $3c^3(c + 4)$

.....

(2)

(b) (i) Factorise $x^2 + 8x - 9$

.....

(2)

(ii) Hence, solve $x^2 + 8x - 9 = 0$

.....

(1)

(Total for Question 5 is 5 marks)

23 (a) Express $2x^2 - 12x + 3$ in the form $a(x + b)^2 + c$ where a, b and c are integers.

.....

(3)

The curve **C** has equation $y = 2(x + 4)^2 - 12(x + 4) + 3$

The point M is the minimum point on **C**

(b) Find the coordinates of M

(..... , ...)

(2)

(Total for Question 23 is 5 marks)

23 The curve **C** has equation $y = x^2 - 8x - 9$
The straight line **L** has equation $y = k$ where k is an integer.

C and **L** intersect at the points A and B

The coordinates of point A are (p, k)
The coordinates of point B are (q, k)

Given that $p - q = 14$

find the value of k
Show clear algebraic working.

$k =$ .....

(Total for Question 23 is 5 marks)

Turn over for Question 24

11 (a) Expand and simplify $(2x - 1)(x + 3)(x - 5)$

.....

(3)

(b) Solve $3x^2 + 6x - 5 = 0$
Show your working clearly.
Give your solutions correct to 3 significant figures.

.....

(3)

(Total for Question 11 is 6 marks)

24 (a) Express $7 - 4x - x^2$ in the form $p - (x + q)^2$ where p and q are constants.

.....

(2)

(b) Use your answer to part (a) to solve the equation $7 - 4(y + 3) - (y + 3)^2 = 0$

Give your solutions in the form $e \pm \sqrt{f}$ where e and f are integers.

.....

(3)

The curve **C** has equation $y = 3 - 5(x + 1)^2$
The point A is the maximum point on **C**.

(c) Write down the coordinates of A.

(..... , ...)

(1)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

8 (a) (i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(b) Solve the inequality $3y + 5 > 7y - 10$

Show clear algebraic working.

.....

(3)

(Total for Question 8 is 6 marks)

6 (a) Solve $x - 4 = \dfrac{3 + 2x}{6}$

Show clear algebraic working.

$x =$ .....

(3)

(b) (i) Factorise $y^2 - 11y + 30$

.....

(2)

(ii) Hence solve $y^2 - 11y + 30 = 0$

.....

(1)

(Total for Question 6 is 6 marks)

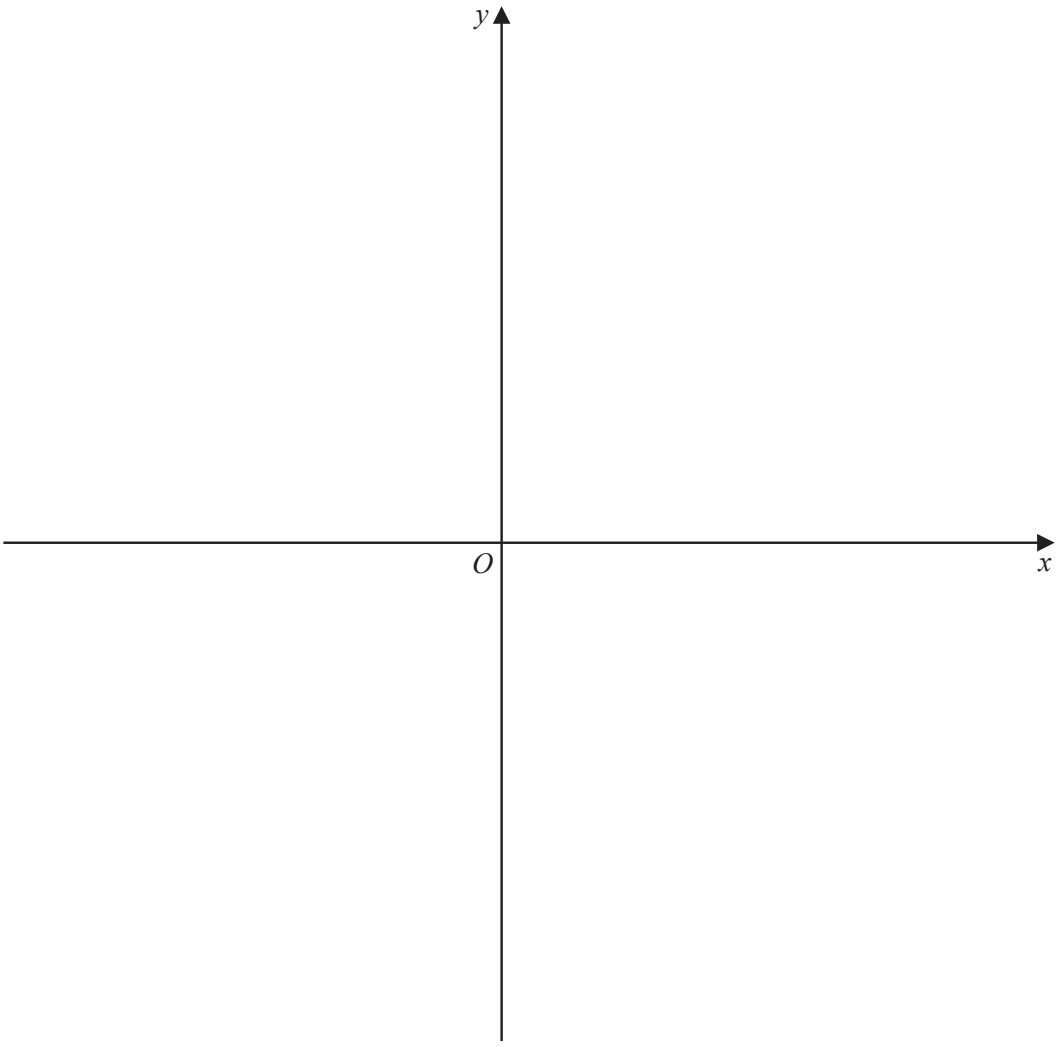
25 (a) Write $28+24x-6x^2$ in the form $a-b(x-c)^2$ where a, b and c are integers.

.....

(3)

(b) On the axes below, sketch the graph of $y = 28 + 24x - 6x^2$

Show clearly the coordinates of the turning point and the coordinates of the point of intersection of the graph with the y-axis.



(3)

(Total for Question 25 is 6 marks)

Turn over for Question 26

16

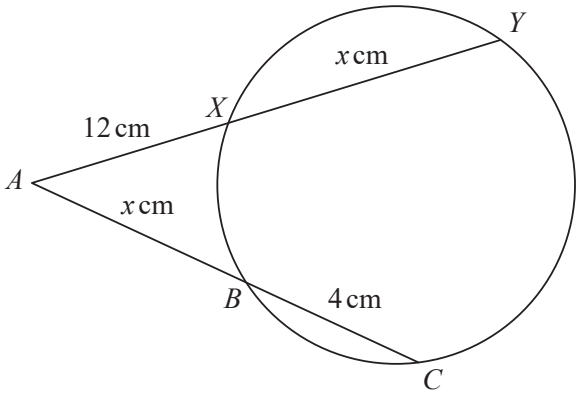


Diagram **NOT** accurately drawn

The points B, C, Y and X lie on a circle.

AXY and ABC are straight lines.

$AX = 12\,\text{cm}$ $XY = x\,\text{cm}$ $AB = x\,\text{cm}$ $BC = 4\,\text{cm}$

(a) Show that $x^2 - 8x - 144 = 0$

(3)

(b) Find the length of AC.
Show your working clearly.
Give your answer correct to 3 significant figures.

..... cm

(4)

(Total for Question 16 is 7 marks)

SUB-TOPIC A2c

SIMULTANEOUS EQUATIONS

Sub-topic A2c · 48 questions · 205 marks · lowest tariff first

10 Solve

$$3x + 2y = 15$$
$$10x - 4y = 2$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

11 Change a speed of 72 kilometres per hour to a speed in metres per second.

..... metres per second

(Total for Question 11 is 3 marks)

8

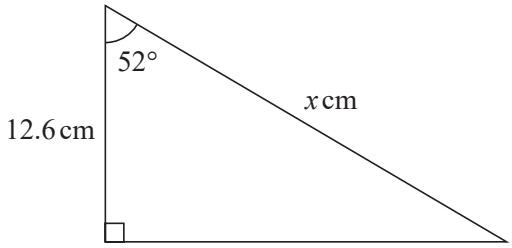


Diagram **NOT** accurately drawn

Work out the value of x.
Give your answer correct to 3 significant figures.

$x =$ .....

(Total for Question 8 is 3 marks)

9 Solve the simultaneous equations

$$x + y = 15$$
$$7x - 5y = 3$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 9 is 3 marks)

8 Solve the simultaneous equations

$$4x + 2y = 9$$

$$x - 4y = 9$$

Show clear algebraic working.

$x =$

$y =$

(Total for Question 8 is 3 marks)

9 Solve the simultaneous equations

$$4x + 5y = 4$$
$$2x - y = 9$$

Show clear algebraic working.

$x =$

$y =$

(Total for Question 9 is 3 marks)

9 Solve the simultaneous equations

$$x + 2y = -0.5$$
$$3x - y = 16$$

Show clear algebraic working.

$x =$.....

$y =$.....

(Total for Question 9 is 3 marks)

7 Solve the simultaneous equations

$$3x + 5y = 6$$
$$7x - 5y = -11$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 7 is 3 marks)

8 Hamish buys a new car for $20 000
The car depreciates in value by 19% each year.

Work out the value of the car at the end of 3 years.
Give your answer to the nearest $.

$ .....

(Total for Question 8 is 3 marks)

8 Solve the simultaneous equations

$$5a + 2c = 10$$
$$2a - 4c = 7$$

Show clear algebraic working.

$a =$ .....

$c =$ .....

(Total for Question 8 is 3 marks)

9 (i) Factorise $x^2 + 2x - 24$

.....

(2)

(ii) Hence solve $x^2 + 2x - 24 = 0$

.....

(1)

(Total for Question 9 is 3 marks)

10 Solve the simultaneous equations

$$3x + 5y = 3.1$$
$$6x + 3y = 3.75$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

10 Solve the simultaneous equations

$$7x + 3y = 3$$
$$3x - y = 7$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

11 (i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(Total for Question 11 is 3 marks)

5 C grams of chocolate is shared in the ratios $2 : 5 : 8$
The difference between the largest share and the smallest share is 390 grams.

Work out the value of C

$C =$ .....

(Total for Question 5 is 3 marks)

6 Solve the simultaneous equations

$$x + 2y = 15$$
$$4x - 6y = 4$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 6 is 3 marks)

6 The points A and B are on a coordinate grid.

The coordinates of A are (6, 4)
The coordinates of B are (17, j) where j is a constant.

The midpoint of AB has coordinates (k, 15) where k is a constant.

Find the value of j and the value of k

$j =$ .....

$k =$ .....

(Total for Question 6 is 3 marks)

7 Solve the simultaneous equations

$$5x + 4y = -2$$
$$2x - y = 4.4$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 7 is 3 marks)

9 Solve the simultaneous equations

$$2x + 9y = 14.5$$
$$7x + 3y = 8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 9 is 3 marks)

10 Here are the test marks of 15 students.

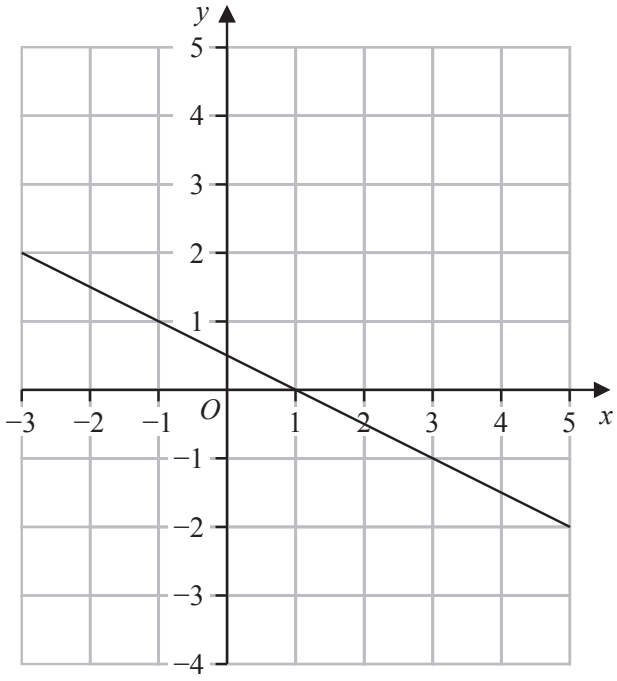
7 10 14 15 16 17 18 19 20 20 23 25 30 39 40

Find the interquartile range of these marks.

.....

(Total for Question 10 is 2 marks)

14 Here is the graph of the equation $2y + x = 1$ drawn on a grid.



By drawing another straight line on the grid, solve the simultaneous equations

$$y - x - 2 = 0$$
$$2y + x = 1$$

$x =$ .....

$y =$ .....

(Total for Question 14 is 3 marks)

10 Solve the simultaneous equations

$$6x + 4y = 1$$
$$3x + 5y = 8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 10 is 3 marks)

11 (i) Factorise $x^2 + 9x - 22$

.....

(2)

(ii) Hence, solve $x^2 + 9x - 22 = 0$

.....

(1)

(Total for Question 11 is 3 marks)

7 Tim buys a bracelet for 4000 Swiss francs.
The value of the bracelet increases by 7% each year.

Work out the value of the bracelet at the end of 3 years.
Give your answer correct to the nearest Swiss franc.

..... Swiss francs

(Total for Question 7 is 3 marks)

8 Solve the simultaneous equations

$$3x + 5y = 8$$
$$4x + y = -3.5$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 8 is 3 marks)

2 Write 1400 as a product of powers of its prime factors.
Show your working clearly.

.....

(Total for Question 2 is 3 marks)

3 Solve the simultaneous equations

$$3x + 2y = 10$$
$$3x - 4y = 16$$

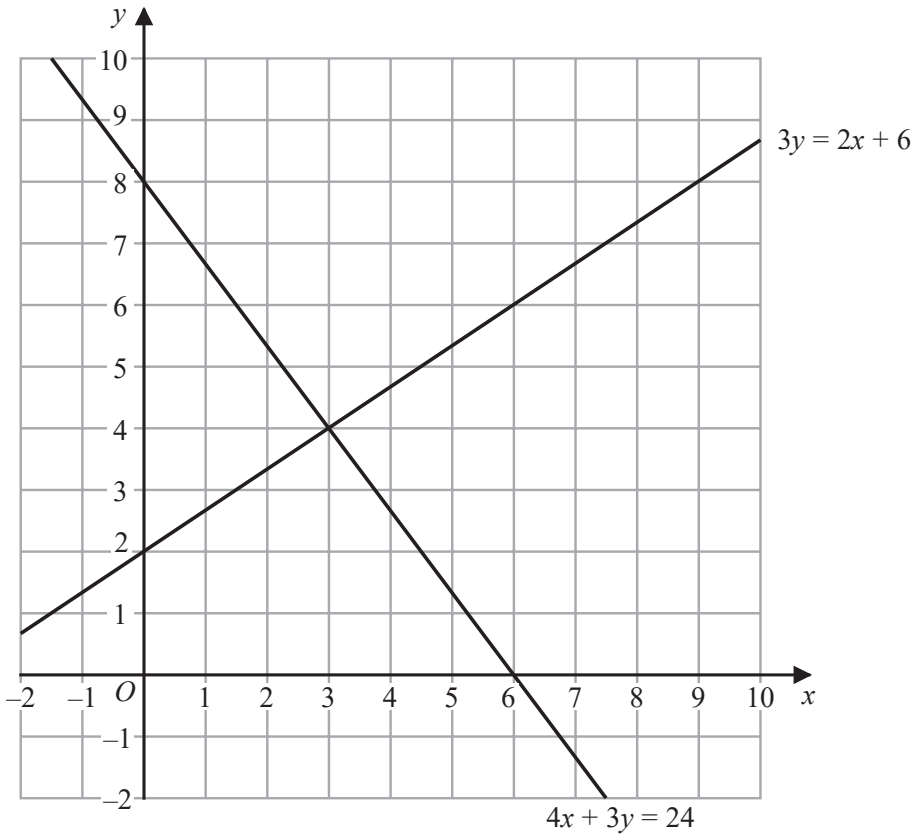
Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 3 is 3 marks)

12 The diagram shows two straight lines drawn on a grid.



(a) Write down the solution of the simultaneous equations

$$3y = 2x + 6$$
$$4x + 3y = 24$$

$x =$ .....

$y =$ .....

(1)

(b) Show, by shading on the grid, the region defined by all five of the inequalities

$x \geqslant 0$ $y \geqslant 0$ $x + y \geqslant 4$ $3y \leqslant 2x + 6$ $4x + 3y \leqslant 24$

Label the region **R**.

(3)

(Total for Question 12 is 4 marks)

12 Solve the simultaneous equations

$$7x - 2y = 34$$
$$3x + 5y = -3$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

12 Solve the simultaneous equations

$$7x + 2y = 5.5$$
$$3x - 5y = 17$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

11 A circle centre O has radius 9 cm.

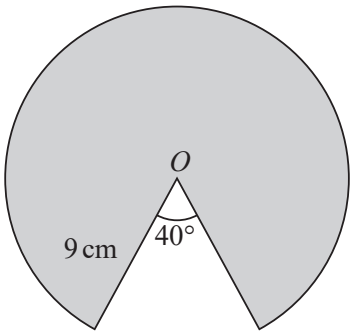


Diagram **NOT** accurately drawn

Calculate the perimeter of the shaded sector of the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 11 is 4 marks)

12 Solve the simultaneous equations $2x + 7y = 17$
$5x + 3y = -1$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

14 Solve the simultaneous equations

$$3x - 5y = 25$$
$$4x + 3y = 14$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 14 is 4 marks)

12 Solve the simultaneous equations

$$4x + 3y = 9.6$$
$$6x + 5y = 16.8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

(Total for Question 12 is 4 marks)

18 Solve the simultaneous equations

$$2x^2 + 3y^2 = 14$$

$$x = 2y - 3$$

Show clear algebraic working.

.....

(Total for Question 18 is 5 marks)

22 Solve the simultaneous equations

$$2x^2 + 3y^2 = 5$$
$$y = 2x + 1$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

20 The equation of the line **L** is $y = 9 - x$
The equation of the curve **C** is $x^2 - 3xy + 2y^2 = 0$

L and **C** intersect at two points.

Find the coordinates of these two points.
Show clear algebraic working.

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

(Total for Question 20 is 5 marks)

22 The line with equation $y = x + 2$ intersects the curve with equation $x^2 + y^2 - 2y = 24$ at the points A and B.

Find the coordinates of A and B.
Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for Question 22 is 5 marks)

16 Solve the simultaneous equations

$$3xy - y^2 = 8$$
$$x - 2y = 1$$

Show clear algebraic working.

.....

(Total for Question 16 is 5 marks)

19 Solve the simultaneous equations

$$x^2 - 9y - x = 2y^2 - 12$$
$$x + 2y - 1 = 0$$

Show clear algebraic working.

.....

(Total for Question 19 is 5 marks)

17 Solve the simultaneous equations

$$x - 6y = 5$$
$$xy - 2y^2 = 6$$

Show clear algebraic working.

.....

(Total for Question 17 is 5 marks)

19 Solve the simultaneous equations

$$y = 3 - 2x$$
$$x^2 + y^2 = 18$$

Show clear algebraic working.

.....

(Total for Question 19 is 5 marks)

5 Yasmin has some identical rectangular tiles.
Each tile is L cm by W cm.

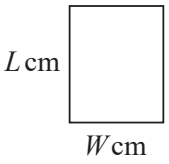


Diagram **NOT** accurately drawn

Using 9 of her tiles, Yasmin makes rectangle $ABCD$, shown in the diagram below.

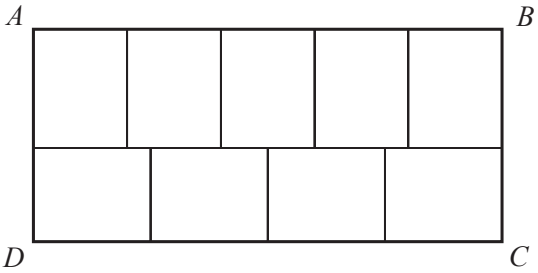


Diagram **NOT** accurately drawn

The area of $ABCD$ is $1620\,\text{cm}^2$

Work out the value of L and the value of W.

$L =$ ..... $W =$ .....

(Total for Question 5 is 5 marks)

6 Alison buys 5 apples and 3 pears for a total cost of $1.96
Greg buys 3 apples and 2 pears for a total cost of $1.22

Michael buys 10 apples and 10 pears.

Work out how much Michael pays for his 10 apples and 10 pears.
Show your working clearly.

$.....

(Total for Question 6 is 5 marks)

7 Write 3.6×10^3 as a product of powers of its prime factors.
Show your working clearly.

.....

(Total for Question 7 is 3 marks)

19 Solve the simultaneous equations

$$3x^2 + y^2 - xy = 5$$
$$y = 2x - 3$$

Show clear algebraic working.

.....

(Total for Question 19 is 5 marks)

18 The line with equation $2y = x + 1$ intersects the curve with equation $3y^2 + 7y + 16 = x^2 - x$ at the points A and B

Find the coordinates of A and the coordinates of B
Show clear algebraic working.

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

(Total for Question 18 is 5 marks)

21 Solve the simultaneous equations

$$x - 2y = 3$$
$$x^2 - y^2 + 2x = 10$$

Show clear algebraic working.

.....

(Total for Question 21 is 5 marks)

20 Solve the simultaneous equations

$$y = 7 - 2x$$
$$x^2 + y^2 = 34$$

Show clear algebraic working.

.....

(Total for Question 20 is 5 marks)

22 Solve the simultaneous equations

$$2y^2 + x^2 = -6x + 42$$
$$2x + y = -3$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

21 Solve the simultaneous equations

$$2x^2 + 3y^2 = 11$$
$$x = 3y - 1$$

Show clear algebraic working.

.....

(Total for Question 21 is 5 marks)

21 Work out the coordinates of the points of intersection of

$$y - 2x = 1 \quad \text{and} \quad y^2 + xy = 7$$

Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for Question 21 is 5 marks)

21 The line with equation $x + 2y = 5$ intersects the curve with equation $x^2 + 3y^2 = 13$ at the points A and B

Find the coordinates of A and the coordinates of B
Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for Question 21 is 5 marks)

22 The straight line **L** has equation $x + y = 5$

The curve **C** has equation $2x^2 + 3y^2 = 210$

Find the coordinates of the points where **L** and **C** intersect.
Show clear algebraic working.

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

(Total for Question 22 is 5 marks)

22 Solve the simultaneous equations

$$x^2 + y^2 = y + 11$$
$$y = 3x - 1$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

22 Solve the simultaneous equations

$$x^2 + y^2 + y = 3$$

$$x + 2 = y$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

22 Solve the simultaneous equations

$$x^2 + 3y + y^2 = 7$$
$$y = x + 2$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

22 Solve the simultaneous equations

$$x^2 + y^2 = 41$$
$$2x + y = 3$$

Show clear algebraic working.

.....

(Total for Question 22 is 5 marks)

21 The curve with equation $y = (10x - 3)(x + 1)$ and the line with equation $y - 6x = 0$ intersect at the points A and B.

Find the coordinates of the midpoint of AB.
Show your working clearly.

(,)

(Total for Question 21 is 6 marks)

22 The curve with equation $x^2 - x + y^2 = 10$ and the straight line with equation $x - y = -4$ intersect at the points A and B.

Work out the exact length of AB.

Show your working clearly and give your answer in the form $\frac{\sqrt{a}}{2}$ where a is an integer.

.....

(Total for Question 22 is 6 marks)

19 The straight line **L** has equation $x - y = 3$
The curve **C** has equation $3x^2 - y^2 + xy = 9$

L and **C** intersect at the points P and Q.

Find the coordinates of the midpoint of PQ.
Show clear algebraic working.

(..... , ...)

(Total for Question 19 is 6 marks)

SUB-TOPIC A2d

INEQUALITIES

Sub-topic A2d · 40 questions · 165 marks · lowest tariff first

8 Jane bought a new car for $18 000
The car depreciates in value by 15% each year.

Work out the value of the car at the end of 4 years.
Give your answer correct to the nearest $

$.....

(Total for Question 8 is 3 marks)

9 Solve the inequality $3 - 4x \leqslant 11$

.....

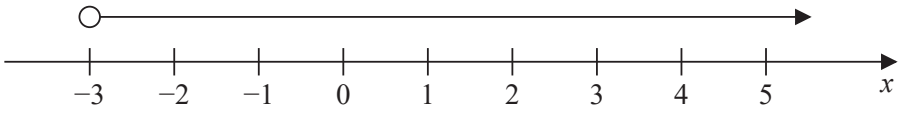
(Total for Question 9 is 2 marks)

Answer ALL TWENTY FOUR 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 the number line.

.....

(1)

(b) Solve the inequality $4y - 13 \leqslant y + 8$

.....

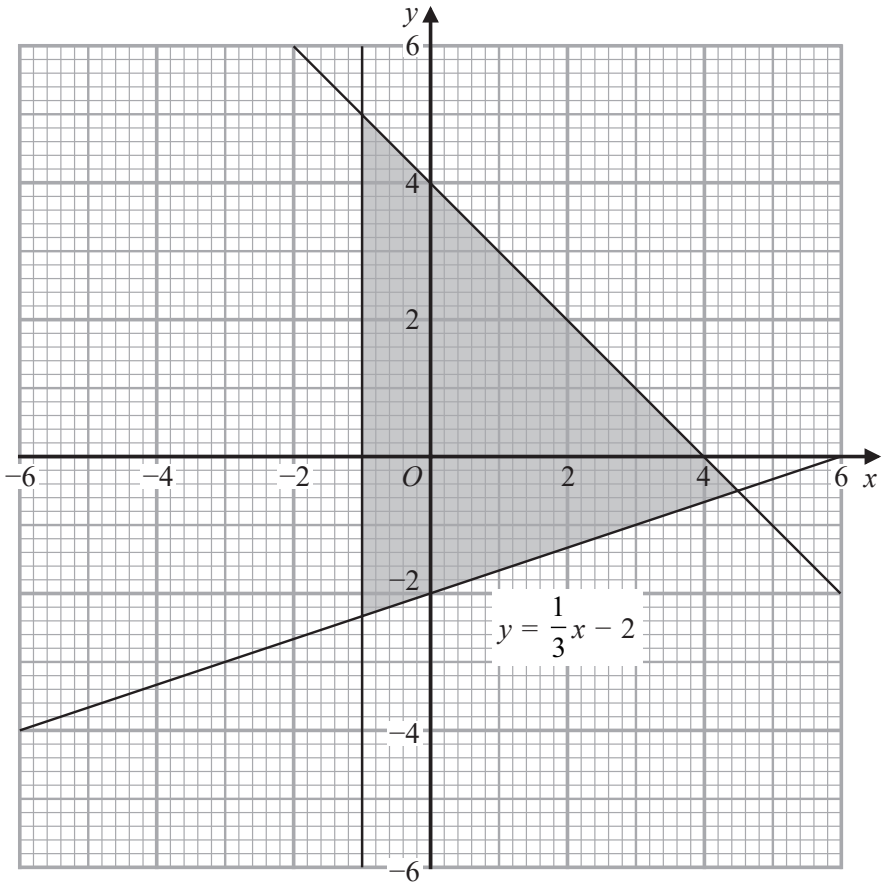
(2)

(Total for Question 1 is 3 marks)

2 Show that $5\frac{2}{3} - 2\frac{3}{4} = 2\frac{11}{12}$

(Total for Question 2 is 3 marks)

10 The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down the three inequalities that define the shaded region.

.....

.....

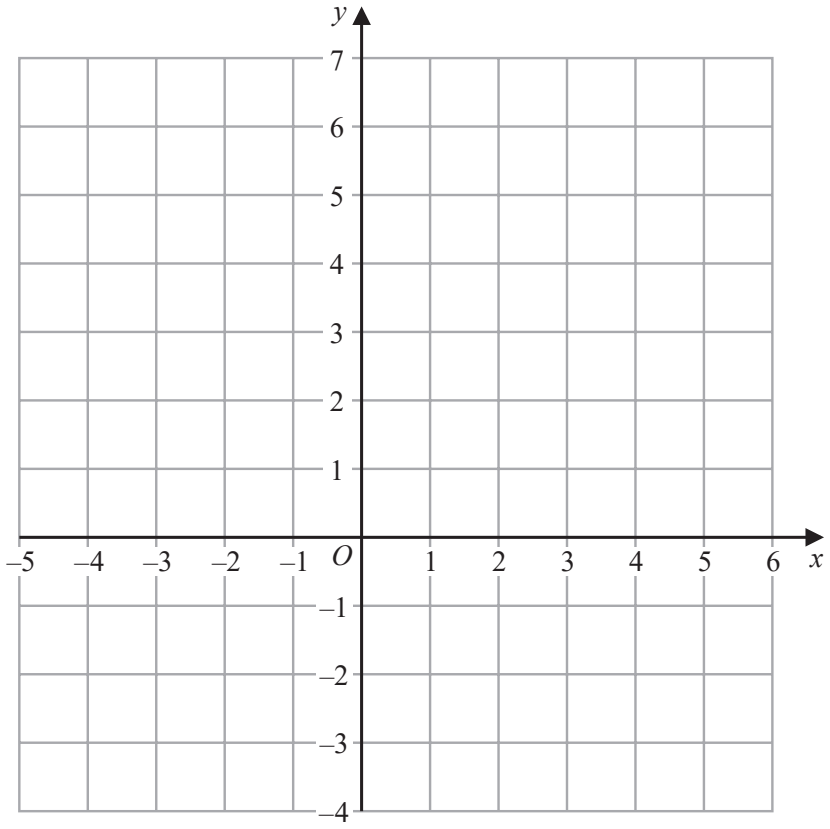
.....

(Total for Question 10 is 3 marks)

11 Show, by shading on the grid, the region that satisfies all three of the inequalities

$$x \leqslant 4 \quad \text{and} \quad y \geqslant -2 \quad \text{and} \quad y \leqslant x$$

Label the region **R**.



(Total for Question 11 is 3 marks)

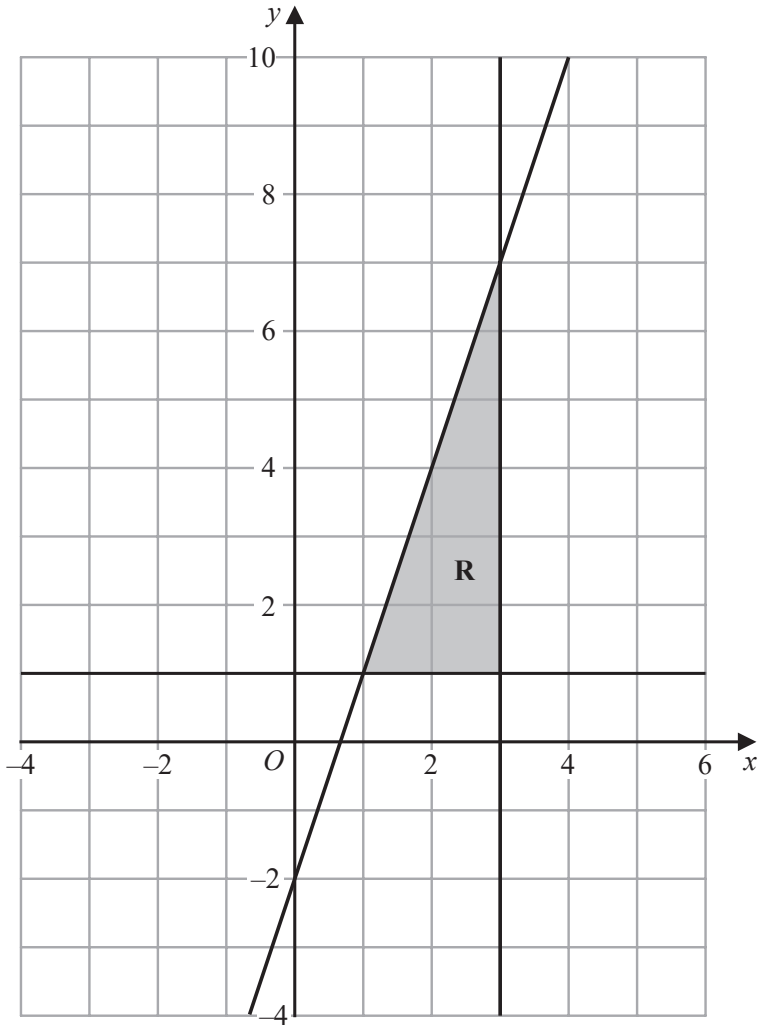
12 Find the gradient of the straight line with equation $5x + 2y = 7$

.....

(Total for Question 12 is 2 marks)

7 The shaded region **R**, shown in the diagram below, is bounded by the straight line with equation $y = 3x - 2$ and by two other straight lines.

Write down the three inequalities that define region **R**.



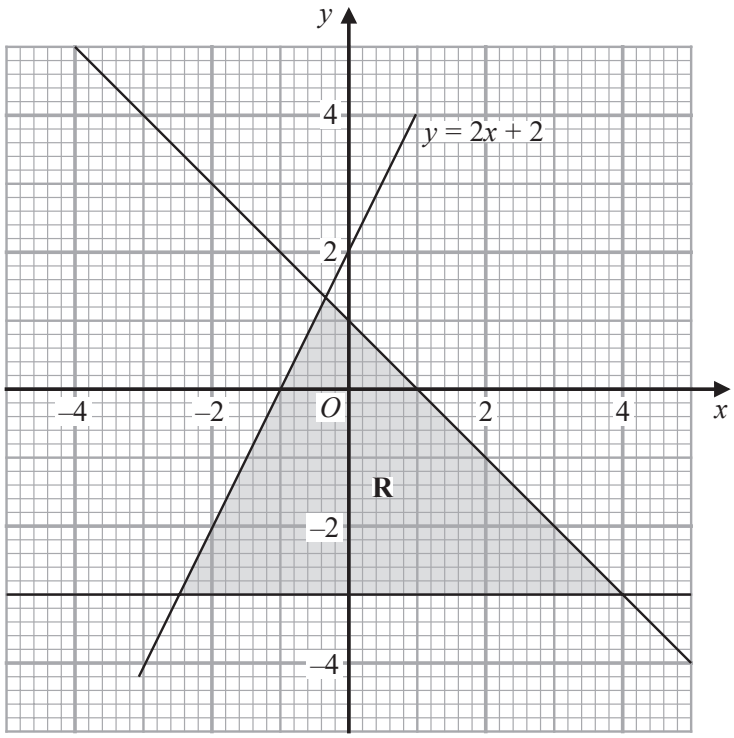
.....

.....

.....

(Total for Question 7 is 3 marks)

13



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Write down the three inequalities that define **R**.

.....

.....

.....

(Total for Question 13 is 3 marks)

Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

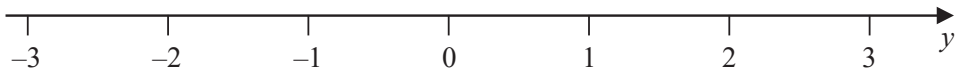
1 n is an integer.

(a) Write down all the values of n such that $-2 \leqslant n < 3$

.....

(2)

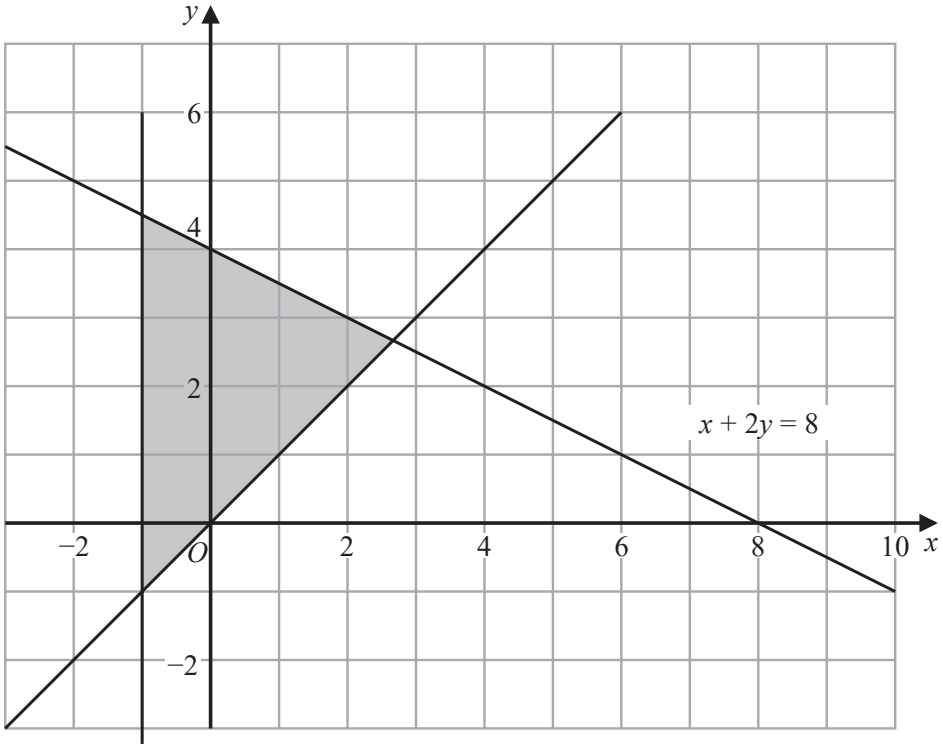
(b) On the number line, represent the inequality $y \leqslant 1$



(1)

(Total for Question 1 is 3 marks)

13 The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down three inequalities that define the shaded region.

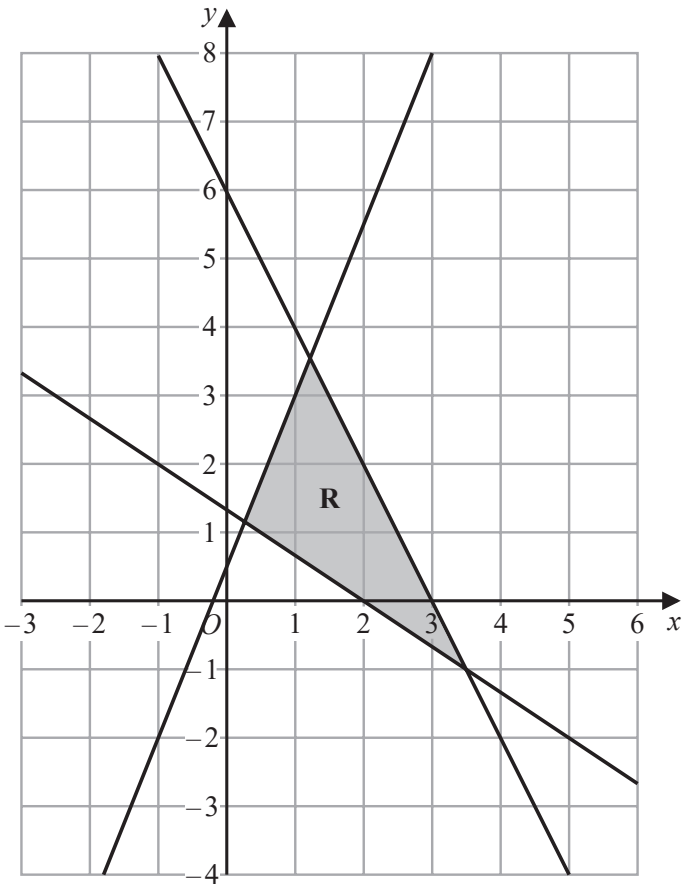
.....

.....

.....

(Total for Question 13 is 3 marks)

11



The region **R**, shown shaded in the diagram, is bounded by the straight lines with equations

$2x + y = 6$

$2y = 5x + 1$

$3y + 2x = 4$

Write down the three inequalities that define **R**

.....

.....

.....

(Total for Question 11 is 3 marks)

22 Solve the inequality $6x^2 + 37x \leqslant 35$
Show clear algebraic working.

.....

(Total for Question 22 is 3 marks)

Turn over for Question 23

3 $-8 < 2y \leqslant 2$

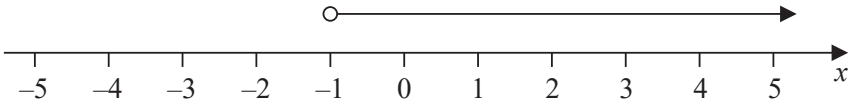
y is an integer.

(a) Find all the possible values of y

.....

(2)

(b) Write down the inequality shown on the number line.

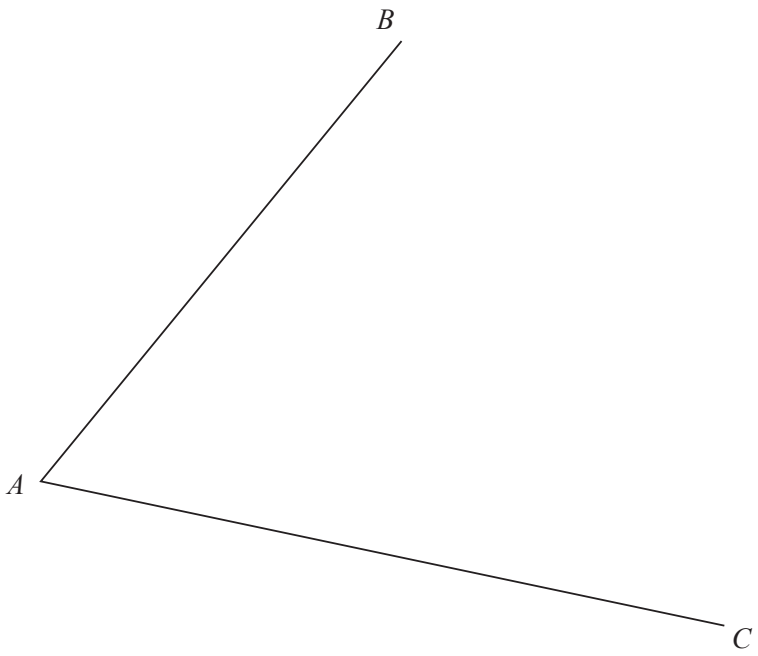


.....

(1)

(Total for Question 3 is 3 marks)

4 Using ruler and compasses only, construct the bisector of angle BAC
You must show all your construction lines.



(Total for Question 4 is 2 marks)

19 A curve has equation $y = f(x)$

There is only one minimum point on the curve.
The coordinates of this minimum point are (5, 4)

Write down the coordinates of the minimum point on the curve with equation

(i) $y = f(x + 5)$

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

(ii) $y = 3f(x)$

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

(iii) $y = f(x) - 7$

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

(Total for Question 19 is 3 marks)

20 Solve the inequality $10x^2 + 11x - 21 < 0$
Show clear algebraic working.

.....

(Total for Question 20 is 3 marks)

18 Use algebra to show that $0.\dot{7}0\dot{2} = \frac{26}{37}$

(Total for Question 18 is 2 marks)

19 Solve the inequality $4x^2 + 4x - 15 < 0$
Show clear algebraic working.

.....

(Total for Question 19 is 3 marks)

21 Solve the inequality $2x^2 - 7x - 15 > 0$

Show clear algebraic working.

.....

(Total for Question 21 is 3 marks)

20 Solve the inequality $4x^2 - 5x - 6 > 0$

.....

(Total for Question 20 is 4 marks)

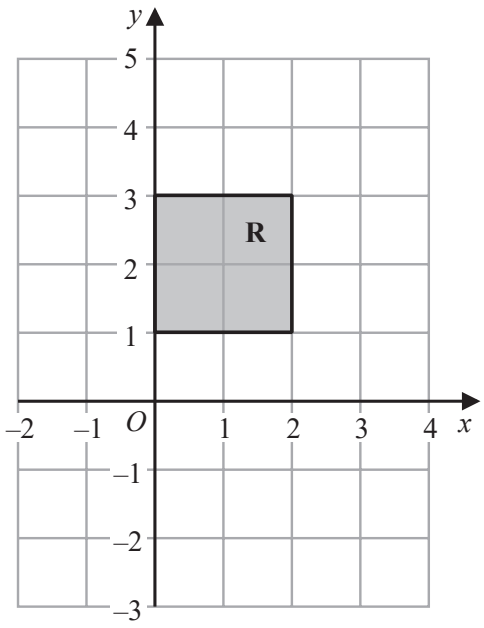
10 The straight line **L** has gradient 5 and passes through the point with coordinates (0, −3)

(a) Write down an equation for **L**.

.....

(2)

(b)



The region **R**, shown shaded in the diagram, is bounded by four straight lines.

Write down the inequalities that define **R**.

.....

(2)

(Total for Question 10 is 4 marks)

11 (a) Write down the integer values of x that satisfy the inequality $-2 < x \leqslant 4$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.

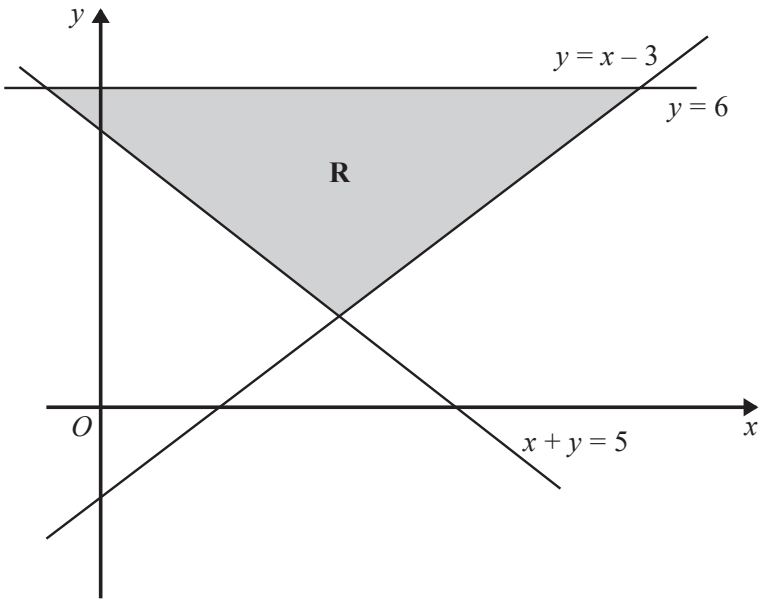


Diagram **NOT** accurately drawn

(b) Write down the three inequalities that define the region **R**.

.....

.....

.....

(2)

(Total for Question 11 is 4 marks)

2 Given that $a < b < c$

the four whole numbers a, a, b and c have

a mode of 7
a median of 8.5
a mean of 9

Work out the value of a, the value of b and the value of c.

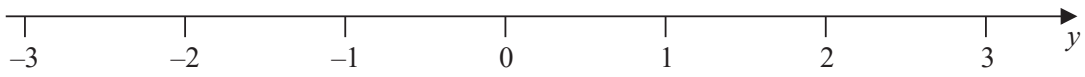
$a =$ .....

$b =$ .....

$c =$ .....

(Total for Question 2 is 4 marks)

3 (a) On the number line, show the inequality $-2 \leqslant y < 1$



(2)

n is an integer.

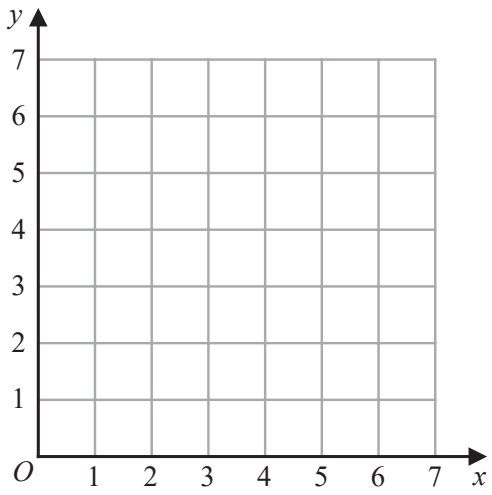
(b) Write down all the values of n that satisfy $-3.4 < n \leqslant 2$

.....

(2)

(Total for Question 3 is 4 marks)

4



(a) On the grid, draw and **label** the straight line with equation

(i) $x = 1.5$

(ii) $y = x$

(iii) $x + y = 6$

(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$x \geqslant 1.5$ $y \geqslant x$ $x + y \leqslant 6$

Label the region **R**.

(1)

(Total for Question 4 is 4 marks)

7 $-4 \leqslant 2y < 6$

y is an integer.

(a) Write down all the possible values of y.

.....

(2)

(b) Solve the inequality $7t - 3 \leqslant 2t + 31$

Show your working clearly.

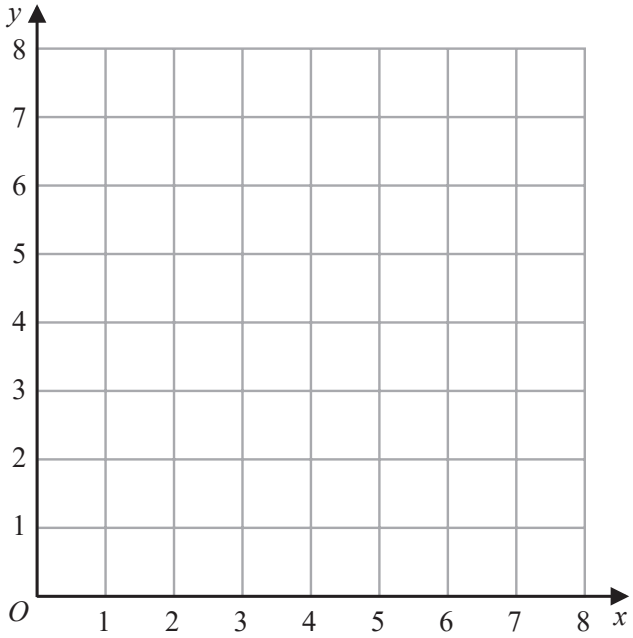
.....

(2)

(Total for Question 7 is 4 marks)

2 (a) On the grid, draw and label with its equation the straight line with equation

(i) $y = 1$ (ii) $x = 2$ (iii) $x + y = 7$



(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

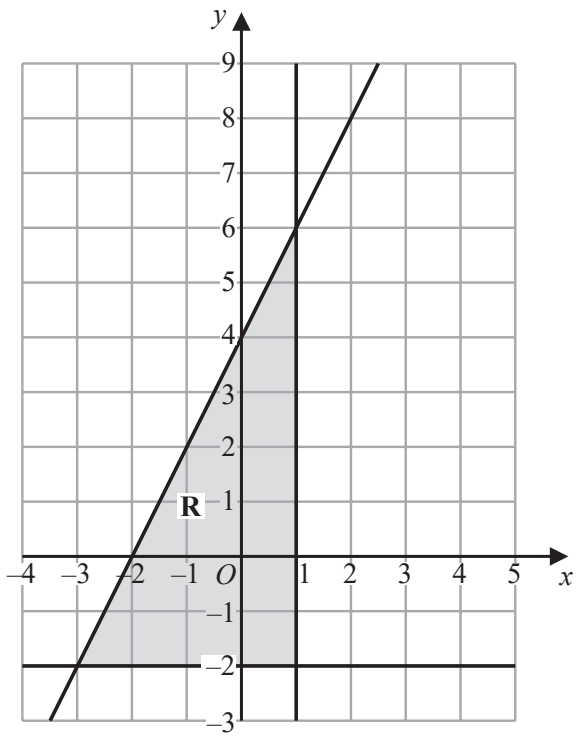
$y \geqslant 1$ $x \geqslant 2$ $x + y \leqslant 7$

Label the region **R**.

(1)

(Total for Question 2 is 4 marks)

7



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Find the inequalities that define **R**

.....

.....

.....

(Total for Question 7 is 4 marks)

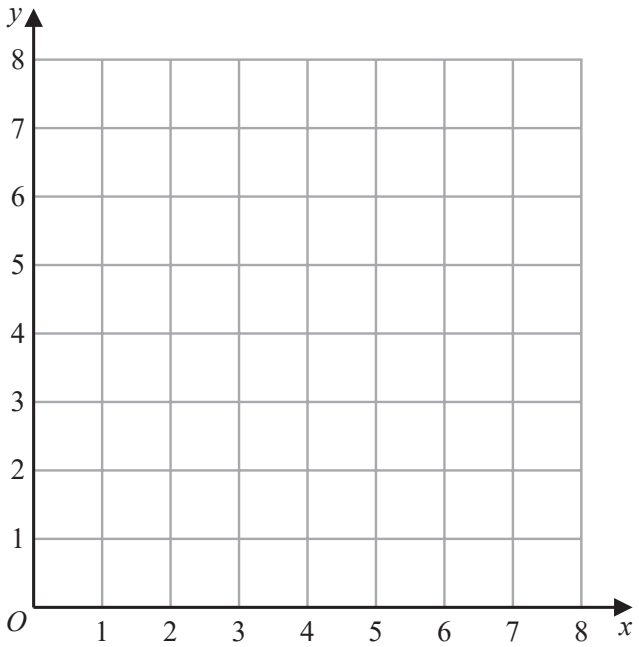
2 (a) On the grid, draw the straight line with equation

(i) $y = 2$

(ii) $x = 6$

(iii) $y = x + 1$

Label each line with its equation.



(3)

(b) Show, by shading on the grid, the region that satisfies all three of the inequalities

$y \geqslant 2$ $x \leqslant 6$ $y \leqslant x + 1$

Label the region **R**

(1)

(Total for Question 2 is 4 marks)

20 Solve $6x^2 - 7x - 20 > 0$
Show clear algebraic working.

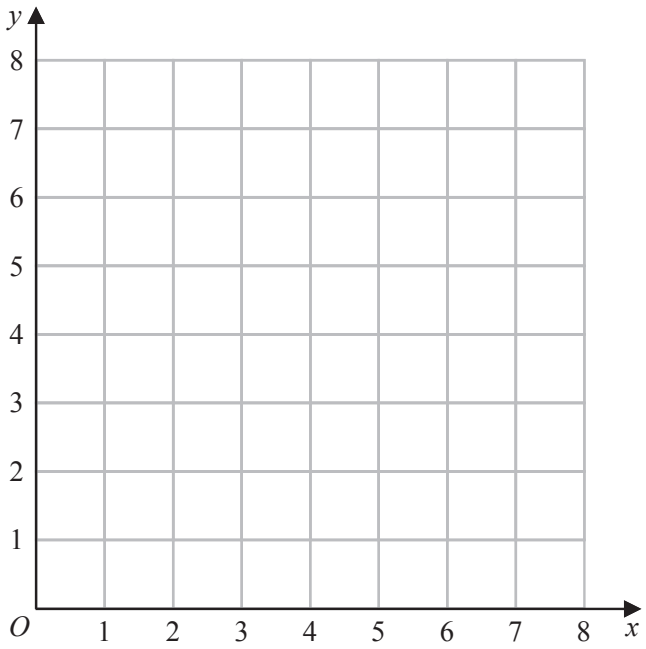
.....

(Total for Question 20 is 4 marks)

7 (a) On the grid, draw the straight line with equation

(i) $x = 3$ (ii) $y = 1$ (iii) $x + y = 7$

Label each line with its equation.



(3)

(b) Show, by shading on the grid, the region that satisfies all three of the inequalities

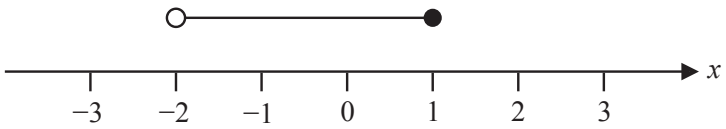
$x \geqslant 3$ $y \geqslant 1$ $x + y \leqslant 7$

Label the region **R**

(1)

(Total for Question 7 is 4 marks)

6



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

.....

(2)

(b) Solve the inequality $7a - 5 \leqslant 3a + 28$
Show clear algebraic working.

.....

(2)

(Total for Question 6 is 4 marks)

7 Change a speed of $50x$ metres per second to a speed in kilometres per hour.

..... km/h

(Total for Question 7 is 3 marks)

8 (a) Simplify fully $\dfrac{15k^4m^3}{5km^2}$

(2)

(b) Solve the inequality $7 < 4x - 1 \leqslant 17$

(3)

(Total for Question 8 is 5 marks)

17 The diagram shows a rectangle.

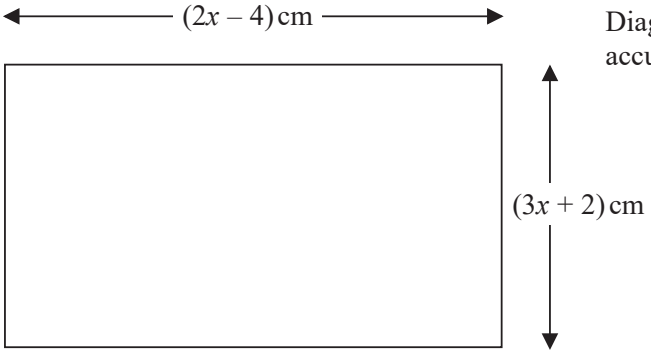


Diagram **NOT** accurately drawn

The area of the rectangle is A cm^2

Given that $A < 3x + 27$
find the range of possible values for x.

.....

(Total for Question 17 is 5 marks)

9 (a) Factorise $x^2 - x - 42$

.....

(2)

(b) Solve the inequality $3x + 15 < 8x + 3$

Show clear algebraic working.

.....

(3)

(Total for Question 9 is 5 marks)

10 Given that $150^x = 1$

(a) write down the value of x.

$x =$.....

(1)

Given that $3^{-8} \div 3^{-6} = 3^n$

(b) find the value of n.

$n =$.....

(1)

(Total for Question 10 is 2 marks)

8 In 2018, the population of Sydney was 5.48 million.
This was 22% of the total population of Australia.

Work out the total population of Australia in 2018
Give your answer correct to 3 significant figures.

..... million

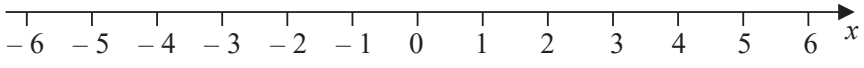
(Total for Question 8 is 3 marks)

9 (i) Solve the inequalities $-7 \leqslant 2x - 3 < 5$

.....

(3)

(ii) On the number line, represent the solution set to part (i)



(2)

(Total for Question 9 is 5 marks)

22 Here is a rectangle.

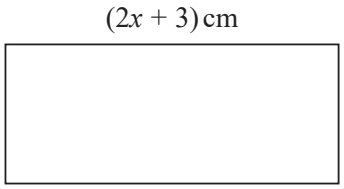


Diagram **NOT** accurately drawn

Given that the area of the rectangle is less than 75 cm^2

find the range of possible values of x

.....

(Total for Question 22 is 5 marks)

3 (a) Solve $4y + 5 > 12$

.....

(2)

(b) Solve $6x - 5 = \frac{4x - 7}{2}$

Show clear algebraic working.

$x =$ .....

(3)

(Total for Question 3 is 5 marks)

7 (a) Write down an equation of the straight line with gradient -3 and which passes through the point with coordinates (0, 5)

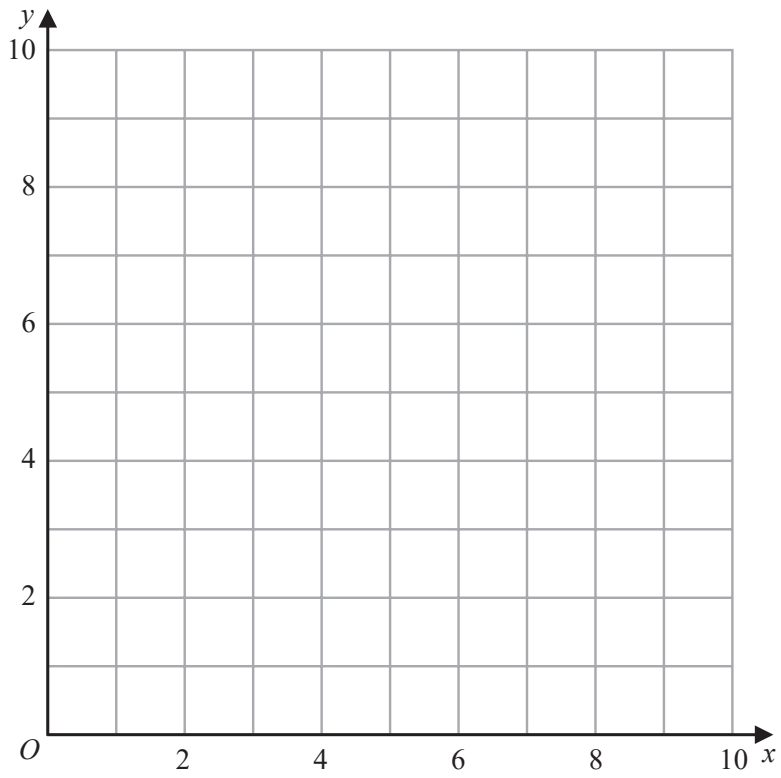
.....

(2)

(b) Show, by shading on the grid, the region defined by **all three** of the inequalities

$x \leqslant 6$ $y \geqslant 2$ $y \leqslant x + 1$

Label the region **R**



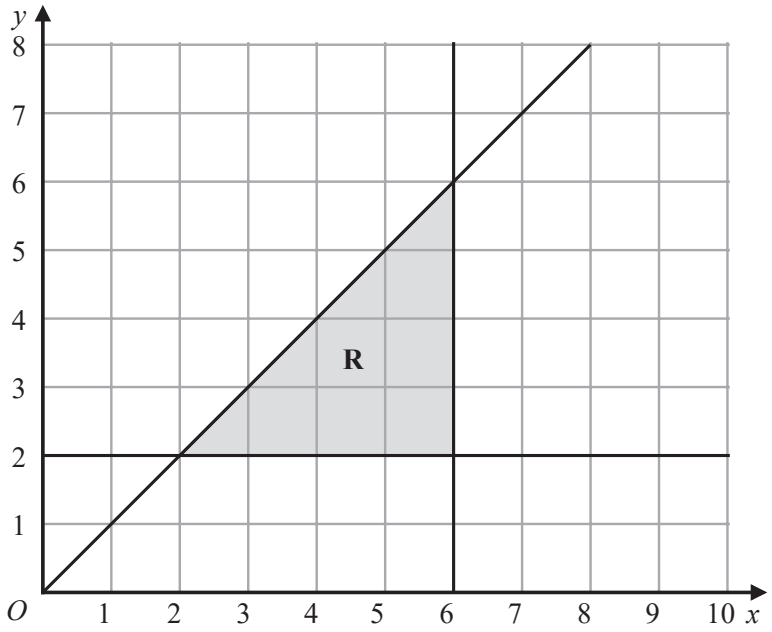
(3)

(Total for Question 7 is 5 marks)

8 (a) Solve $9 - 4x > 17$

.....

(2)



(b) Write down the three inequalities that represent the shaded region **R**

.....

.....

.....

(3)

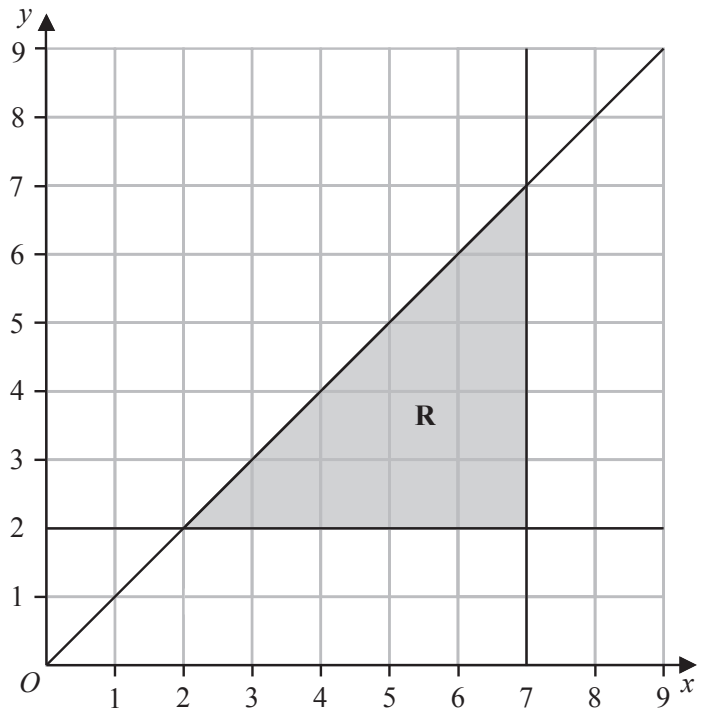
(Total for Question 8 is 5 marks)

8 (a) Solve the inequality $8x - 4 \geqslant 3x - 10$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down the three inequalities that define the region **R**

.....

.....

.....

(3)

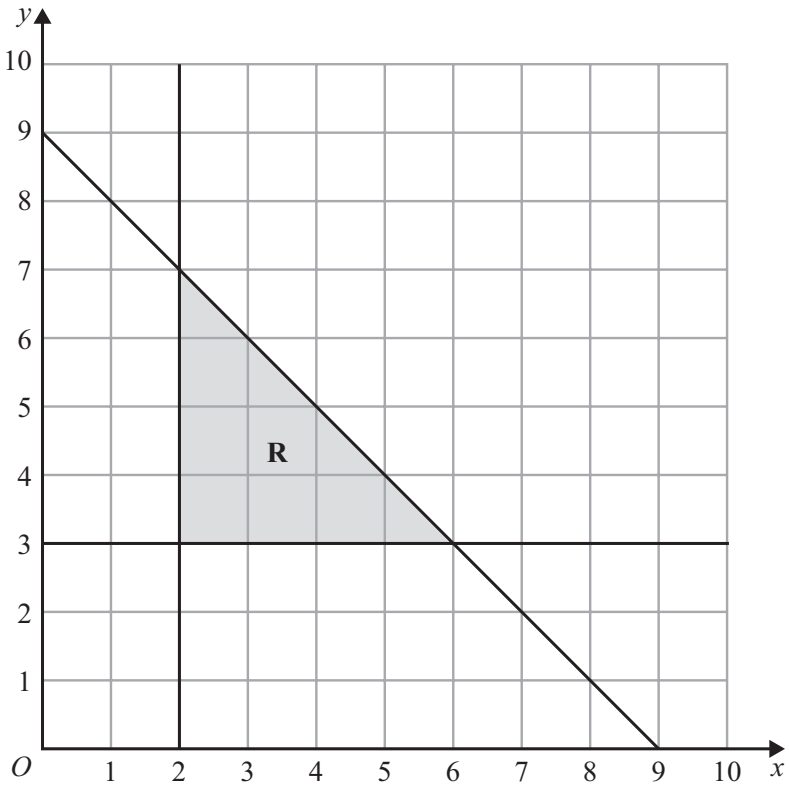
(Total for Question 8 is 5 marks)

9 (a) Solve the inequality $7 - 3t < 2t + 15$

.....

(2)

The region **R**, shown shaded in the diagram, is bounded by three straight lines.



(b) Write down three inequalities that define the region **R**

.....

.....

.....

(3)

(Total for Question 9 is 5 marks)

19 (a) Solve $\frac{4-3x}{5} - \frac{3x-5}{2} = -3$

Show clear algebraic working.

$x =$ .....

(3)

(b) Solve the inequality $5y^2 - 17y \leqslant 40$

.....

(3)

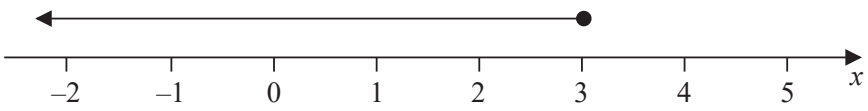
(Total for Question 19 is 6 marks)

10 (a) Factorise $y^2 - 2y - 48$

.....

(2)

(b) Write down the inequality shown on the number line



.....

(1)

(c) Solve the inequality $7w + 6 > 12w + 14$

.....

(3)

(Total for Question 10 is 6 marks)

5 (a) Expand and simplify $4x(2x + 5) – 3x(2x – 3)$

.....

(2)

Given that $\frac{y^5 \times y^n}{y^6} = y^{13}$

(b) work out the value of n.

$n =$ .....

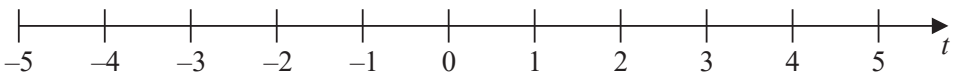
(2)

(c) (i) Solve the inequality $7t – 8 < 2t + 7$

.....

(2)

(ii) On the number line below, represent the solution set of the inequality solved in part (c)(i)



(1)

(Total for Question 5 is 7 marks)

15 (a) Solve $\frac{4x+5}{3} - \frac{3-2x}{2} = 13$

Show clear algebraic working.

$x =$ .....

(4)

(b) Solve the inequality $2y^2 - 7y - 30 \leqslant 0$

Show your working clearly.

.....

(3)

(Total for Question 15 is 7 marks)

MARK SCHEMES

official mark schemes, in the same order as the questions

3	(i)		12, 18	1	B1
	(ii)		12, 14, 15, 16, 18, 20	1	B1
	(iii)		11, 13, 15, 17, 19	1	B1
					Total 3 marks

4	e.g. $4x - 8x = 17 + 13$ oe		2	M1 For collecting terms in x and number terms on either side of a correct equation
		−7.5		A1 oe e.g. $-\frac{30}{4}$
				Total 2 marks

5	(a)	e.g. 720 = 2 × 360 = 2 × 2 × 180 or 720 = 3 × 240 = 3 × 3 × 80 etc		3	M1 At least 2 correct stages in prime factorisation
		2, 2, 2, 2, 3, 3, 5			M1 condone inclusion of 1 (may be a fully correct factor tree or ladder)
			2 × 2 × 2 × 2 × 3 × 3 × 5		A1 dep on M2, accept $2^4 \times 3^2 \times 5$
	(b)		5	1	B1
					Total 4 marks

8	(a)		Pacific	1	B1	Accept 1.357×10^5
	(b)	$1.119 \times 10^5 - 1.797 \times 10^4$		2	M1	Accept 111 900 – 17 970 oe or 93 930 or −93 930
			$9.393(0) \times 10^4$		A1	Accept $(\pm)\ 9.393(0) \times 10^4$ or $(\pm)\ 9.39 \times 10^4$ or $(\pm)\ 9.4 \times 10^4$
						Total 3 marks

9	eg $(x \pm 20)(x \pm 1)$	$\frac{-(-21) \pm \sqrt{(-21)^2 - 4 \times 1 \times 20}}{2 \times 1}$ **or** $\left(x - \frac{21}{2}\right)^2 - \left(\frac{21}{2}\right)^2 + 20 = 0$		3	M1	If factorising, allow brackets which expanded give 2 out of 3 terms correct – if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\frac{21 \pm \sqrt{441 - 80}}{2}$ or eg $\left(x - \frac{21}{2}\right)^2 - \frac{361}{4} = 0$ oe
	$(x - 20)(x - 1)$	eg $\frac{21 \pm \sqrt{441 - 80}}{2}$ or $\frac{21 \pm \sqrt{361}}{2}$ or $\frac{21 \pm 19}{2}$ **or** $x = \pm\sqrt{\frac{361}{4}} + \frac{21}{2}$ oe			M1	dep on M1 for correct factorisation, or a correct expression for x if completing the square. or a correct substitution into quadratic formula with some processing.
			1, 20		A1	for both correct values, dep on 1st M1 with no incorrect working.
						Total 3 marks

2	$6-12x$ or $2-4x=\frac{5}{3}-\frac{8}{3}x$		3	M1 for expansion of bracket on the LHS or dividing the RHS by 3 with two terms
	$6-5=12x-8x$ or $1 = 4x$ or $-12x+8x=5-6$ oe or $-4x = -1$ or $\frac{8}{3}x-4x=\frac{5}{3}-2$ oe or $2-\frac{5}{3}=-\frac{8}{3}x+4x$ oe			M1 ft (dep on 4 terms) for terms in x on one side of equation; number terms on the other
	Working required	$\frac{1}{4}$		A1 oe dep on M1 awarded
				Total 3 marks

3	**Two pairs** of intersecting arcs with equal radii centre A and B		2	M1 for arcs that intersect within or on the guidelines **or** correct perpendicular bisector without arcs.
	Working required	Bisector with construction arcs		A1 for a fully correct bisector with two intersecting arcs
				Total 2 marks

Question	Working	Answer	Mark	Notes
13	eg $20\times\frac{x+3}{4}-20\times\frac{7-x}{5}=20\times4.3$ or eg $5(x+3)-4(7-x)=20\times4.3$ or eg $\frac{5(x+3)}{20}-\frac{4(7-x)}{20}(=4.3)$ or eg $\frac{5(x+3)-4(7-x)}{20}(=4.3)$		3	M1 For clear intention to multiply all terms by 20 (or 4 × 5) or a multiple of 20 oe or to express LHS as two fractions over 20 (or 4 × 5) or a multiple of 20 oe or as a single fraction with a denominator of 20 (or 4 × 5) or a multiple of 20 oe if expanded numerator, allow one error
	eg $5x + 15 – 28 + 4x = 4.3 \times 20$ oe eg $9x – 13 = 86$ eg $9x = 99$			M1 Expanding brackets and multiplying by denominator with no more than one error in total from multiplying out brackets [we must see 4.3 × 20 or 86 accurately]
	Working required	11		A1 dep on M1
				Total 3 marks

18	$\frac{5}{x+2}+\frac{3}{x(x+2)}$ (= 2) or $\frac{5x}{x^2+2x}+\frac{3}{x^2+2x}$ (= 2)		5	M1	Factorising $x^2 + 2x$ in correct expression on LHS or for writing the two fractions over a common denominator.
	$\frac{5x+3}{x(x+2)}=2$ **or** $\frac{5x+3}{x^2+2x}=2$ **or** $5x + 3 = 2x(x + 2)$ oe **or** $5x + 3 = 2x^2 + 4x$ oe			M1	Correct simplified single fraction = 2 or correct equation with no fractions.
	$2x^2 – x – 3$ (= 0)			M1	Correct 3 term quadratic
	$(2x – 3)(x + 1)$ (=0) **or** $\frac{--1\pm\sqrt{(-1)^2-4\times2\times(-3)}}{2\times2}$ **or** $\left(x-\frac{1}{4}\right)^2-\frac{1}{16}-\frac{3}{2}=0$ oe			M1ft	independent For solving *their* 3 term quadratic equation using any correct method. If factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\frac{1\pm\sqrt{1+24}}{4}$ or eg $\left(x-\frac{1}{4}\right)^2=\frac{25}{16}$ oe
		1.5 and –1		A1	oe dep on M3
					Total 5 marks

Alternative Mark Scheme for question 18 (obtaining a cubic)					
18	$\frac{5(x^2+2x)+3(x+2)}{(x^2+2x)(x+2)}$ (=2) oe		5	M1	Correct fraction over a common denominator (may be 2 separate fractions)
	eg $5(x^2+2x)+3(x+2)=2(x^2+2x)(x+2)$ oe			M1	Correct equation with no fractions.
	$2x^3+3x^2-5x-6 \quad (=0)$			M1	Correct cubic
	$(x+1)(2x-3)(x+2) \quad (=0)$			M1	For product of 3 correct linear factors.
		1.5 and –1		A1	oe dep on M3 Do not award A mark if extra solution (–2) given.
					Total 5 marks

Question	Working	Answer	Mark	Notes
24	$\frac{x+3x-4}{x(3x-4)}$ or $\frac{4x-4}{3x^2-4x}$ oe eg $\frac{4(x-1)}{x(3x-4)}$		5	M1 For adding the terms in the brackets correctly eg $\frac{x+3x-4}{x(3x-4)}$ oe and may be 2 fractions with a common denominator
	$\frac{5x(3x+4)(3x-4)}{(3x+4)(x-1)}$ **or** $(45x^3-80x)(4x-4)=180x^4-180x^3-320x^2+320x$ **or** $(3x^2+x-4)(3x^2-4x)=9x^4-12x^3+3x^3-4x^2-12x^2+16x$ $\left(=9x^4-9x^3-16x^2+16x\right)$			M1 indep (score best method if both shown) For factorising the numerator of the first fraction correctly **or** factorising the denominator of the first fraction correctly **OR** expanding the numerators correctly **or** expanding the denominators correctly
	$\frac{5x(3x+4)(3x-4)}{(3x+4)(x-1)}\times\frac{4(x-1)}{x(3x-4)}(=20)$ oe eg $\frac{5x(9x^2-16)\times4}{x(9x^2-16)}$ oe $\frac{180x^4-180x^3-320x^2+320x}{9x^4-9x^3-16x^2+16x}(=20)$ oe			M1 (assumes previous mark if this is awarded) All terms factorised (some terms may be cancelled) **or** showing an expression that will cancel **or** the correct fraction with all terms correctly expanded
	$20=\frac{4(x+2)}{5x-8}$ oe allow up to a quadratic on the LHS – must be correct			M1 Cancelling and LHS = RHS or division of top by bottom = 20 and LHS = RHS
	Working required	$\frac{7}{4}$		A1 oe dep on a fully correct method shown, ie all steps that lead to the correct answer
				Total 5 marks

3	(a)		h^9	1	B1	
	(b)	$(-5)^2 - 4 \times -5$ oe e.g. $25 + 20$		2	M1	for a correct substitution
			45		A1	
	(c)	$5x - 3 = 4(2x + 3)$ oe **or** $\frac{5x}{4} - \frac{3}{4} = 2x + 3$ oe		3	M1	for correctly removing the denominator, condone missing brackets
		e.g. $5x - 8x = 12 + 3$ **or** $-3x = 12 + 3$ **or** $8x - 5x = -12 - 3$ **or** $3x = -12 - 3$ **or** $-\frac{3}{4} - 3 = 2x - \frac{5x}{4}$ **or** $-\frac{15}{4} = \frac{3x}{4}$			M1	for a correct rearrangement with terms in x on one side and numbers on the other, allow correct rearrangement of their equation in the form $ax + b = cx + d$
			-5		A1	dep on at least M1 SCB2 for an answer of $x = -2$ coming from $5x - 3 = 8x + 3$ **or** $x = 5$ coming from $5x - 3 = 2x + 12$
						Total 6 marks

4	(a)		$30 < t \leq 40$	1	B1	
	(b)	e.g. $5 \times 4 + 15 \times 10 + 25 \times 15 + 35 \times 25 + 45 \times 6$ (= 1690) **or** $20 + 150 + 375 + 875 + 270$ (= 1690)		4	M2	For correct products using midpoints (allowing one error) with intention to add. If not M2 then award M1 for products using frequency and a consistent value within the range (allowing one error) with intention to add or correct products using midpoint without addition.
		"1690" ÷ 60			M1	dep on M1
			28.2		A1	accept 28.1 – 28.2
						Total 5 marks

15 (a)	eg $12\times\frac{5a+8}{3}-12\times\frac{2a+5}{4}=12\times23$ **or** eg $4(5a+8)-3(2a+5)=12\times23(=276)$ **or** eg $\frac{4(5a+8)}{12}-\frac{3(2a+5)}{12}(=23)$ **or** eg $\frac{4(5a+8)-3(2a+5)}{12}(=23)$		4	M1	for clear intention to multiply all terms by 12 or a multiple of 12 **or** to express LHS as two fractions over 12 or a multiple of 12 **or** as a single fraction with a denominator of 12 or a multiple of 12 (If expanded numerator, allow one sign error **or** one numerical error but not both) Accept $\frac{20a+32}{12}-\frac{6a+15}{12}(=23)$ or $\frac{20a+32}{12}-\frac{6a+15}{12}(=23)$ or $\frac{20a+32-6a+15}{12}(=23)$
	eg $20a+32-6a-15=12\times23(=276)$ oe **or** $14a+17=276$			M1	ft for expanding brackets and multiplying both sides by denominator with no more than one error in total leading to a linear equation Accept a linear equation leading to 14a – 17 = 276 oe **or** 14a + 47 = 276 oe **or** $26a + 17 = 276$ This mark implies the previous M mark if not already awarded
	eg $20a-6a=276-32+15$ oe or $14a=259$			M1	ft dep on previous M1 for correctly rearranging terms in a on one side and number terms on the other side
	Working required	18.5		A1	oe dep on M2 eg $\frac{259}{14}$ **or** $\frac{37}{2}$

(b)	eg $\frac{3}{\sqrt{y}}\left(=\frac{3\sqrt{y}}{y}\right)$ **or** $\frac{3}{y^{0.5}}$ **or** $\frac{3}{y^{\frac{1}{2}}}$ **or** $\left(\frac{y^{0.5}}{3}\right)^{-1}$ **or** $\left(\frac{y^{\frac{1}{2}}}{3}\right)^{-1}$ oe		2	M1	for a correct first step by applying one of the following index rules $\sqrt{x}=x^{\frac{1}{2}}=x^{0.5}$ or $\left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)$
	Correct answer scores full marks (unless from obvious incorrect working)	$3y^{-0.5}$		A1	oe eg $3y^{-\frac{1}{2}}$, accept $c = 3$ and $n = -0.5$ oe
					Total 6 marks

15	(a)		$8a^9$	2	B2	for a fully correct answer. if not B2, then B1 for 8 or a^9 as part of a product in answer, or final line of working
	(b)		$1000x^3$	2	B2	for a fully correct answer. (B1 for final answer or final line of working with: 1000 or x^3 as part of a product or $(10x)^3$ or $\frac{1}{1000x^3}$)
	(c)	eg $30\times\frac{1-2y}{3} = 30\times\frac{4}{5}-30\times\frac{2y-1}{2}$ oe or eg $\frac{10(1-2y)}{30}=\frac{6\times4}{30}-\frac{15(2y-1)}{30}$ oe or eg $\frac{1-2y}{3}=\frac{2\times4}{10}-\frac{5(2y-1)}{10}$ oe or eg $10(1-2y)=3\times2\times4-3\times5(2y-1)$ oe or eg $\frac{10(1-2y)+15(2y-1)}{30}=\frac{4}{5}$ or $\frac{2(1-2y)}{6}+\frac{3(2y-1)}{6}=\frac{4}{5}$ oe (as above)		3	M1	For clear intention to multiply all terms by 30 (or 3 × 5 × 2) or a multiple of 30 oe in an equation or to express all terms over 30 (or 3 × 5 × 2) or a multiple of 30 oe in an equation **or** writing RHS over 10 or a multiple of 10 or 'cross multiplying' in an equation **or** bringing terms in y on LHS side and leaving $\frac{4}{5}$ on RHS and writing terms on LHS over 6 or a multiple of 6 in an equation [if expanded numerators, allow one error]
		eg $10 - 20y = 24 - 30y + 15$ oe eg $10y = 29$ or $50 - 100y + 150y - 75 = 120$ oe or $10 - 20y + 30y - 15 = 24$ oe $2 - 4y + 6y - 3 = 4.8$			M1	(ft if only one error) Expanding brackets and multiplying by denominator with no more than one error in total
		Working required	2.9		A1	oe eg $\frac{29}{10}$ or $2\frac{9}{10}$ dep on M2
						Total 7 marks

14 (a)	$(3y)(2y + 5) = 6y^2 + 15y$ $(3y)(y + 7) = 3y^2 + 21y$ $(2y + 5)(y + 7) = 2y^2 + 14y + 5y + 35$ $(=2y^2 + 19y + 35)$		3	M1	An expansion with only one error. Do not award this mark for $6y^2 + 15y + 3y^2 + 21y$	M2 for 3 (out of a maximum of 4) of $6y^3+42y^2+15y^2+105y$ (M1 for 2 correct out of a maximum of 4)
	$(6y^2 + 15y)(y + 7) = 6y^3 +42y^2 +15y^2 + 105y$ $(3y^2 +21y)(2y + 5) = 6y^3 +15y^2 +42y^2 + 105y$ $3y(2y^2 + 19y + 35) = 6y^3 + 57y^2 + 105y$			M1	ft dep on M1 allow one further error	
	working required	$6y^3 + 57y^2 + 105y$		A1	cao (terms may be in any order but must be simplified) dep on M1 accept $a = 6$, $b = 57$, $c = 105$	

14 (b)	eg $\frac{4(2x+3)+5(6x-5)}{20}(=1.63)$ oe or $\frac{40x+60}{100}(+)\frac{150x-125}{100}\left(=\frac{163}{100}\right)$ oe $4(2x + 3) + 5(6x – 5) = 1.63 \times 5 \times 4$ oe		4	M1	Writing fractions over a common denominator(can be 2 fractions) or for a method to remove the denominator by multiplying each term by eg 20 or 100 etc (if expanded numerator, allow one error) or $20(2x+3)+25(6x-5)=163$ (could all be written over 100)
	eg $8x + 12 + 30x – 25 = 32.6$ or $40x + 60 + 150x – 125 = 163$ or $\frac{190x-65}{100}=\frac{163}{100}$ or $\frac{38x-13}{20}=\frac{163}{100}$ oe			M1	Removing brackets and fractions on the LHS in an equation with no more than one error from expanding on the numerator or an equation with terms on numerator of fraction simplified with no more than one error from expanding on the numerator
	$8x + 30x = 32.6 – 12 + 25$ or oe eg $38x = 45.6$ or $190x = 228$			M1	Terms in x on one side and number terms the other in a correct equation.
	working required	1.2		A1	oe dep on M1
					Total 7 marks

Question	Working	Answer	Mark	Notes
4 (a)	$2x + 5 = 6(2x - 5)$ or $2x + 5 = 12x - 30$ or $\frac{2}{6}x + \frac{5}{6} = 2x - 5$ oe (allow $0.33x + 0.83 = 2x - 5$)		3	M1 For multiplying both sides by 6 or separating values in fraction correctly in an equation. (decimals 2 dp or better)
	$2x - 12x = -30 - 5$ or $-10x = -35$ or $5 + 30 = 12x - 2x$ or $35 = 10x$ oe or $\frac{5}{6} + 5 = 2x - \frac{1}{3}x$ oe or $1\frac{2}{3}x = 5\frac{5}{6}$ oe			M1ft For collecting the terms in x on one side and the number terms on the other side. ft from incorrect expansion dep on a number term and a term in x on both sides.
	Working required	3.5		A1 dep on M1 oe eg $\frac{7}{2}$ or $3\frac{1}{2}$
(b)		h^{12}	1	B1 Allow x^{12} or another letter to the power 12 but do not allow just 12
(c)	*Working not required, so correct answer scores full marks (unless from obvious incorrect working)*	$16g^{12}k^{20}$	2	B2 B1 for 2 terms correct in a product [must be 16 and not 2^4]
(d)	eg $\frac{y^n}{y^2} = y^{12}$ or $y^{-2} \times y^n = y^{12}$ or $y^5 \times y^{n-7} = y^{12}$ or $\frac{y^{5+n}}{y^7} = y^{12}$ $y^5 \times y^n = y^{19}$ or $y^{5+n-7} = y^{12}$ or $\frac{y^5}{y^{7-n}} = y^{12}$ or $y^{5+n} = y^{12+7}$ or $5 + n - 7 = 12$ oe		2	M1 for one correct application of an index rule (must be seen in powers of y) this could be after an initial mistake – working will need to be clearly seen **or** for a **correct** equation in n (no mistakes allowed)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	14		A1 Allow y^{14}
				Total 8 marks

5	$\pi \times 7.2^2 \div 2$ (= 81.4....)			M1	allow 81.3 – 81.5 for area of semi circle
	"81.4" ÷ 6 (= 13.5...) **or** 12 × 6 (= 72) **or** "81.4" ÷ 12 (= 6.7...)			M1	(dep) allow 13.5 – 13.6 for the number of boxes needed (NB: 12 × 6 = 72 alone is 0 marks)
		No with correct figures	3	A1	
					Total 3 marks

6	$(x \pm 9)(x \pm 4)$	$\frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 1 \times (-36)}}{2 \times 1}$ **or** $\frac{5 \pm \sqrt{25 + 144}}{2}$			M1	**or** $(x + a)(x + b)$ where $ab = -36$ **or** $a + b = -5$ **OR** correct substitution into quadratic formula (condone one sign error in a, b or c) (if + rather than ± shown then award M1 only unless recovered with answers)
	$(x - 9)(x + 4)$	$\frac{5 \pm \sqrt{169}}{2}$ **or** $\frac{5 \pm 13}{2}$			M1	**or** $\frac{5 \pm \sqrt{169}}{2}$ **or** $\frac{5 \pm 13}{2}$
			9, −4	3	A1	dep on at least M1
						Total 3 marks

7	20.40 ÷ (1 – 0.15)			M2	for a complete method eg 20.40 ÷ (1 – 0.15) for 20.40 ÷ (100 – 15) (= 0.24)
				(M1)	**or** e.g. $0.85x = 20.40$
		24	3	A1	
					Total 3 marks

Question	Working	Answer	Mark	Notes
23	$-2(x^2+6x-3.5)$ or $-2(x^2+6x)+7$		3	M1 Factorising by -2
	$-2[(x+3)^2-9\ -3.5]$ or $-2[(x+3)^2-9]+7$			M1 Completing the square
		$25-2(x+3)^2$		A1
	Alt : $a+b(x^2+2cx+c^2)$			
	$2bc=-12$ or $a+bc^2=7$ or $b=-2$			M1 Equating coefficients or stating value of b
	$2\times-2\times c=-12$ or $c=3$			M1 Equating coefficients or stating value of c
	$a+-2\times(3)^2=7$ or $a=25$ seen			A1 Equating coefficients or stating value of a
				Special Cases: SC B2 for answer of $-2(x+3)^2$ + constant or $25-2(x+$ positive constant$)^2$ SC B1 for answer of $-2(x-3)^2$ + constant
				Total 3 marks

24	Gradient of $\mathbf{L_2}=-10\div-5)\ (=2)$		5	M1 Method to find gradient of $\mathbf{L_2}$
	$6=2\times8+c\ \rightarrow c=-10$ $y=2x-10$ oe			A1 Equation for $\mathbf{L_2}$
	$0=2x-10\ \rightarrow x=5$ or (5, 0) $y=2\times-3-10\ \rightarrow y=-16$ or $(-3,-16)$			A1 Finding point A and point B
	(Area =) $0.5\times5\times16$ or $(0.5\times5\times10)+(0.5\times10\times3)$ or $0.5\times5\times\sqrt{265}\times\sin100.6°$ or $0.5\times\sqrt{320}\times\sqrt{265}\times\sin15.9°$			M1 Method to find area of triangle
		40		A1 cao Dep on M2
				Total 5 marks

Question		Working	Answer	Mark	Notes
9	(i)	$(x \pm 6)(x \pm 4)$		2	M1 or $(x + a)(x + b)$ where $ab = -24$ **or** $a + b = 2$
		Working not required, so correct answer scores full marks	$(x + 6)(x - 4)$		A1
	(ii)	*Answer must come from the factors in (i) as the questions says 'Hence solve…'*	$-6, 4$	1	B1ft **Must** follow through from their factors in (i), so even if the answers 4 and –6 are given the mark can only be awarded if it follows from the factorisation in (i) (dep on 2 factors)
					Total 3 marks
					NB: Some students may show the whole of their working in the space for (i) or (ii). Please award the marks for (i) and (ii) so long as there is no ambiguity.

18	$\sqrt{4}:\sqrt{9}\ (=2:3)$ or $\frac{\sqrt{4}}{\sqrt{9}}\left(=\frac{2}{3}\right)$ oe or $\sqrt{9}:\sqrt{4}\ (=3:2)$ or $\frac{\sqrt{9}}{\sqrt{4}}\left(=\frac{3}{2}\right)$ oe		4	M1 for finding the ratio or fraction for lengths for $A : B$ or $B : A$
	$\sqrt[3]{125}:\sqrt[3]{343}\ (=5:7)$ or $\frac{\sqrt[3]{125}}{\sqrt[3]{343}}\left(=\frac{5}{7}\right)$ oe or $\sqrt[3]{343}:\sqrt[3]{125}\ (=7:5)$ or $\frac{\sqrt[3]{343}}{\sqrt[3]{125}}\left(=\frac{7}{5}\right)$ oe			M1 for finding the ratio or fraction for lengths for $B : C$ or $C : B$
	$A : B = 10 : 15$ and $B : C = 15 : 21$ oe			M1 for mainpulating $A : B$ and $B : C$ so that both B values are equal
		10 : 21		A1 Allow 1 : 2.1 SC3 for 21 : 10 with all working shown
				Total 4 marks

19	(a)		$-\frac{4}{3}$	1	B1
	(b)	$3(x^2 + 4x) + 19$ **and** $3[(x + 2)^2 - 2^2] + 19$ **or** $3\left(x^2+4x+\frac{19}{3}\right)$ **and** $3\left((x+2)^2-2^2+\frac{19}{3}\right)$ **or** $a = 3$ and $2ab = 12$ oe and $b^2a + c = 19$ oe **or** $a = 3$ and $b=\frac{12}{2\times3}$ oe and $c=-\frac{12^2}{4\times3}+19$ oe			M1 for correctly taking out a factor of 3 and correctly completing the square **or** for equating coefficients by expanding $a(x+b)^2+c=ax^2+2abx+b^2a+c$ **or** for equating coefficients by using $ax^2+bx+c=a\left(x+\frac{b}{2a}\right)^2-\frac{b^2}{4a}+c$
			$3(x + 2)^2 + 7$		A1 accept $a = 3$, $b = 2$, $c = 7$
					Total 3 marks

10	eg $\begin{matrix}+\\ \end{matrix}\begin{matrix}7x+3y=3\\ 9x-3y=21\end{matrix}$ or $\begin{matrix}-\\ \end{matrix}\begin{matrix}21x+9y=9\\ 21x-7y=49\end{matrix}$ or eg $7x+3(3x-7)=3$ or $7\left(\frac{7+y}{3}\right)+3y=3$		3	M1	a correct method to eliminate x or y – multiplying one or both equations so that one variable can be eliminated (allow a total of one error in multiplication) **and** the correct operation to eliminate or for substitution of one variable into the other equation.
	If first M1 gained then they can substitute an incorrect value if from 'correct' method to gain this mark.			M1	dep on M1 for a correct method to calculate the value of other letter eg substitution or starting again with elimination
		$x = 1.5$, $y = -2.5$		A1	oe dep on M1
					Total 3 marks

11	(i)	$(x \pm 3)(x \pm 8)$		2	M1	or $(x + a)(x + b)$ where $ab = -24$ **or** $a + b = 5$
			$(x - 3)(x + 8)$		A1	
	(ii)		3, −8	1	B1ft	Must ft from their answer to (i) ft from their incorrect factors in the form $(x + a)(x + b)$
						Total 3 marks

19	$3(x^2-2x).....$ or $3(x^2-2x+.....)$ oe or		3	M1	(where …… is any number or no number)
	$3(x-1)^2$…… or $3[(x-1)^2.....]$ oe			M1	(where …… is any number or no number)
	Correct answer scores full marks (unless from obvious incorrect working)	$3(x-1)^2+2$		A1	(if student continues to solve a quadratic equation, ISW)
					Total 3 marks
Alternative mark scheme for 19					
19	$ax^2-2abx+ab^2+c$		3	M1	for multiplying out $a(x-b)^2+$ c to obtain $ax^2-2abx+ab^2+c$ oe
	Any 2 of the following: $a=3$ or $2ab=6$ or $ab^2+c=5$ oe			M1	for equating coefficients with any 2 of $a=3$ or $2ab=6$ or $ab^2+c=5$ oe seen
	Correct answer scores full marks (unless from obvious incorrect working)	$3(x-1)^2+2$		A1	(if student continues to solve a quadratic equation, ISW)
					Total 3 marks

11	(i)	$(x \pm 2)(x \pm 11)$		2	M1 Or $(x + a)(x + b)$ where $ab = -22$ **or** $a + b = 9$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x - 2)(x + 11)$		A1
	(ii)		2, −11	1	B1ft **Must** ft from their factors in (i)
					Total 3 marks

12	$4 \times 11\,800$ (= 47 200) or $3 \times 13\,207$ (= 39 621) or 86 821		3	M1 for one correct product or for the sum of the products
	$\frac{"47\,200" + "39\,621"}{7} \left(= \frac{86821}{7}\right)$			M1 for a fully correct method to find the mean for the 7 days
	Correct answer scores full marks (unless from obvious incorrect working)	12 403		A1 cao
				Total 3 marks

Question		Working	Answer	Mark	Notes	
19		$\frac{BD}{\sin 97} = \frac{9.3}{\sin 58}$ $BD = \frac{9.3}{\sin 58} \times \sin 97$ (= 10.8846..) 0.5 × '10.88.' × 11.2 × sin47 (= 44.57.....) 0.5 × '10.88..' × 9.3 × sin25 (=21.39.....) or 0.5 × '4.63458 …' × 9.3 × sin97 (=21.39.....)	66.0	5	M1 M1 M1 M1 A1	 Complete method to find area *BCD* Complete method to find area *ABD* Allow 65.9 – 66.1
20	(a)	$3(x^2 - 4x) + 7$ or $3\left(x^2 - 4x + \frac{7}{3}\right)$ $3((x-2)^2 - 4) + 7$ or $3\left((x-2)^2 - 4 + \frac{7}{3}\right)$ or $3(x-2)^2 - 12 + 7$	$3(x-2)^2 - 5$	3	M1 M1 A1	or expanding $a(x^2+2bx+b^2)+c$ $-12 = 2ab$ or $7 = ab^2 + c$ or $a = 3$, $b = -2$, $c = -5$
	(b)		$x = 2$	1	B1	ft from (a)

Question	Working	Answer	Mark	Notes
21	$(10x - 3)(x + 1) = 6x$	$(-0.05, -0.3)$	6	M1 for a correct equation to find points A and B
	$10x^2 + x - 3\ (= 0)$			M1 for rearranging equation in the form $ax^2 + bx + c\ (= 0)$
	$(5x + 3)(2x - 1)\ (= 0)$ or $x = \frac{-1 \pm \sqrt{1^2 - (4 \times 10 \times -3)}}{2 \times 10}$ or $10(x + 0.05)^2 - 0.025 - 3 = 0$			M1 dep on M1for solving the quadratic equation using factorisation or using the formula or by completing the square
	$x = -0.6$ and $x = 0.5$ $(y = -3.6$ and $y = 3)$			A1 Both x values correct dep on M2
	$\frac{'-0.6' + '0.5'}{2}$ or $\frac{'-3.6' + '3'}{2}$ oe			M1 dep on M1 A1

Question		Working	Answer	Mark		Notes
22		$-2(x^2-6x)+5$ or $-2(x^2-6x\ -2.5)$		4	M1	Factorising by extracting -2 in a correct expression
		$-2[(x-3)^2-\ 9-2.5\ ]$ or $-2[(x-3)^2-9]+5$			M1	Correct expression equivalent to $5+12x-2x^2$
		$-2[(x-3)^2-11.5]$ or $-2(x-3)^2+\ 18+5$			M1	Correct expression equivalent to $5+12x-2x^2$
			$23-2(x-3)^2$		A1	**Award full marks if a, b, and c are correctly stated and $23-2(x-3)^2$ is not stated anywhere.** SC B3 for $23-2(3-x)^2$ SC B2 for $-2(x-3)^2$ + constant or $23-2(x+\text{constant})^2$ SC B1 for $-2(x+3)^2$ +constant
		Alt: $a+b(x^2\pm 2cx+c^2)$			M1	Multiplying out expression correctly
		$2bc=12$ or $a+bc^2=5$ or $b=-2$			M1	Equating coefficients or stating value of b Method to calculate c
		$2\times -2\times c=12$ or $c=-3$			M1	Method to calculate a
		$a+-2\times(-3)^2=5$ or $a=23$ seen			M1	SC B3 for $23-2(3-x)^2$
			$23-2(x-3)^2$			
						Total 4 marks

8	(a)		1	1	B1
	(b)(i)	$(x \pm 4)(x \pm 9)\ (= 0)$		2	M1 or $(x + a)(x + b)$ where $ab = -36$ **or** $a + b = -5$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x+4)(x-9)$		A1 (isw if they also solve the equation in this part)
	(ii)	*Answers must ft from (b)(i)*	-4 and 9	1	B1 ft Answer **must** ft from their $(x + p)(x + q)$ in (b)(i) Award B0 for -4 and 9 if no marks scored in (i)
					Total 4 marks

9	(a)	$1.75 \times 10^6 \div 2.4 \times 10^7$ or 1 750 000 ÷ 24 000 000 oe eg $\frac{1.75}{24}$		3	M1
		0.0729(16…) or 0.072 or 0.073 or for $\frac{7}{96}$ or 7.29(16…)% or 7.2% or 7.3%			A1
		Correct answer scores full marks (unless from obvious incorrect working)	7.3×10^{-2}		A1 accept 7.3×10^{-2} or better $(7.29(16\ldots) \times 10^{-2})$
	(b)	$2.4 \times 10^7 \times 5.01 \times 10^{21} \div 3$ oe		2	M1
		Correct answer scores full marks (unless from obvious incorrect working)	4×10^{28}		A1 accept 4×10^{28} , 4.0×10^{28} , 4.01×10^{28} , 4.008×10^{28}
					Total 5 marks

20	(a)	$7 - 3(x^2 - 4x)$		3	M1 **or** for one of a, b or c correct
		$7 - 3[(x - 2)^2 - 4]$			M1 **or** for two of a, b or c correct
			$19 - 3(x - 2)^2$		A1
	(b)		(2, 19)	1	B1 ft their expression
					Total 4 marks

24	$-q\left(x^2-\frac{12}{q}x\right)+q$ or $-q\left(x^2-\frac{12}{q}x-\frac{q}{q}\right)$ oe		4	M1 for a correct factorisation of the expression or $b = q$ (must be stated)
	$-q\left[\left(x-\frac{12}{2q}\right)^2.....\right]$ oe or $-q\left[\left(x-\frac{6}{q}\right)^2.....\right]$ oe			M1 for starting the correct process to complete the square
	E.g. $-q\left(x-\frac{6}{q}\right)^2+\frac{36}{q}+q$ oe or $-q\left(x-\frac{12}{2q}\right)^2+\frac{144q}{4q^2}+q$ oe			M1 for a complete process of completing the square. (Does not need to be simplified)
		$a=\frac{36}{q}+q$ $b=q$ $c=\frac{6}{q}$		A1 oe a and c must come from a correct process of completing the square. (Does not need to be simplified)
				Total 4 marks

24 ALT	$a - bx^2 + 2bcx - bc^2$ oe or $-bx^2 + 2bcx - bc^2 + a$ oe or $b = q$		4	M1 for correctly multiplying out $a - b(x - c)^2$
	$2bc = 12$ or $a - bc^2 = q$ oe			M1 for correctly equating coefficients
	$c = \frac{12}{2q}$ or $a = q\left(\frac{12}{2q}\right)^2 + q$ or $c = \frac{6}{q}$ or $a = q\left(\frac{6}{q}\right)^2 + q$			M1 for correctly finding a or c (Does not need to be simplified)
		$a = \frac{36}{q} + q$ $b = q$ $c = \frac{6}{q}$		A1 oe (Does not need to be simplified)
				Total 4 marks

25	$\pm 3(x^2 \pm 4x)$.....or $\pm 3(x^2 \pm 4x$.....$)$ or $b = 3$		4	M1 for factorising $-3x^2 + 12x$ or stating the correct value of b or $b = 3$ embedded in an incorrect final answer in the form $a - 3(x - c)^2$
	$-3\left[(x-2)^2 \text{.....}\right]$ or $-3(x-2)^2$			M1 for a **correct** first step to complete the square
	$-3\left[(x-2)^2 - (2)^2\right]$.....oe or $-3(x-2)^2 + 12$..... or $-3\left[(x-2)^2 - (2)^2 \text{.....}\right]$ oe			M1 for a **correct** second step to complete the square
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$29 - 3(x-2)^2$		A1 oe eg $-3(x-2)^2 + 29$
				Total 4 marks

25 **ALT**	$-bx^2 + 2bcx - bc^2 + a$ oe or $b = 3$		4	M1 for multiplying out $a - b(x - c)^2$ or stating the correct value of b or $b = 3$ embedded in an incorrect final answer in the form $a - 3(x - c)^2$
	$2bc = 12$ or $a - bc^2 = 17$ oe			M1 for equating coefficients
	$2 \times$"3"$\times c = 12$ or $a -$ "3" $\times$ "2"$^2 = 17$ oe			M1 for finding at least 2 from a or b or c
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$29 - 3(x-2)^2$		A1 oe eg $-3(x-2)^2 + 29$
				Total 4 marks

7	(a)	$2x > 4 - 7$ **or** $x + 3.5 > 2$			2	M1 For a correct first step allow $2x = 4 - 7$ or $x + 3.5 = 2$ or an answer of $x = -1.5$ or $x < -1.5$ or -1.5
			$x > -1.5$			A1 for $x > -1.5$ oe
	(b)	$(x \pm 8)(x \pm 5)$	$\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 1 \times (-40)}}{2 \times 1}$ **or** $\frac{3 \pm \sqrt{9 + 160}}{2}$			M1 **or** $(x + a)(x + b)$ where $ab = -40$ **or** $a + b = -3$ **OR** correct substitution into quadratic formula (condone one sign error in a, b or c and missing brackets) (if + rather than ± shown then award M1 only unless recovered with answers)
		$(x - 8)(x + 5)$	$\frac{3 \pm \sqrt{169}}{2}$ **or** $\frac{3 \pm 13}{2}$			M1 $\frac{3 \pm \sqrt{169}}{2}$ **or** $\frac{3 \pm 13}{2}$
			8, −5		3	A1 dep on at least M1 for correct values
						Total 5 marks

24	(a)	$-3\left(x^2-4x\right)+7$ or $-3\left(x^2-4x-\frac{7}{3}\right)$		4	M1	for factorising the expression to find b or $b=-3$ stated or shown clearly in answer.
		$-3\left[(x-2)^2.....\right]$ or c = –2 $-3\left[(x-2)^2-4\right]+7$ or $-3\left[(x-2)^2-4-\frac{7}{3}\right]$			M1	or for c shown clearly in answer.
		$-3(x-2)^2+12+7$ or $-3\left[(x-2)^2-\frac{19}{3}\right]$			M1	fully correct method.
			$19-3(x-2)^2$		A1	for $19-3(x-2)^2$ oe
	(b)		(2, 19)	1	B1 ft	dep on M1 in part (a) answer must follow answer from (a) if given
						Total 5 marks

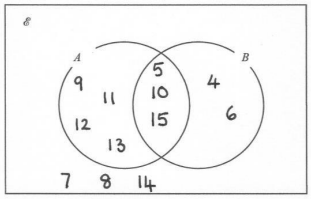
Alternative mark scheme for 24						
24	(a)	$a + bx^2 + 2bcx + bc^2$		4	M1	for multiplying out $a + b(x + c)^2$ to obtain $a + bx^2 + 2bcx + bc^2$ oe
		$b = -3$ or $2bc = 12$ or $a + bc^2 = 7$ oe			M1	for equating coefficients
		$b = -3$ and $c = -2$			M1	for correctly finding b and c
		$a = 19$	$19-3(x-2)^2$		A1	for $19-3(x-2)^2$ oe
	(b)		(2, 19)	1	B1 ft	dep on M1 in part (a)
						Total 5 marks

8	$2 \times \pi \times 7$ (= 43.982… or 14π) **or** $(2 \times \pi \times 7) \div 2$ (= 21.991… or 7π) **or** $2 \times \pi \times 9$ (= 56.548… or 18π) **or** $(2 \times \pi \times 9) \div 2$ (= 28.274… or 9π)		3	M1	for finding the circumference of either the full circle or the length of the arc for either semicircle
	e.g. "21.991" + "28.274" (= 50.26…) **or** "7π" + "9π" (=16π) **or** "21.991" + "28.274" + 2 (= 52.26…) **or** "7π" + "9π" + 2 (= 52.26…) **or** "21.991" + "28.274" + 2 + 2 **or** "7π" + "9π" + 2 + 2			M1	for a method to find the length of the two arcs with intention to add
		54.3		A1	accept 54.2 – 54.3
					Total 3 marks

9	(a)		$16x^{12}y^{20}$	2	B2	B1 for an answer in the form ax^ny^m with 2 correct from $a = 16$, $n = 12$, $m = 20$
	(b)(i)	$(x \pm 9)(x \pm 4)$		2	M1	for $(x \pm 9)(x \pm 4)$ **or** for $(x + a)(x + b)$ where $ab = -36$ or $a + b = 5$
			$(x + 9)(x - 4)$		A1	
	(ii)		–9, 4	1	B1	ft from (b)(i)
						Total 5 marks

16	a	E.g. $x^2 + 4x - 2x - 8$ ($= x^2 + 2x - 8$) **or** $x^2 - 2x + x - 2$ ($= x^2 - x - 2$) **or** $x^2 + 4x + x + 4$ ($= x^2 + 5x + 4$)		3	M1	for multiplying out two brackets correctly with no more than one error
		E.g. $x^3 + 2x^2 - 8x + x^2 + 2x - 8$ or $x^3 + 4x^2 - 2x^2 - 8x + x^2 + 4x - 2x - 8$ **or** $x^3 - x^2 - 2x + 4x^2 - 4x - 8$ or $x^3 - 2x^2 + x^2 - 2x + 4x^2 - 8x + 4x - 8$ **or** $x^3 + 5x^2 + 4x - 2x^2 - 10x - 8$ or $x^3 + 4x^2 + x^2 + 4x - 2x^2 - 8x - 2x - 8$			M1	for at least 3 terms correct out of a maximum of 6 terms **or** for at least 4 terms correct out of a maximum of 8 terms
			$x^3 + 3x^2 - 6x - 8$		A1	
	b	E.g. $(x - 5)^2 - 5^2$ (+ 40) or $(x - 5)^2 - 25$ (+ 40) $\left(x^2 + 2ax + a^2\left(+b^2\right)\right)$ $2a = -10$ or $a = -5$		2	M1	for a correct first step **or** for equating coefficients
			$(x - 5)^2 + 15$		A1	accept $a = -5$, $b = 15$ SC B1 for $(-x+5)^2+15$ or $(5-x)^2+15$
						Total 5 marks

6	(a)	$5x \leq 2+7$ **or** $5x \leq 9$ **or** $\frac{5x}{5} - \frac{7}{5} \leq \frac{2}{5}$ oe		2	M1	allow any sign instead of ≤ **or** for an answer of 1.8 oe **or** x and 1.8 oe with the incorrect sign
			$x \leq 1.8$		A1	oe
	(b)(i)	$(y \pm 7)(y \pm 5)$		2	M1	for $(y \pm 7)(y \pm 5)$ **or** $(y + a)(y + b)$ where $ab = -35$ **or** $a + b = -2$
			$(y - 7)(y + 5)$		A1	isw if student goes on to solve the equation in this part
	(ii)		7, −5	1	B1ft	answer must ft from their $(y + a)(y + b)$ in (b)(i). Award B0 for 7, −5 if no marks scored in (i)
						Total 5 marks

7			3	B3	all 4 parts of diagram correct (B2 for 2 or 3 parts correct) (B1 for 1 part correct) SCB1 if no marks scored, award B1 if 4,6 in the section $A \cap B'$ and 9, 11, 12, 13 in the section $A' \cap B$
					Total 3 marks

5	(a)		$3c^4+12c^3$	2	B2	for $3c^4+12c^3$ (B1 for $3c^4$ or $12c^3$)
	(b)(i)			2	M1	for $(x\pm9)(x\pm1)$ **or** for $(x+a)(x+b)$ with $ab=-9$ or $a+b=8$
			$(x+9)(x-1)$		A1	for correct factors
	(ii)		-9, 1	1	B1	ft dep on factorising in the form $(x+p)(x+q)$
						Total 5 marks

6	$\frac{8}{3}(+)\frac{15}{4}$ **or** $(2)\frac{8}{12}(+)(3)\frac{9}{12}$ **or** $(2)\frac{8a}{12a}(+)(3)\frac{9a}{12a}$		3	M1	for correct improper fractions **or** fractional part of numbers written correctly over a common denominator
	eg $\frac{8\times4+15\times3}{3\times4}$ **or** $\frac{32}{12}+\frac{45}{12}$ **or** $\frac{32a}{12a}+\frac{45a}{12a}$ **or** $2\frac{8}{12}+3\frac{9}{12}=5\frac{17}{12}$ oe			M1	for correct fractions with a common denominator of 12 or a multiple of 12
	$\frac{32}{12}+\frac{45}{12}=\frac{77}{12}=6\frac{5}{12}$ **or** $5\frac{17}{12}=6\frac{5}{12}$ **or** if shows $6\frac{5}{12}=\frac{77}{12}$ at the beginning then show that the addition comes to $\frac{77}{12}$	Shown		A1	dep on M2 for a correct answer from fully correct working **or** shows that RHS = $\frac{77}{12}$ **and** fully correct working shows LHS = $\frac{77}{12}$
					Total 3 marks

22	(a)	$\left(\frac{dy}{dx}=\right) 2x + px^{-2}$ oe		4	M2	Both terms correct (M1 for one term correct)
		$2(-3) + p(-3)^{-2} (= 0)$			M1	(dep on M1) substitute -3 into a derivative of the form $ax + bx^{-2}$
			54		A1	
	(b)	$\left(\frac{dy}{dx}=\right) 2x + 16x^{-2} = 0$		3	M1	set $\frac{dy}{dx} = 0$, at least one term correct
		eg $2x^3 + 16 = 0$ **or** $2x^3 = -16$ **or** $x^3 = -8$ **or** $x = \sqrt[3]{-8}$ **or** $x = -2$			M1	rearrangement of the correct equation to remove the negative power of x
			12		A1	
						Total 7 marks

23	(a)	$2(x^2 - 6x) + 3$ **or** $2(x^2 - 6x + \frac{3}{2})$		3	M1	**or** for one of a, b or c correct **OR** expanding $a(x^2 + 2bx + b^2) + c$
		$2\left[(x-3)^2 - 9\right] + 3$ **or** $2\left[(x-3)^2 - 3^2 + \frac{3}{2}\right]$ oe			M1	**or** for two of a, b or c correct **OR** $-12 = 2ab$ **or** $3 = ab^2 + c$
			$2(x-3)^2 - 15$		A1	accept $a = 2$, $b = -3$, $c = -15$
	(b)		$(-1, -15)$	2	B2ft	eg accept [their $-b - 4$] for the x-coordinate or [their c] for the y-coordinate (B1 ft for one correct coordinate)
						Total 5 marks

23	$\left(\frac{dy}{dx}=\right)2x-8$ or $(x-4)^2$….. or $(x=)\frac{-1+9}{2}$		5	M1 for using differentiation **or** completing the square **or** by symmetry
	$x = 4$ or $(4, -25)$ or $(4, \ldots)$ or $\frac{p+q}{2} = 4$ oe			M1
	$q=-3$ **or** $p=11$			A1
	$(k=)(-3)^2-8(-3)-9$ **or** $(k=)(11)^2-8(11)-9$			M1
	Working required	24		A1 dep on M2
				Total 5 marks

23	$p^2 - 8p - 9 = k$ **and** $q^2 - 8q - 9 = k$ or $(p - 9)(p + 1) = k$ **and** $(q - 9)(q + 1) = k$		5	M1
ALT 1	$(q+14)^2-8(q+14)-9=q^2-8q-9$ **or** $(p-14)^2-8(p-14)-9=p^2-8p-9$ **or** $(q + 14 - 9)(q + 14 + 1) = (q - 9)(q + 1)$ **or** $(p - 9)(p + 1) = (p - 14 - 9)(p - 14 + 1)$ oe			M1 for a correct equation in one variable
	$q=-3$ **or** $p=11$			A1
	$(k=)(-3)^2-8(-3)-9$ **or** $(k=)(11)^2-8(11)-9$			M1
	Working required	24		A1 dep on M2
				Total 5 marks

23	$(q+14)^2-8(q+14)-9(=k)$ **or** $(p-14)^2-8(p-14)-9(=k)$		5	M1
ALT 2	$(q+14)^2-8(q+14)-9=q^2-8q-9$ **or** $(p-14)^2-8(p-14)-9=p^2-8p-9$			M1 for a correct equation in one variable
	$q=-3$ **or** $p=11$			A1
	$(k=)(-3)^2-8(-3)-9$ **or** $(k=)(11)^2-8(11)-9$			M1
	Working required	24		A1 dep on M2
				Total 5 marks

23	$y=(x-4)^2-16-9$ oe or $k=(x-4)^2-25$ oe or $x^2-8x-9-k=0$		5	M1
ALT 3	$(x=)4\pm\sqrt{k+25}$ or $(x=)\dfrac{--8\pm\sqrt{(-8)^2-(4\times1\times(-9-k))}}{2\times1}$ oe or $(x=)\dfrac{8\pm\sqrt{100+4k}}{2}$ oe			M1
	$4+\sqrt{k+25}-\left(4-\sqrt{k+25}\right)=14$ oe or $\dfrac{8+\sqrt{100+4k}}{2}-\left(\dfrac{8-\sqrt{100+4k}}{2}\right)=14$ oe			A1 for a correct equation in one variable
	$25+k=\left(\dfrac{14}{2}\right)^2$ oe			M1
	Working required	24		A1 dep on M2
				Total 5 marks

Question	Working	Answer	Mark	Notes
11 a	$2x^2 - x + 6x - 3$ **or** $2x^2 + 5x - 3$ **or** $x^2 + 3x - 5x - 15$ **or** $x^2 - 2x - 15$ **or** $2x^2 - 10x - x + 5$ **or** $2x^2 - 11x + 5$ eg. $2x^3 + 5x^2 - 3x - 10x^2 - 25x + 15$ **or** $2x^3 - 4x^2 - 30x - x^2 + 2x + 15$ **or** $2x^3 - 11x^2 + 5x + 6x^2 - 33x + 15$	$2x^3 - 5x^2 - 28x + 15$	3	M1 for expansion of any 2 of the 3 brackets (at least 3 of 4 terms correct) M1 (dep) ft for at least half of their terms correct in second expansion (the correct number of terms **must** be present) A1
	Alternative scheme			
	$2x^3 - 10x^2 - x^2 + 5x + 6x^2 - 30x - 3x + 15$	$2x^3 - 5x^2 - 28x + 15$	3	M2 for a complete expansion with 8 terms present, at least 4 of which must be correct A1

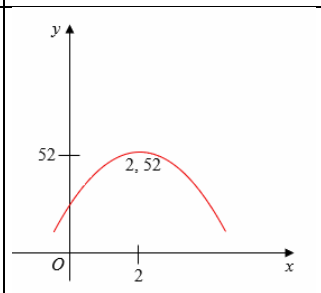
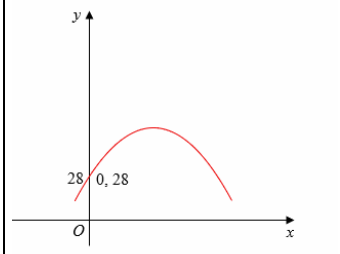
Question	Working	Answer	Mark	Notes
11 b	$\frac{-6\pm\sqrt{96}}{6}$ or $\frac{-6\pm\sqrt{6^2--60}}{6}$ Accept 9.79 – 9.8(0) in place of $\sqrt{96}$ NB: denominator must be 2 × 3 or 6 **and** there must be evidence for correct order of operations in the numerator	0.633, −2.63	3	M2 If not M2 then award M1 for $\frac{-6\pm\sqrt{6^2-4\times3\times-5}}{2\times3}$ condone one sign error in substitution; allow evaluation of individual terms e.g 36 in place of 6^2 A1 dep on M1 for answers in range 0.63 to 0.633 , −2.63 to −2.633 Award M2A1 for correct answer with correct working that would gain at least M1
	Alternative scheme e.g $3((x+1)^2-1)-5\ (=0)$ **or** $(x+1)^2-1-\frac{5}{3}(=0)$ $(x=)\ -1\pm\sqrt{\frac{5}{3}+1}$ oe	0.633, −2.63	3	M1 for completing the square M1 for correct method to isolate x A1 dep on M1 for answer in range 0.63 to 0.633 , −2.63 to −2.633 Award M2A1 for correct answer with correct working that would gain at least M1

Question		Working	Answer	Mark	Notes
24	(a)		$11 - (x + 2)^2$	2	M1 For $11 - (x + q)^2$ or $p - (x + 2)^2$ A1 fully correct, accept $p = 11$, $q = 2$
	(b)	$(y + 3 + 2)^2 = 11$ or $11 - (y + 3 + 2)^2$		3	M1 substituting $x = y + 3$ into their $p - (x + q)^2$
		$y + 3 + 2 = \pm\sqrt{11}$			M1
			$-5 \pm \sqrt{11}$		A1 Both answers correct, ft their answer from (a) eg $-(3 + "q") \pm \sqrt{"p"}$
	ALT (b)	**Alternative scheme**			M2 for $-y^2 - 10y - 14 = 0$ or $y^2 + 10y + 14 = 0$
			$-5 \pm \sqrt{11}$		A1 cao, both values correct
	(c)		$(-1, 3)$	1	B1 cao
					Total 6 marks

8	(a)(i)	$(x\pm8)(x\pm3)$ or $x(x-3)+8(x-3)$ or $x(x+8)-3(x+8)$		2	M1 for $(x\pm8)(x\pm3)$ or $(x+a)(x+b)$ where $ab = -24$ or $a + b = 5$ and, a and b are integers
		Correct answer scores full marks (unless from obvious incorrect working)	$(x+8)(x-3)$		A1 for $(x+8)(x-3)$ Allow any letter for x Must be in the form $(x+a)(x+b)$ where a and b are integers
	(ii)		–8 and 3	1	B1 must ft from their answer in (a)(i) ft from their incorrect factors in the form $(x + a)(x + b)$ Award B0 for –8 and 3 if no marks scored in (a)(i)
	(b)	$3y-7y>-10-5$ or $5+10>7y-3y$		3	M1 allow use of = or condone incorrect inequality sign
		$-4y>-15$ or $15>4y$ or $y=\frac{15}{4}$ oe or			M1 allow use of = or condone incorrect inequality sign
		Working required	$y<\frac{15}{4}$		A1 dep on M1 oe eg $y < 3.75$ or $\frac{15}{4}>y$ or $3.75 > y$ Must have correct sign on answer line NB Sight of correct answer in working space and just $(y=)\frac{15}{4}$ oe on answer line gains M2 only
					Total 6 marks

6 (a)	$6x - 24 = 3 + 2x$ **or** $x - 4 = \frac{3}{6} + \frac{2}{6}x$ oe		3	M1	for correct removal of fraction and expansion of bracket in a correct equation **or** separating fraction (RHS) in an equation
	$6x - 2x = 3 + 24$ **or** $4x = 27$ **or** $-24 - 3 = 2x - 6x$ **or** $-27 = -4x$ oe **or** $x - \frac{2}{6}x = \frac{3}{6} + 4$ oe **or** $-4 - \frac{3}{6} = \frac{2}{6}x - x$ oe			M1ft	(dep on 4 terms) correctly rearranging their 4 term equation for terms in x on one side of equation and number terms on the other
	Working required	$\frac{27}{4}$		A1	oe eg 6.75 or $6\frac{3}{4}$, dep on M1
(b)(i)	$(y \pm 6)(y \pm 5)$ **or** $(6 \pm y)(5 \pm y)$ **or** $y(y - 6) - 5(y - 6)$ **or** $y(y - 5) - 6(y - 5)$		2	M1	for $(y \pm 6)(y \pm 5)$ **or** $(6 \pm y)(5 \pm y)$ **or** for $(y + a)(y + b)$ where $ab = 30$ or $a + b = -11$ **or** $y(y + a) + b(y + a)$ or $y(y + b) + a(y + b)$ where $ab = 30$ or $a + b = -11$
	Correct answer scores full marks (unless from obvious incorrect working)	$(y - 6)(y - 5)$		A1	oe, allow any letter for y
(ii)		$(y =) 6, (y =) 5$	1	B1	must ft from their answer in (b)(i) ft from their factors in the form $(y + a)(y + b)$
					Total 6 marks

Question	Working	Answer	Mark	Notes
25 (a)	$\pm 6\left(x \pm \frac{4}{2}\right)^2$ ..... or $\pm 6(x \pm 2)^2$ ..... **or** $\pm 6\left[(x \pm 2)^2 .....\right]$ or $\pm 6\left[\left(x \pm \frac{4}{2}\right)^2 .....\right]$ **or** $\pm 6\left(x \pm \frac{24}{2\times -6}\right)^2$		3	M1 for a start to completing the square **or** correct substitution into $a\left(x+\frac{b}{2a}\right)^2+$.... from the formula $a\left(x+\frac{b}{2a}\right)^2-\frac{(b)^2}{4a}+c$
	$-6\left[\left(x-\frac{4}{2}\right)^2-\left(\frac{4}{2}\right)^2\right]$..... or $-6\left[(x-2)^2-2^2\right]$..... **or** $-6\left[\left(x-\frac{4}{2}\right)^2-\left(\frac{4}{2}\right)^2 .....\right]$ or $-6\left[(x-2)^2-2^2.....\right]$ **or** $-6\left(x+\frac{24}{2\times -6}\right)^2-\frac{24^2}{4\times -6}$.....			M1 for correctly completing the square but terms do not need to be simplified and 28 may or may not be present or correct simplification of the first two parts of $a\left(x+\frac{b}{2a}\right)^2-\frac{(b)^2}{4a}(+c)$ **NB: Please refer to ALT mark scheme after (b) for comparison of coefficients method**
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$52-6(x-2)^2$		A1 oe eg $-6(x-2)^2+52$
25(a) **ALT**	$-bx^2+2bcx-bc^2+a$ **and** $b = 6$ or $b = -6$		3	M1 for multiplying out $a-b(x-c)^2$ **and** $b = 6$ or $b = -6$
	$2bc = 24$ or $-bc^2+a = 28$			M1 for equating coefficients
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$52-6(x-2)^2$		A1 oe eg $-6(x-2)^2+52$

(b)		'∩' or '∪' shaped symmetrical quadratic curve	3	B1 for drawing a '∩' or '∪' shaped symmetrical quadratic curve with the turning point in any quadrant
		Turning point marked as (2, 52)		B1 for drawing a '∩' shaped symmetrical quadratic curve in the correct quadrant with a turning point at (2, 52)
		Intersection with *y*-axis marked as (0, 28) or crossing at 28 marked		B1 for drawing a '∩' shaped symmetrical quadratic curve in the correct quadrant with an intersection on the *y*-axis marked as (0, 28) or marked as 28 on the *y*-axis
				Total 6 marks

15	(a)		$\frac{9}{20}$ on first red branch	3	B1
			Correct binary structure		B1
		$\frac{9}{16}, \frac{7}{16}, \frac{9}{16}, \frac{7}{16}$	Labels and correct probabilities on all second branches		B1
	(b)	$\frac{'9'}{20} \times \frac{'7'}{16}$	$\frac{63}{320}$ or 0.196(875)	2	M1
					A1 oe ft diagram Accept 0.20 or better
	(c)	$\frac{'9'}{20} \times \frac{'7'}{16} + \frac{11}{20} \times \frac{9}{16}$	$\frac{162}{320}$ or 0.506(25)	3	M1 for $\frac{11}{20} \times \frac{9}{16}$
					M1 for $\frac{'9'}{20} \times \frac{'7'}{16} + \frac{11}{20} \times \frac{9}{16}$
					A1 oe Accept 0.51 or better
					Total 8 marks

16	(a)	$x(x+4)=12(12+x)$	Shown	3	M1
		$x^2+4x=144+12x$			M1 for at least one correct expression
					A1 for completion
	(b)	$x=\frac{--8\pm\sqrt{(-8)^2-4\times1\times(-144)}}{2}$ or $\frac{8\pm\sqrt{8^2-4\times1\times(-144)}}{2}$ or $\frac{8\pm\sqrt{-8^2-4\times1\times(-144)}}{2}$	20.6	4	M1 M1 for correctly substituting into the quadratic formula condone one sign error in substitution; allow partial correct evaluation
		$\frac{8\pm\sqrt{640}}{2}$ **or** $\frac{--8\pm\sqrt{(-8)^2--576}}{2\times1}$ **or** $\frac{8\pm8\sqrt{10}}{2}$ NB denominator must be 2×1 or 2 **and** there must be evidence for correct order of operations in the numerator Allow + instead of ± in the formula			M1 If the first M1 is awarded and an answer of 16.6.... or $4+4\sqrt{10}$ seen award this M mark
					A1 (dep on M1) 16.6….
					B1 (dep on M1) 20.6 - 20.65 ft
					Total 7 marks

17	FDs are 2, 3, 2.8, 0.7, 0.8	Correct histogram	3	M1 for any two correct FD calculations (can be implied by at least two correct bars)
				M1 for any three correct FDs (can be implied by at least three correct bars)
				A1 fully correct histogram
				(SC: B2 for all five bars of correct width with heights in the correct ratio)
				(SC:B1 for three bars of correct width with heights in the correct ratio)
				Total 3 marks

10	$16x = 32$ or $32y = 144$	(2, 4.5)	3	M1	for a correct sequence of operations which leads to 1 equation in one unknown, allowing one arithmetical error
	$3 \times$ '2' + $2y = 15$ or $3x + 2 \times$ '4.5' = 15			M1	(dep) substitute found value of one variable in one equation
				A1	
					Total 3 marks

11	72×1000 (= 72000) or $72 \div 60$ (= 1.2) or $72 \div 60 \div 60$ (= 0.02) or $60 \div 60 \times 1000$ (= 3.6)	20	3	M1	for at least **one** of $\times 1000$ or $\div 60$
	$\frac{72}{60 \times 60} \times 1000$			M1	(dep) for a complete method
				A1	
					Total 3 marks

12	(a)	$6 \times 25 + 6 \times 45$ (= 150 + 270 = 420)	20	4	M1	for 6×25 (=150) or 6×45 (=270)
		"150" + "270" – 350 (= 70) or "420" – 350			M1	
		$\frac{\text{"70"}}{350} \times 100$			M1	(dep on M2)
					A1	
		Alternative scheme				
		$6 \times 25 + 6 \times 45$ (= 150 + 270 = 420)	20	4	M1	for 6×25 (=150) or 6×45 (=270)
		$\frac{\text{"420"}}{350} \times 100 = 120$			M1	
		"120" – 100			M1	(dep on M2)
					A1	
	(b)	500 000 ÷ 8 (=62 500)	6 250 000	3	M1	
		$500\,000 \div 8 \times 100$			M1	for a complete method
					A1	
						Total 7 marks

Question	Working	Answer	Mark	Notes
9	eg $7x + 7y = 105$ − $7x - 5y = 3$ $5x + 5y = 75$ + $7x - 5y = 3$ $7(15 - y) - 5y = 3$ **or** $7x - 5(15 - x) = 3$ oe		3	M1 Correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting
	"6.5" + y = 15 **or** x + "8.5" = 15 **or** 7 × "6.5" − 5y = 3 **or** $7x - 5 \times$ "8.5" = 3			M1 dep Correct method to find second variable using their value from a correct method to find first variable or for repeating above method to find second variable
		$x = 6.5$, $y = 8.5$		A1oe dep on first M1
				Total 3 marks

10	(a)	$\frac{2^3}{2^7}$ **or** $2^3 \times 2^{-7}$ **or** $\frac{1}{2^4}$ **or** $\frac{1}{16}$ **and** $16 = 2^4$		2	M1
			-4		A1 Accept 2^{-4}
	(b)	$13^{-24} \times 13^5$		2	M1 for 13^{-24} or for $k = -6 \times 4 + 5$
			-19		A1 Accept 13^{-19}
					Total 4 marks

11	$V = \frac{4}{3} \times \pi \times 1.5^3$ (= 14.1(37)... or $\frac{9}{2}\pi$)		3	M1 Correct expression for volume.
	$D = \frac{109.6}{\frac{4}{3}\pi \times 1.5^3}$ oe			M1 dep
		7.75		A1 7.75 – 7.78
				Total 3 marks

Question	Working	Answer	Mark	Notes
8	eg $8x + 4y = 18 + x - 4y = 9$ **or** $4x + 2y = 9 - 4x - 16y = 36$ **or** $4(9 + 4y) + 2y = 9$ eg $4 \times$ "3" $+ 2y = 9$ **or** $4x + 2 \times$ "−1.5" $= 9$ **or** $x = 9 + 4 \times$ "−1.5"	$x = 3$, $y = -1.5$	3	M1 correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate the selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting M1 (dep) correct method to find second variable using their value from a correct method to find first variable or for repeating above method to find second variable A1 oe, dep first M1
9 (a)		4.8×10^{11}	1	B1
(b)		$2^{14} \times 3 \times 5^{10}$	3	B3 for the correct answer B2 for an answer in the form $2^m \times 3 \times 5^n$, where m and n are positive integers B1 for at least 2 correct steps in repeated prime factorisation (including tree diagram)
(c)		29 296 875	1	B1 Accept 3×5^{10}, 2.9296875×10^7

Question	Working	Answer	Mark	Notes
9	e.g. $4x + 5y = 4$ $4x - 2y = 18$ with the operation of subtraction $4x + 5y = 4$ $10x - 5y = 45$ With the operation of adding $y = 2x - 9$ and $4x + 5(2x - 9) = 4$	$x = 3.5$ oe, $y = -2$	3	M1 for correct method to eliminate one variable – multiplying one or both equations so the coefficient of x or y is the same in both with the intention to add or subtract to eliminate one variable(condone one arithmetic error) or isolating x or y in one equation and substituting into the other equation M1 (dep) for substitution of found variable into one equation or correct method to eliminate second variable A1 Dep on M1
10	$3 \div 2$ (=1.5) or eg $\frac{4-1}{2(-0)}$ or $c = 1$ $y =$ "1.5"$x + c$ **or** $y = mx + 1$ or eg $y - 4 = m(x - 2)$	$y = 1.5x + 1$ oe	3	M1 for correct method to find gradient – may see this on grid. For $c = 1$, could be $(L =) mx + 1$ oe or for $1.5x + c$ M1 for use of $y = mx + c$ with either m or c or for $(L =) 1.5x + 1$ A1 oe eg $y - 4 = \frac{3}{2}(x - 2)$

8		$(x) \times 1000$ **or** $(x) \div 60$ **or** $(x) \div 60 \div 60$ **or** $(x) \times 1000 \div 60$ oe			M1 for at least **one** of $\times 1000$ **or** $\div 60$ **or** $\frac{5}{18}$ oe
		$x \times \frac{1000}{60 \times 60}$ oe			M1 (dep) for a complete correct method
			$\frac{5}{18}x$	3	A1 accept $0.2\dot{7}x$ **or** $0.2\bar{7}x$ **or** $\frac{x}{3.6}$ **or** $\frac{1}{3.6}x$
					Total 3 marks

Using elimination then substitution					
9		e.g. $x + 2y = -0.5$ $+ \ 6x - 2y = \ 32$ $(7x = 31.5)$	e.g. $3x + 6y = -1.5$ $- \ 3x - y = \ 16$ $(7y = -17.5)$		M1 for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone any one arithmetic error)
		e.g. '4.5' + $2y = -0.5$ **or** $3 \times$ '4.5' $- y = 16$	e.g. $x + 2 \times$ '−2.5' = −0.5 **or** $3x -$ '−2.5' = 16		M1 (dep) for substituting their value found of one variable into one of the equations **or** for repeating above method to find second variable
			$x = 4.5$ $y = -2.5$	3	A1 (dep on first M1) for both solutions
					Total 3 marks

Using substitution					
9		3(−0.5 − 2*y*) − *y* = 16 (7*y* = −17.5) **or** $\frac{16+y}{3}+2y=-0.5$ (7*y* = −17.5)	$3x-\left(\frac{-0.5-x}{2}\right)=16$ (7*x* = 31.5) **or** $x+2(3x-16)=-0.5$ (7*x* = 31.5)		M1 for correctly writing *x* or *y* in terms of the other variable and correctly substituting
		e.g. *x* = −0.5 − 2'−2.5' or $x=\frac{16+'-2.5'}{3}$	e.g. $y=\frac{-0.5-'4.5'}{2}$ or $y=3'4.5'-16$		M1 (dep) for substituting their value found of one variable into one of the equations
			x = 4.5 *y* = −2.5	3	A1 (dep on first M1) for both solutions
					Total 3 marks

Question	Working	Answer	Mark	Notes
4	$8.5^2 + 5.6^2$ (= 103.61)		3	M1
	$\sqrt{8.5^2 + 5.6^2}$			M1
		10.2		A1 Accept 10.1 to 10.2 or better
				Total 3 marks

5	3 hours 36 mins = 216 (mins) or 3.6 (hours) or $3\frac{36}{60}$ oe (hours)		3	M1
	2470 ÷ 3.6 or 2470 ÷ $3\frac{36}{60}$ or 2470 ÷ 216 × 60			M1 Allow 2470 ÷ 3.36 (=735 or better)
		686		A1 Accept 686.1 or better
				Total 3 marks

6		Fully correct perpendicular bisector with all relevant arcs shown.	2	B2 Fully correct bisector with all arcs. Correct arcs can be on the same side of *AB*. B1 for all correct arcs and no bisector drawn or for a correct bisector within guidelines but no arcs. NB: On tramlines = within tramlines.
				Total 2 marks

7	(adding) $10x = -5$ or $21x + 35y = 42$ $21x - 15y = -33$ then $50y = 75$		3	M1 Correct method to eliminate x or y Or making coefficients of x or y the same **and** correct operator has been applied to eliminate x or y (2 out of 3 terms correct implies a correct operator) or correct algebraic substitution for x or y into other equation
		$x = -0.5$ oe $y = 1.5$ oe		A1 Both A marks dep on M1 A1
				Total 3 marks

Question	Working		Answer	Mark	Notes
8	eg $10a + 4c = 20$ $+ \ 2a - 4c = 7$ eg $[c = \frac{10-5a}{2}]$ oe $2a - 4\left(\frac{10-5a}{2}\right) = 7$ oe	eg $10a + 4c = 20$ $- \ 10a - 20c = 35$ eg $[a = \frac{7+4c}{2}]$ oe $5\left(\frac{7+4c}{2}\right) + 2c = 10$ oe		3	M1 multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if + or − is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into second
	eg $5 \times$ "2.25" $+ 2c = 10$ **or** $2 \times$ "2.25" $- 4c = 7$	eg $5a + 2 \times$ "−0.625" $= 10$ **or** $2a - 4 \times$ "−0.625" $= 7$			M1 (dep on previous M1 but not on a correct first value) correct method to find second unknown – this could be a correct substitution into one of the equations given or calculated or starting again with the same style of working as for the first method mark
	Working required		$a = 2.25$ $c = -0.625$		A1 oe eg $a = \frac{9}{4}$, $c = -\frac{5}{8}$ for both solutions dependent on first M1
					Total 3 marks

10	eg $6x + 10y = 6.2$ _ $6x + 3y = 3.75$ $7y = 2.45$ eg $30x + 15y = 18.75$___ $9x + 15y = 9.3$ $21x = 9.45$ **or** eg $6\left(\frac{3.1-5y}{3}\right)+3y=3.75$		3	M1	for correct method to eliminate one variable – multiplying one or both equations so the coefficient of x or y is the same in both (condone one arithmetic error), with the intention to subtract all 3 terms to eliminate one variable (intention to subtract is clearly showing a minus sign or subtracting 2 or 3 out of 3 terms) **or** isolating x or y in one equation and substituting into the other
	eg. $6 \times$ "0.45" $+ 3y = 3.75$ or $3 \times$ "0.45" $+ 5y = 3.1$ **or** $3x + 5 \times$ "0.35" $= 3.1$ or $6x + 3 \times$ "0.35" $= 3.75$			M1	dep. Substitute found value into one equation **or** correct method to eliminate second unknown.
		$x = 0.45$ oe $y = 0.35$ oe		A1	dep M1
					Total 3 marks

6	eg $4x + 8y = 60$ or $3x + 6y = 45$ $-\ \underline{4x - 6y = 4}$ $+\ \underline{4x - 6y = 4}$ $(14y = 56)$ $(7x = 49)$ eg $4x - 6\left(\frac{15-x}{2}\right) = 4$ or $4(15-2y) - 6y = 4$ oe		3	M1	Correct method to eliminate x or y: coefficients of x or y the same **and** correct operator to eliminate selected variable (condone any one arithmetic error in multiplication) **or** correctly writing x or y in terms of the other variable and correctly substituting.
	eg $x + 2 \times 4 = 15$ or $7 + 2 \times y = 15$			M1	dep correct method to find second variable using their value from a correct method to find first variable or for repeating above method to find second variable.
	Working required	$x = 7$, $y = 4$		A1	dep on M1
					Total 3 marks

7	(a)		0.000 0932	1	B1
	(b)		2.4×10^5	2	B2 If not B2, then B1 for 240 000 or 24×10^4 oe or 2.4×10^a $a \neq 5$
	(c)		1.8×10^{121}	2	B2 If not B2, then B1 for 18×10^{120} or 1.8×10^b $b \neq 121$
					Total 5 marks

Question	Working		Answer	Mark	Notes
7	eg $5x + 4y = -2$ $+ 8x - 4y = 17.6$ $(13x = 15.6)$ eg $[x = \frac{4.4 + y}{2}]$ oe $5\left(\frac{4.4 + y}{2}\right) + 4y = -2$ oe	eg $10x + 8y = -4$ $- 10x - 5y = 22$ $(13y = -26)$ eg $[y = 2x - 4.4]$ oe $5x + 4(2x - 4.4) = -2$ oe		3	M1 multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if + or – is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into second
	eg $5 \times$ "1.2" $+ 4y = -2$ **or** $2 \times$ "1.2" $- y = 4.4$	eg $5x + 2 \times$ "–2" $= 4.4$ **or** $2x -$ "–2" $= 4.4$			M1 (dep on previous M1 but not on a correct first value) correct method to find second unknown – this could be a correct substitution into one of the equations given or calculated or starting again with the same style of working as for the first method mark
	Working required		$x = 1.2$ $y = -2$		A1 oe eg $x = \frac{6}{5}$ for both solutions dependent on first M1
					Total 3 marks

9	eg $21x + 9y = 24$ _ $2x + 9y = 14.5$ or $14x + 63y = 101.5$ _ $14x + 6y = 16$ **or** eg $7\times\left(\frac{14.5-9y}{2}\right)+3y=8$		3	M1	for a correct method to eliminate x or y: multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if + or – is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into second
				M1	(dep on previous M1 but not on a correct first value) correct method to find second unknown – this could be a correct substitution into one of the equations given or calculated or starting again with the same style of working as for the first method mark
	Working required	$x = 0.5$ **and** $y = 1.5$		A1	oe, dep on M1
					Total 3 marks

10	Correctly identifying 15 and 25		2	M1	could be clearly shown in list (condone 19 also being indicated)
	Correct answer scores full marks (unless from obvious incorrect working)	10		A1	
					Total 2 marks

Question	Working	Answer	Mark	Notes
14	For drawing the line $y - x - 2 = 0$ ($y = x + 2$) Goes through (–2, 0) (–1, 1) (0, 2) (1, 3) (2, 4) etc		3	M1 At least long enough for the intercept with the other line and to clearly see that it is the correct line
	This question is testing use of graphs to solve simultaneous equations H2.6B Therefore please ignore any algebraic methods to solve the equations.	$x = -1$ $y = 1$		A2 for both values correct, dep on M1 (A1 dep on M1 for one correct value or both values the wrong way round,) [if more than one line is drawn, one of which is correct, and the correct coordinates given, please given credit]
				Total 3 marks

10	$\_6x + 4y = 1$ $\quad \_30x + 20y = 5$ eg $6x + 10y = 16$ or $12x + 20y = 32$ oe $(6y = 15)$ $\quad (18x = -27)$ or eg $6x + 4\left(\frac{8-3x}{5}\right) = 1$ or $3\left(\frac{1-4y}{6}\right) + 5y = 8$		3	M1	A correct method to eliminate x or y – multiplying one or both equations so that one value can be eliminated **and** the correct operation to eliminate which can be shown by 2 out of 3 terms correct for subtraction or addition (allow one arithmetic error in multiplying) **or** for a correct substitution of one variable into the other equation. NB: the mark is for the method and not for the result of the method – although if the correct result is seen, this means the mark is awarded
				M1dep	A correct method to calculate the value of the other letter (dep on M1) eg substitution of found variable into an equation (equation does not need to be solved) or starting again with elimination or substitution
	working required	$x = -1.5$, $y = 2.5$		A1oe	dep on M1 Must be a vulgar fraction or mixed number or a decimal (eg do not allow $y = \frac{12.5}{5}$)
					Total 3 marks

Question	Working		Answer	Mark	Notes
8*	eg $3x + 5y = 8$_ $20x + 5y = -17.5$ **Subtracting** ($3x - 20x = 8 - -17.5$ or $-17x = 25.5$) **or** $3x + 5(-3.5 - 4x) = 8$ **or** $4x + \frac{8-3x}{5} = -3.5$	eg $12x + 20y = 32$_ $12x + 3y = -10.5$ **Subtracting** ($20y - 3y = 32 - -10.5$ or $17y = 42.5$) **or** $3\left(\frac{-3.5-y}{4}\right) + 5y = 8$ **or** $4\left(\frac{8-5y}{3}\right) + y = -3.5$		3	M1 for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operator to eliminate selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting (condone missing brackets) NB The mark is for the method and not for the result of the method. However, if the correct result of the method is seen, the mark can be awarded.
	$3\times$"-1.5" $+ 5y = 8$ **or** $4 \times$ "-1.5" $+ y = -3.5$ **or** $y = -3.5 - 4\times$"-1.5" **or** $y = \frac{8-3\times"-1.5"}{5}$	$3x + 5 \times$ "2.5" $= 8$ **or** $4x +$ "2.5" $= -3.5$ **or** $x = \frac{-3.5-"2.5"}{4}$ **or** $x = \frac{8-5\times"2.5"}{3}$			M1 dep on first M1for a correct method to find other variable by substitution of found variable into one equation **or** for repeating the above method to find the second variable.
	Working required		$x = -1.5$ $y = 2.5$		A1 oe dep on M1
					Total 3 marks

3	eg $3x+2y=10$ $-$ $3x-4y=16$ $(6y=-6)$ **or** eg $3\left(\frac{10-2y}{3}\right)-4y=16$ **or** $3\left(\frac{16+4y}{3}\right)+2y=10$ **or** $6y=-6$ oe	Eg $6x+4y=20$ $+$ $3x-4y=16$ $(9x=36)$ **or** eg $3x-4\left(\frac{10-3x}{2}\right)=16$ **or** $3x+2\left(\frac{3x-16}{4}\right)=10$ **or** $9x=36$ oe		3	M1	a correct method to eliminate x or y: coefficients of x or y are the same **and** the correct operation to eliminate is selected; if operator not written, the correct operation can be implied by 2 out of 3 terms correct Allow one arithmetic error if multiplying to equate coefficients **or** for a correct substitution of one variable into the other equation NB: the mark is for the method and not for the result of the method. However, if the correct result of this method is seen, the mark can be awarded
	$3x+2\times$"-1"$=10$ or $3x-4\times$"-1"$=16$ **or** $x=\frac{10-2\times\text{"}-1\text{"}}{3}$ or $x=\frac{16+4\times\text{"}-1\text{"}}{3}$	$3\times$"4"$+2y=10$ or $3\times$"4"$-4y=16$ **or** $y=\frac{10-3\times\text{"}4\text{"}}{2}$ or $y=\frac{3\times\text{"}4\text{"}-16}{4}$			M1	dep on M1 a correct substitution to find the value of the second variable using their value **or** for starting again with elimination or substitution (as above)
	Working required		$x=4$ $y=-1$		A1	dep on M1
						Total 3 marks

Question	Working	Answer	Mark	Notes
12 (a)		3, 4	1	B1
(b)		see graph at end of mark scheme	3	B3 for correct region identified If not B3 then award B2 for $x + y = 4$ drawn (with no additional lines drawn) **and** a region identified that satisfies at least 3 of the 5 given inequalities If not B2 then award B1 for line $x + y = 4$ drawn NB. May shade wanted or unwanted regions; lines may be solid or dashed
13 a (i)		54	1	B1 cao
(ii)		angle at centre is twice angle at circumference	1	B1 dep on B1 in (a)(i) accept alternative reasons eg. angle at circumference is half the angle at the centre
b (i)		27	1	B1 ft from (a)(i) for $\frac{"54"}{2}$
(ii)		alternate segment theorem	1	B1 dep on B1 in (b)(i) accept alternative reason angle between tangent and radius is 90^o If answer for (b)(i) is ft from (a)(i) then reason must be angle between tangent and radius is 90^o

12	**Elimination** E.g. $21x-6y=102$ $21x+35y=-21$ $(-41y=123)$ or $35x-10y=170$ $6x+10y=-6$ $(41x=164)$	**Substitution** E.g. $3\left(\frac{34+2y}{7}\right)+5y=-3$ or $3x+5\left(\frac{7x-34}{2}\right)=-3$ or $7\left(\frac{-3-5y}{3}\right)-2y=34$ or $7x-2\left(\frac{-3-3x}{5}\right)=34$		4	M1	for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone 1 arithmetical error) **or** for correctly writing x or y in terms of the other variable and correctly substituting
					A1	dep on M1 for $x = 4$ or $y = -3$
	E.g. $7x-2\times-3=34$				M1	dep on M1 for substitution of found variable **or** repeating the steps in first M1 for the second variable
			$x = 4$ $y = -3$		A1	cao A correct answer without working scores no marks
						Total 4 marks

12	e.g. $35x + 10y = 27.5$ **or** $21x + 6y = 16.5$ $6x - 10y = 34$ $21x - 35y = 119$ $41x = 61.5$ $41y = -102.5$ e.g. $3x - 5\left(\frac{5.5-7x}{2}\right) = 17$ or $7\left(\frac{17+5y}{3}\right) + 2y = 5.5$ oe		4	M1	for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operator to eliminate selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting.
		$x = 1.5$ **or** $y = -2.5$		A1	oe, dep on M1
				M1	(dep on 1st M1) for a correct method to find other variable by substitution of found variable into one equation **or** for repeating the above method to find the second variable.
		$x = 1.5$ **and** $y = -2.5$		A1	oe, dep on M1
					Total 4 marks

11	$360 - 40\ (= 320)$ or $\frac{320}{360}$ oe **or** $\frac{40}{360} \times 2\pi \times 9\ (= 6.28...)$		4	M1
	$\frac{"320"}{360} \times 2\pi \times 9\ (= 16\pi\ = 50.26...)$ **or** $2\pi \times 9$ – "6.28" (= 50.26)			M1
	"50.26" + 2 × 9			M1 complete method to find perimeter
		68.3		A1 68.2 to 68.3
				Total 4 marks

12	eg. $10x + 35y = 85$ $10x + 6y = -2$ with the operation of subtraction **or** $29y = 87$ **or** $6x + 21y = 51$ $35x + 21y = -7$ with the operation of subtraction **or** $29x = -58$ **or** eg $5\left(\frac{17-7y}{2}\right)+3y=-1$ **or** eg $5x+3\left(\frac{17-2x}{7}\right)=-1$		4	M1 for correct method to eliminate one variable – multiplying one or both equations so the coefficient of x or y is the same in both, with the correct operation to eliminate one variable (condone one arithmetic error) **or** isolating x or y in one equation and substituting into the other (condone one arithmetic error).
				M1 dep 1st M1 Substitute found value into one equation **or** correct method to eliminate second unknown.
		$x = -2$ $y = 3$		A1 dep 1st M1 A1
				Total 4 marks

13	12 (−) 3		2	M1 for both values unambiguously identified
		9		A1
				Total 2 marks

14	**Elimination** eg $9x-15y=75$ $20x+15y=70$ + $(29x=145)$ or $12x-20y=100$ $12x+9y=42$ − $(-29y=58)$	**Substitution** eg $4\left(\frac{25+5y}{3}\right)+3y=14$ or $4x+3\left(\frac{25-3x}{-5}\right)=14$ or $3\left(\frac{14-3y}{4}\right)-5y=25$ or $3x-5\left(\frac{14-4x}{3}\right)=25$		4	M1 for a correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone 1 arithmetical error) **or** for correctly writing x or y in terms of the other variable and correctly substituting
					A1 dep on M1 for $x = 5$ **or** $y = -2$
	eg $3x - 5 \times$ "−2" = 25 **or** $4x + 3 \times$ "−2" = 14 **or** $3 \times$ "5" $- 5y = 25$ **or** $4 \times$ "5" $+ 3y = 14$				M1 dep on M1 for substitution of found variable **or** repeating the steps in first M1 for the second variable
		$x = 5$ $y = -2$			A1 cao, dep on M1 a correct answer without working scores no marks
					Total 4 marks

12	eg $\begin{array}{r} -12x+9y=28.8 \\ 12x+10y=33.6 \end{array}$ or $\begin{array}{r} -20x+15y=48 \\ 18x+15y=50.4 \end{array}$ **or** eg $4x+3\left(\frac{16.8-6x}{5}\right)=9.6$ **or** $6\left(\frac{9.6-3y}{4}\right)+5y=16.8$		4	M1	for multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if + or – is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into the second
		$x = –1.2$ oe **or** $y = 4.8$ oe		A1	dep on M1
				M1	(dep on M1) for substitution of found variable **or** repeating the steps in first M1 for the second variable
	Working required	$x = –1.2$ oe **and** $y = 4.8$ oe		A1	dep on M1
					Total 4 marks

Question	Working		Answer	Mark	Notes
18	$2(2y-3)^2+3y^2=14$ or	$2x^2+3\left(\frac{x+3}{2}\right)^2=14$		5	M1 correct first step eg substitution
	$11y^2-24y+4=0$	$11x^2+18x-29=0$			A1 for a correct simplified quadratic
	$(11y-2)(y-2)\ (=0)$ or $\frac{24\pm\sqrt{(-24)^2-4\times11\times4}}{2\times11}$	$(11x+29)(x-1)\ (=0)$ or $\frac{-18\pm\sqrt{18^2-4\times11\times-29}}{2\times11}$			M1 (dep on M1) first step to solve their 3 term quadratic
	$y=\frac{2}{11}$ or $y=2$ (need both)	$x=\frac{-29}{11}$ or $x=1$(need both)			A1
			$x=\frac{-29}{11}$, $y=\frac{2}{11}$ $x=1$, $y=2$		A1 Dep on first M1 Must be paired correctly Must be 2 dp or better
					Total 5 marks

22	$2x^2 + 3(2x + 1)^2 = 5$		5	M1 $2\left(\frac{y-1}{2}\right)^2 + 3y^2 = 5$
	eg $14x^2 + 12x - 2 = 0$ **or** if completing the square, allow $14x^2 + 12x = 2$ oe			A1 $7y^2 - 2y - 9 = 0$ **or** if completing the square, allow $7y^2 - 2y = 9$ oe
	eg $(7x - 1)(x + 1)$ or $(7x - 1)(2x + 2)$ eg $\frac{-12 \pm \sqrt{12^2 - 4 \times 14 \times -2}}{2 \times 14}$ oe eg $7\left(\left(x + \frac{3}{7}\right)^2 - \frac{9}{49}\right) = 2$ oe			M1 ft as long as M1 awarded and 3 term quadratic eg $(7y - 9)(y + 1)$ eg $\frac{2 \pm \sqrt{(-2)^2 - 4 \times 7 \times -9}}{2 \times 7}$ oe eg $7\left(\left(y - \frac{1}{7}\right)^2 - \frac{1}{49}\right) = 9$ oe
	$x = \frac{1}{7}, x = -1$ (need both)			A1 $y = \frac{9}{7}, y = -1$ (need both)
		$x = \frac{1}{7}$, $y = \frac{9}{7}$ $x = -1$, $y = -1$		A1 Dep on M1 Must be paired correctly Must be 3 sf or better (0.142857...) (1.28571...)
				Total 5 marks

20		$x^2 - 3x(9 - x) + 2(9 - x)^2$ (= 0)	$(9 - y)^2 - 3y(9 - y) + 2y^2$ (= 0)			M1 substitution of linear equation into quadratic
		e.g. $6x^2 - 63x + 162$ (= 0) **or** $2x^2 - 21x + 54$ (= 0) allow $2x^2 - 21x = -54$ oe	e.g. $6y^2 - 45y + 81$ (= 0) **or** $2y^2 - 15y + 27$ (= 0) allow $2y^2 - 15y = -27$ oe			A1 (dep on M1) writing the correct quadratic expression in form $ax^2 + bx + c$ (= 0) allow $ax^2 + bx = c$
		e.g. $(2x - 9)(x - 6)$ (= 0) $x = \frac{-(-21) \pm \sqrt{(-21)^2 - 4\times2\times54}}{2\times2}$ e.g. $2\left(\left(x - \frac{21}{4}\right)^2 - \left(\frac{21}{4}\right)^2\right) = -54$	e.g. $(2y - 9)(y - 3)$ (= 0) $y = \frac{-(-15) \pm \sqrt{(-15)^2 - 4\times2\times27}}{2\times2}$ e.g. $2\left(\left(x - \frac{15}{4}\right)^2 - \left(\frac{15}{4}\right)^2\right) = -27$			M1 (dep on M1) for a complete method to solve their 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{21 \pm \sqrt{441 - 432}}{4}$)
		$x = 4.5$ and $x = 6$	$y = 4.5$ and $y = 3$			A1 (dep on M1) both x-values **or** both y-values
				(4.5, 4.5) and (6, 3)	5	A1 (dep on M1) oe Must be paired correctly
						Total 5 marks

20 Alt		$(x - y)(x - 2y)$ (= 0)			M1 for a method to factorise **C**
		$(x - (9 - x))(x - 2(9 - x))$ (= 0)	$(9 - y - y)(9 - y - 2y)$ (= 0)		A1 (dep M1) substitution of **L** into their factorised **C**
		$(2x - 9)(3x - 18)$ (= 0) oe	$(9 - 2y)(9 - 3y)$ (= 0) oe		M1 (dep on M1)
		$x = 4.5$ and $x = 6$	$y = 4.5$ and $y = 3$		A1 (dep on M1) both x-values **or** both y-values
				(4.5, 4.5) and (6, 3) 5	A1 (dep on M1) oe Must be paired correctly
					Total 5 marks

22	$x^2+(x+2)^2-2(x+2)=24$		5	M1	for substituting linear equation into the quadratic equation
	$2x^2+2x-24\ (=0)$ or $x^2+x-12\ (=0)$ or $2x^2+2x=24$ or $x^2+x=12$			A1	for a correct equation in the form $ax^2+bx+c=0$ or $ax^2+bx=-c$
	$(x+4)(x-3)\ (=0)$ or $x=\frac{-1\pm\sqrt{1^2-(4\times1\times-12)}}{2\times1}$ or $\left(x-\frac{1}{2}\right)^2-\left(\frac{1}{2}\right)^2-12=0$			M1ft	dep on M1 for solving their quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-1\pm\sqrt{1+48}}{2}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$x=-4$ and $x=3$			A1	for both x values dep on M1
	$(-4,-2)$ and $(3,5)$	$(-4,-2)$ and $(3,5)$		A1	for both solutions dep on M1
Alternative mark scheme for 22					
	$(y-2)^2+y^2-2y=24$		5	M1	for substituting linear equation into the quadratic equation
	$2y^2-6y-20\ (=0)$ or $y^2-3y-10\ (=0)$ $2y^2-6y=20$ or $y^2-3y=10$			A1	for a correct equation in the form $ay^2+by+c=0$ or $ay^2+by=-c$
	$(y-5)(y+2)=0$ or $y=\frac{--3\pm\sqrt{(-3)^2-(4\times1\times-10)}}{2\times1}$ or $\left(y-\frac{3}{2}\right)^2-\left(\frac{3}{2}\right)^2-10=0$			M1ft	dep on M1 for solving their quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{3\pm\sqrt{9+40}}{2}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct
	$y=5$ and $y=-2$			A1	for both y values dep on M1
	$(-4,-2)$ and $(3,5)$	$(-4,-2)$ and $(3,5)$		A1	for both solutions dep on M1
					Total 5 marks

16	$3y(2y+1)-y^2=8$ **or** $x=\frac{8+y^2}{3y} \rightarrow \frac{8+y^2}{3y}-2y=1$ **or** $\_3xy-y^2=8$ $3xy-3y\times 2y=3y\times 1$ oe	$3x\left(\frac{x-1}{2}\right)-\left(\frac{x-1}{2}\right)^2=8$ oe			M1	correct first step eg substitution by eg $x = 1 + 2y$ or $y = \frac{x-1}{2}$ to get an equation in a single variable **or** writing 2nd equation with x the subject and substituting into 1st **or** multiplying 2nd equation by $3y$ and subtracting from 1st oe
	eg $5y^2 + 3y - 8 (= 0)$	eg $5x^2 - 4x - 33 (= 0)$			A1	for a correct simplified quadratic
	$(5y + 8)(y - 1) (= 0)$ or $\frac{-3\pm\sqrt{3^2-4\times 5\times(-8)}}{2\times 5}$	$(5x + 11)(x - 3) (= 0)$ or $\frac{4\pm\sqrt{(-4)^2-4\times 5\times(-33)}}{2\times 5}$			M1ft	dep on M1 for solving their 3 term quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-3\pm\sqrt{9+160}}{10}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$y = -\frac{8}{5}$ and $y = 1$ (both)	$x = -\frac{11}{5}$ and $x = 3$ (both)			A1	dep on first M1
			$x = -\frac{11}{5}, y = -\frac{8}{5}$ $x = 3, y = 1$	5	A1	oe dep on first M1 Must be paired correctly
						Total 5 marks

19	$(1-2y)^2-9y-(1-2y)=2y^2-12$	$x^2-9\left(\frac{1-x}{2}\right)-x=2\left(\frac{1-x}{2}\right)^2-12$		5	M1 substitution of linear equation into quadratic
	e.g. $2y^2-11y+12(=0)$ oe allow $2y^2-11y=-12$ oe	e.g. $x^2+9x+14(=0)$ oe allow $x^2+9x=-14$ oe			A1 (dep on M1) writing the correct quadratic expression in the form $ax^2 + bx + c$ (= 0) allow $ax^2 + bx = c$
	e.g. $(2y-3)(y-4)(=0)$ $(y=)\frac{11\pm\sqrt{(-11)^2-4\times2\times12}}{2\times2}$ e.g. $2\left[\left(y-\frac{11}{4}\right)^2-\left(\frac{11}{4}\right)^2\right]=-12$ oe	e.g. $(x+7)(x+2)(=0)$ $(x=)\frac{-9\pm\sqrt{9^2-4\times1\times14}}{2}$ e.g. $\left(x+\frac{9}{2}\right)^2-\left(\frac{9}{2}\right)^2=-14$			M1 (dep on M1) for a complete method to solve their 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{11\pm\sqrt{121-72}}{4}$ or $\frac{-9\pm\sqrt{81-56}}{2}$)
	$y=\frac{3}{2}$ oe and $y = 4$	$x = -7$ and $x = -2$			A1 (dep on M1) both x-values **or** both y-values
			$x = -2$, $y=\frac{3}{2}$ oe and $x = -7$, $y = 4$		A1 (dep on first M1) must be paired correctly
					Total 5 marks

17	$y(6y + 5) - 2y^2 = 6$	$x\left(\frac{x-5}{6}\right) - 2\left(\frac{x-5}{6}\right)^2 = 6$		5	M1 for substitution of linear equation into quadratic **or** multiplying linear equation by y e.g. $xy - 6y^2 = 5y$ **and** intention to subtract the two equations
	E.g. $4y^2 + 5y - 6 (= 0)$ oe $4y^2 + 5y = 6$	E.g. $4x^2 - 10x - 266 (= 0)$ oe $4x^2 - 10x = 266$			A1 (dep on M1) writing the correct quadratic expression in form $ax^2 + bx + c (= 0)$ allow $ax^2 + bx = c$
	E.g. $(4y - 3)(y + 2) (= 0)$ $(y =) \frac{-5 \pm \sqrt{5^2 - 4\times4\times-6}}{2\times4}$ $4\left[\left(y + \frac{5}{8}\right)^2 - \left(\frac{5}{8}\right)^2\right] = 6$ oe	E.g. $(2x - 19)(x + 7) (= 0)$ $(x =) \frac{5 \pm \sqrt{(-5)^2 - 4\times2\times(-133)}}{2\times2}$ $4\left[\left(x - \frac{10}{8}\right)^2 - \left(\frac{10}{8}\right)^2\right] = 266$ oe			M1 (dep on M1) for a complete method to solve their 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{-5 \pm \sqrt{25+96}}{8}$ or $\frac{5 \pm \sqrt{25+1064}}{4}$
	$(y =) \frac{3}{4}$ and $(y =) -2$	$(x =) \frac{19}{2}$ and $(x =) -7$			A1 Dep on first M1 for having two correct x values or two correct y values
			$x = \frac{19}{2}, y = \frac{3}{4}$ $x = -7, y = -2$		A1 Dep on first M1 Must be paired and labelled correctly
					Total 5 marks

Question	Working		Answer	Mark	Notes
19	$x^2+(3-2x)^2=18$	$\left(\frac{3-y}{2}\right)^2+y^2=18$		5	M1 substitution of linear equation into quadratic
	$5x^2-12x-9[=0]$ oe	$5y^2-6y-63[=0]$ oe			M1 simplified to a correct 3 term quadratic
	$(5x+3)(x-3)$ [= 0] $\frac{-(-12)\pm\sqrt{(-12)^2-4\times5\times(-9)}}{2\times5}$ $5[(x-\frac{12}{10})^2-\frac{144}{100}]-9=0$ oe	$(5y-21)(y+3)$ [= 0] $\frac{-(-6)\pm\sqrt{(-6)^2-4\times5\times(-63)}}{2\times5}$ $5[(y-\frac{6}{10})^2-\frac{36}{100}]-63=0$ oe			M1ft dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{12\pm\sqrt{144+180}}{10}$ or $\frac{6\pm\sqrt{36+1260}}{10}$)(if completing the square allow as far as shown)
			$x=-0.6$ **and** $x=3$ **OR** $y=4.2$ **and** $y=-3$		A1 oe dep on M2 for both x-values **OR** both y-values
	Working must be shown		$x=-0.6$, $y=4.2$ $x=3$, $y=-3$		A1 oe dep on M2 (must be clearly shown as correct pairs), accept answers given as coordinates
					Total 5 marks

5	$LW = 180$ oe ($9LW = 1620$) or $4L \times (L + W) = 1620$ oe or $5W \times (L + W) = 1620$ oe or $4L = 5W$ oe ($L = \frac{5}{4}W$ oe or $W = \frac{4}{5}L$ oe)		5	M2 for any two correct equations from (i) $LW = 180$ oe ($9LW = 1620$) (ii) $4L \times (L + W) = 1620$ oe (iii) $5W \times (L + W) = 1620$ oe (iv) $4L = 5W$ oe ($L = \frac{5}{4}W$ oe or $W = \frac{4}{5}L$ oe) (M1 for one correct equation **or** $1620 \div 9$ (= 180))
	$L \times "\frac{4}{5}L" = "180"$ oe or $W \times "\frac{5}{4}W" = "180"$ oe or $4L \times \left(L + \frac{4}{5}L\right) = 1620$ oe or $5W \times \left(\frac{5}{4}W + W\right) = 1620$ oe or $9L\left("\frac{4}{5}L"\right) = 1620$ oe or $9\left("\frac{5}{4}W"\right)W = 1620$ oe or $4\left("\frac{180}{W}"\right)^2 + 4("180") = 1620$ oe or $5("180") + 5\left("\frac{180}{L}"\right)^2 = 1620$ oe			M1 for a correct equation in terms of one variable only
	Correct answer scores full marks (unless from obvious incorrect working)	$L = 15$ and $W = 12$		A2 for both correct (A1 for one correct) Award 4 marks for $L = 12$ and $W = 15$ dep on M3
				Total 5 marks

<table>
<tr><td colspan="7">Elimination</td></tr>
<tr><td rowspan="4">6</td><td colspan="2">$5a+3p=1.96$ and $3a+2p=1.22$ oe
or
$5a+3p=196$ and $3a+2p=122$ oe</td><td rowspan="4">M2 for an arithmetical method (must see the calculation to find 0.22 or 0.26 or 0.74 and 0.48 oe)
E.g.
6.1(0) – 5.88 (= 0.22) oe
or
3.92 – 3.66 (= 0.26) oe
or
1.96 – 1.22 (= 0.74) oe
and 1.22 – “0.74” (= 0.48)</td><td rowspan="4"></td><td rowspan="4">5</td><td rowspan="4">M1 for setting up both equations oe
Allow the use of apples and pears oe throughout, e.g.
5 apples + 3 pears = 1.96 and
3 apples + 2 pears = 1.22</td></tr>
<tr><td>E.g.
$15a+9p=5.88$
$15a+10p=6.1\ 0$
Subtracting
$(-p=-0.22)$</td><td>E.g.
$10a+6p=3.92$
$9a+6p=3.66$
Subtracting
$(a=0.26)$</td></tr>
<tr><td colspan="2">E.g. $5a+3p=1.96$ and $6a+4p=2.44$ oe
Subtracting</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3"></td><td>E.g.
$5a+3(\text{"0.22"})=1.96$
or
$3a+2(\text{"0.22"})=1.22$</td><td>E.g.
$5(\text{"0.26"})+3p=196$
or
$3(\text{"0.26"})+2p=1.22$</td><td rowspan="3">E.g.
3 × 0.22 (= 0.66)
1.96 – “0.66” (= 1.3(0))
“1.3(0)” ÷ 5 (= 0.26)
or
5 × 0.26 (= 1.3(0))
1.96 – “1.3(0)” (= 0.66)
“0.66” ÷ 3 (= 0.22)
or
Apple and pear is 0.48 oe</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3">M1 (dep on M2) for substituting their value found (must be > 0) of one variable into one of the equations or
for repeating above method to find second variable or
for third working column allow $k(a+p)=k(0.48)$ or
for a complete arithmetical method to find the other value</td></tr>
<tr><td colspan="2">E.g
$a+p=0.48$ oe</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">$10\times\text{"0.26"}+10\times\text{"0.22"}$ or $(a+p=)\ 0.48\times10$ oe or $k(a+p)=k(0.48)\times\frac{10}{k}$</td><td></td><td></td><td>M1 (dep on M3) can be implied by $10(a + p)$ provided a and p must be > 0</td></tr>
<tr><td></td><td colspan="2">Working required</td><td>4.8(0)</td><td></td><td>A1 dep M2</td></tr>
<tr><td></td><td colspan="5"></td><td>Total 5 marks</td></tr>
</table>

Substitution				
6	$5a+3p=1.96$ and $3a+2p=1.22$ oe **or** $5a+3p=196$ and $3a+2p=122$ oe		5	M1 for setting up both equations oe Allow the use of apples and pears oe throughout, e.g. 5 apples + 3 pears = 1.96 and 3 apples + 2 pears = 1.22
	E.g. $3\left(\frac{1.96-3p}{5}\right)+2p=1.22$ or $5\left(\frac{1.22-2p}{3}\right)+3p=1.96$ or $3a+2\left(\frac{1.96-5a}{3}\right)=1.22$ or $5a+3\left(\frac{1.22-3a}{2}\right)=1.96$ or $p = 0.22$ or $a = 0.26$			M1 for correctly writing a or p in terms of the other variable **and** correctly substituting (condone any one arithmetic error)
	E.g. $(a=)\frac{1.96-3(0.22)}{5}$ or $(a=)\frac{1.22-2(0.22)}{3}$ or $(p=)\frac{1.96-5(0.26)}{3}$ or $(p=)\frac{1.22-3(0.26)}{2}$			M1 (dep on M2) for substituting their value found (must be > 0) of one variable into one of the equations **or** for repeating above method to find second variable
	$10\times"0.26"+10\times"0.22"$			M1 (dep on M3) can be implied by $10(a + p)$ provided a and p must be > 0
	Working required	4.8(0)		A1 dep M2
				Total 5 marks

19	$3x^2+(2x-3)^2-x(2x-3)=5$	$3\left(\frac{y+3}{2}\right)^2+y^2-y\left(\frac{y+3}{2}\right)=5$		5	M1	Correct substitution of x for y (or y for x)
	$5x^2-9x+4(=0)$ oe **or** $5x^2-9x=-4$	$5y^2+12y+7(=0)$ oe **or** $5y^2+12y=-7$			M1	for a correct equation in the form $ax^2+bx+c\ (=0)$ oe **or** $ax^2+bx=-c$
	$(5x-4)(x-1)(=0)$ or $(x=)\frac{9\pm\sqrt{(-9)^2-4\times5\times4}}{2\times5}$ or $5\left[\left(x-\frac{9}{10}\right)^2-\left(\frac{9}{10}\right)^2\right]+4(=0)$ [leading to x values of 0.8 and 1]	$(5y+7)(y+1)(=0)$ or $(y=)\frac{-12\pm\sqrt{12^2-4\times5\times7}}{2\times5}$ or $5\left[\left(y+\frac{6}{5}\right)^2-\left(\frac{6}{5}\right)^2\right]+7(=0)$ [leading to y values of −1.4 and −1]			M1ft	dep on M1 for solving their quadratic equation using any correct method - if factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as $\frac{9\pm\sqrt{81-80}}{10}$ oe **or** $\frac{-12\pm\sqrt{144-140}}{10}$ oe **or** $5\left(x-\frac{9}{10}\right)^2-\frac{1}{20}$ oe **or** $5\left(y+\frac{6}{5}\right)^2-\frac{1}{5}$ oe
	$(y=)\ 2\times$ "0.8" -3 **and** $2\times$ "1" -3	$(y=)\ \frac{\text{"}-1.4\text{"}+3}{2}$ **and** $\frac{\text{"}-1\text{"}+3}{2}$			M1	dep on previous M1
			$x=0.8$ & $y=-1.4$ / $x=1$ & $y=-1$		A1	oe, for both solutions dep on M2
						Total 5 marks

18	$3y^2+7y+16=(2y-1)^2-(2y-1)$	$3\left(\frac{x+1}{2}\right)^2+7\left(\frac{x+1}{2}\right)+16=x^2-x$		5	M1 substitution of linear equation into quadratic.
	E.g. $y^2-13y-14\,(=0)$ oe $y^2-13y=14$	E.g. $x^2-24x-81\,(=0)$ oe $x^2-24x=81$			A1 (dep on M1) writing the correct quadratic expression in form $ax^2+bx+c\,(=0)$ allow $ax^2+bx=c$
	E.g. $(y-14)(y+1)\,(=0)$ or $(y=)\frac{-(-13)\pm\sqrt{(-13)^2-4\times1\times-14}}{2}$ or $\left(y-\frac{13}{2}\right)^2-\left(\frac{13}{2}\right)^2=14$ oe	E.g. $(x+3)(x-27)\,(=0)$ or $(x=)\frac{-(-24)\pm\sqrt{(-24)^2-4\times1\times-81}}{2}$ or $\left(x-\frac{24}{2}\right)^2-\left(\frac{24}{2}\right)^2=81$ oe			M1 (dep on M1) for the first stage to solve their 3-term quadratic equation (allow one sign error and some simplification – allow as far as $\frac{13\pm\sqrt{169+56}}{2}$ or $\frac{24\pm\sqrt{576+324}}{2}$ or eg $\left(x-\frac{24}{2}\right)^2-225$ oe
	$(x=)$ 2×'14'−1 and 2×'−1'−1	$(y=)\frac{'27'+1}{2}$ and $\frac{'-3'+1}{2}$ oe			M1 (dep on previous M1) may be implied by values of y or x that are consistent with a correct substitution.
			(27, 14) and (−3, −1)		A1 for both solutions dep on M2 Must be paired correctly. accept $x=27$, $y=14$ and $x=-3$, $y=-1$
					Total 5 marks

21	$(3+2y)^2-y^2+2(3+2y)=10$	$x^2-\left(\frac{x-3}{2}\right)^2+2x=10$		5	M1	for using correct substitution of a linear equation into the quadratic – all terms shown correctly
	eg $3y^2+16y+5(=0)$	eg $3x^2+14x-49(=0)$ $3x^2+14x=49$			A1	for a correct 3 term quadratic
	eg $(3y+1)(y+5)(=0)$ **or** $\frac{-16\pm\sqrt{16^2-4\times3\times5}}{2\times3}$ **or** $3\left[\left(y+\frac{8}{3}\right)^2-\left(\frac{8}{3}\right)^2\right]+5=0$ (should give $(y=)-\frac{1}{3}, -5$)	eg $(3x-7)(x+7)(=0)$ **or** $\frac{-14\pm\sqrt{14^2-4\times3\times(-49)}}{2\times3}$ **or** $3\left[\left(x+\frac{7}{3}\right)^2-\left(\frac{7}{3}\right)^2\right]-49=0$ (should give $(x=)\frac{7}{3}, -7$)			M1	dep on M1 method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{-16\pm\sqrt{256-60}}{6}$ **or** $\frac{-14\pm\sqrt{196+588}}{6}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) **or** correct values for x **or** correct values for y
	eg $x=3+2\times-5$ and $x=3+2\times-\frac{1}{3}$	eg $\frac{7}{3}-2\times y=3$ $-7-2\times y=3$			M1ft	dep on previous M1 for substituting **their** 2 found values of x or y in a suitable equation (use 2dp or better for substitution) **or** fully correct values for the other variable (correct labels for x / y)
			$x=\frac{7}{3}, y=-\frac{1}{3}$ $x=-7, y=-5$		A1	dep on M1 (allow coordinates) must be paired correctly allow $x=-7$, $y=-5$ $x=2.33(3\ldots)$, $y=-0.33(3\ldots)$
						Total 5 marks

20	$x^2+(7-2x)^2=34$	$\left(\frac{7-y}{2}\right)^2+y^2=34$		5	M1	substitution of linear equation into quadratic
	$5x^2-28x+15[=0]$ oe	$5y^2-14y-87[=0]$ oe			M1	dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of $ax^2+bx+c\ (=0)$ **where at least 2 coefficients** (a or b or c) **are correct** and all are non-zero
	$(5x-3)(x-5)\ [=0]$ or $\frac{-(-28)\pm\sqrt{(-28)^2-4\times5\times15}}{2\times5}$ or $5[(x-\frac{28}{10})^2-\frac{784}{100}]+15=0$ oe or $x=0.6$ **and** $x=5$ (allow incorrect labels for x/y)	$(5y-29)(y+3)\ [=0]$ or $\frac{-(-14)\pm\sqrt{(-14)^2-4\times5\times(-87)}}{2\times5}$ or $5[(y-\frac{14}{10})^2-\frac{196}{100}]-87=0$ oe or $y=5.8$ **and** $y=-3$ (allow incorrect labels for x/y)			M1ft	dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{28\pm\sqrt{784-300}}{10}$ or $\frac{14\pm\sqrt{196+1740}}{10}$) (if completing the square allow as far as shown) or **correct values for x** or **correct values for y dep on correct quadratic**
	eg $y=7-2\times5$ and $y=7-2\times0.6$ (correct labels for x/y)	eg $5.8=7-2x$ and $-3=7-2x$ (correct labels for x/y)			M1ft	dep on previous M1 for substituting **their** 2 found values of x or y in a suitable equation **or** correct values for the other variable
	Working must be shown		$x=0.6, y=5.8$ $x=5, y=-3$		A1	dep on M1 and **the correct quadratic** (allow coordinates) must be paired correctly

22	eg $2(-3-2x)^2+x^2=-6x+42$	eg $2y^2+\left(\frac{-3-y}{2}\right)^2=-6\left(\frac{-3-y}{2}\right)+42$		5	M1	substitution of $y=\pm3\pm2x$ (or $x=\frac{\pm3\pm y}{2}$) into $2y^2+x^2=-6x+42$ to obtain an equation in x only (or y only)
	eg $9x^2+30x-24(=0)$ **or** $3x^2+10x-8(=0)$ allow eg $3x^2+10x=8$	eg $\frac{9}{4}y^2-\frac{3}{2}y-\frac{195}{4}(=0)$ **or** $9y^2-6y-195(=0)$ **or** $3y^2-2y-65(=0)$ allow eg $3y^2-2y=65$			M1 ft	(dep on previous M1) for multiplying out and collecting terms, forming a three term quadratic in any form of ax^2+bx+c (= 0) where at least 2 coefficients (a or b or c) are correct
	eg $(3x-2)(x+4)(=0)$ **or** $\frac{-10\pm\sqrt{10^2-4\times3\times-8}}{2\times3}$ **or** $3\left[\left(x+\frac{5}{3}\right)^2-\left(\frac{5}{3}\right)^2\right]=8$ oe (should give $(x=)\frac{2}{3}, -4$)	eg $(3y+13)(y-5)(=0)$ **or** $\frac{2\pm\sqrt{(-2)^2-4\times3\times-65}}{2\times3}$ **or** $3\left[\left(y-\frac{1}{3}\right)^2-\left(\frac{1}{3}\right)^2\right]=65$ oe (should give $(y=)-\frac{13}{3}, 5$)			M1 ft	(dep on M1) method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{-10\pm\sqrt{100+96}}{6}$ **or** $\frac{2\pm\sqrt{4+780}}{6}$) **or** if factorising allow brackets which expanded give 2 out of 3 terms correct)**or** correct values for x (allow 0.66(6…) or 0.67) **or** correct values for y (allow −4.33(3…))
	eg $2\left("\frac{2}{3}"\right)+y=-3$ **and** $2("-4")+y=-3$	eg $2x+"-\frac{13}{3}"=-3$ **and** $2x+"5"=-3$			M1	(dep on previous M1) for substituting **their** 2 found values of x or y in a suitable equation (use 2dp or better for substitution) **or** fully correct values for the other variable (correct labels for x / y)
	Working required		$x=-4$, $y=5$ and $x=\frac{2}{3}$, $y=-\frac{13}{3}$		A1	oe (dep on M1) and a correct quadratic (allow coordinates) allow $x=0.66(6\ldots)$ or 0.67, $y=-4.33(3\ldots)$, $x=-4$, $y=5$
						Total 5 marks

21	$2(3y-1)^2+3y^2=11$	$2x^2+3\left(\frac{x+1}{3}\right)^2=11$		5	M1	substitution of linear equation into quadratic
	$21y^2-12y-9=0$ oe	$7x^2+2x-32=0$ oe			M1	dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of $ax^2 + bx + c$ (= 0) with at least 2 coefficients (a or b or c) correct
	eg $(7y+3)(y-1)=0$ $\frac{-(-12)\pm\sqrt{(-12)^2-4\times21\times(-9)}}{2\times21}$ $21\left[(y-\frac{2}{7})^2-\frac{4}{49}\right]-9=0$ oe (gives $y=1, y=-\frac{3}{7}$)	eg $(7x+16)(x-2)=0$ $\frac{-(2)\pm\sqrt{(2)^2-4\times7\times-32}}{2\times7}$ $7\left[(x-\frac{1}{7})^2-\frac{1}{49}\right]-32=0$ (gives $x=2, x=-\frac{16}{7}$)			M1	dep on M1 for solving **their** 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error in subst terms and some simplification – allow as far as eg $\frac{12\pm\sqrt{144+756}}{42}$ or $\frac{-2\pm\sqrt{4+896}}{14}$)(if completing the square allow as far as shown (allow error in final constant) **or** correct values for x **or** correct values for y
	eg $3\times1-1$ **and** $3\times-\frac{3}{7}-1$	eg $\frac{2+1}{3}$ and $\frac{-\frac{16}{7}+1}{3}$			M1ft	dep on previous M1 for substituting (must be shown) **their** 2 found values of x or y in a suitable equation (use 2dp or better for substitution) **or** fully correct values for the other variable (correct labels for x / y)
	Working required		$x=2, y=1$ **and** $x=-\frac{16}{7}, y=-\frac{3}{7}$		A1	dep on M2 (allow coordinates) must be paired correctly allow $x = -2.28(57\ldots)$ and $y = -0.42(85\ldots)$ (even if obtained from premature rounding of the other variable.)
						Total 5 marks

21	Eg $(2x+1)^2+x(2x+1)=7$	eg $y^2+\left(\frac{y-1}{2}\right)y=7$		5	M1 for substitution of $y=\pm 2x\pm 1$ (or $x=\frac{\pm y\pm 1}{2}$) into $y^2+xy=7$ to obtain an equation in x only (or y only)
	E.g. $6x^2+5x-6(=0)$ $6x^2+5x=6$	E.g. $3y^2-y-14(=0)$ $3y^2-y=14$			M1ft dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of ax^2+bx+c (= 0) where at least 2 coefficients (a or b or c) are correct
	E.g. $(2x+3)(3x-2)(=0)$ or $x=\frac{-5\pm\sqrt{5^2-4\times 6\times -6}}{2\times 6}$ or $\left(x+\frac{5}{12}\right)^2-\left(\frac{5}{12}\right)^2=1$ $\left(x=-\frac{3}{2}\text{ and }x=\frac{2}{3}\right)$	E.g. $(y+2)(3y-7)(=0)$ or $y=\frac{-(-1)\pm\sqrt{(-1)^2-4\times 3\times -14}}{2\times 3}$ or $\left(y-\frac{1}{6}\right)^2-\left(\frac{1}{6}\right)^2=\frac{14}{3}$ $\left(y=-2\text{ and }y=\frac{7}{3}\right)$			M1ft dep on first M1 method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{-5\pm\sqrt{25+144}}{12}$ **or** $\frac{1\pm\sqrt{1+168}}{6}$ or if factorising allow brackets which expanded give 2 out of 3 terms correct) **or** correct values for x **or** correct values for y Accept (x =) 0.6(66..) rounded or truncated or (y =) 2.3(33…)
	$y=2\left("-\frac{3}{2}"\right)+1(=-2)$ **and** $y=2\left("\frac{2}{3}"\right)+1\left(=\frac{7}{3}\right)$	$-2=2x+1$ or $x=-\frac{3}{2}$ **and** $\frac{7}{3}=2x+1$ or $x=\frac{2}{3}$			M1ft dep on previous M1 for substituting **their** 2 found values of x or y into one of the two given equations **or** fully correct values for the other variable (correct labels for x / y)

		$\left(-\frac{3}{2}, -2\right)$ $\left(\frac{2}{3}, \frac{7}{3}\right)$		A1 oe dep on M2 allow $x = -1.5$, $y = -2$ $x = 0.66(6\ldots)$, $y = 2.33(3\ldots)$ truncated or rounded
	Working required			**Total 5 marks**

Question	Working		Answer	Mark	Notes
21	$(5-2y)^2+3y^2=13$	$x^2+3\left(\frac{5-x}{2}\right)^2=13$		5	M1 substitution of linear equation into quadratic allow $\pm5\pm2y$ or $\frac{\pm5\pm x}{2}$ oe
	$7y^2-20y+12[=0]$ oe	$7x^2-30x+23[=0]$ oe			M1 dep on M1 simplified to a 3 term quadratic(in any form) with at least 2 correct coefficients
	$(7y-6)(y-2)\ [=0]$ $\frac{-(-20)\pm\sqrt{(-20)^2-4\times7\times12}}{2\times7}$ $7[(y-\frac{20}{14})^2-\frac{400}{196}]+12=0$ oe (leading to y values of 2 and $\frac{6}{7}(0.857...)$) (allow if labelled x)	$(7x-23)(x-1)\ [=0]$ $\frac{-(-30)\pm\sqrt{(-30)^2-4\times7\times23}}{2\times7}$ $7[(x-\frac{30}{14})^2-\frac{900}{196}]+23=0$ oe (leading to x values of 1 and $\frac{23}{7}(3.28\ldots)$			M1 ft dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{20\pm\sqrt{400-336}}{14}$ or $\frac{30\pm\sqrt{900-644}}{14}$) or if completing the square then as far as shown on LHS **or** both correct values for the correct equation
	$(x=)\ 5-2\times2$ oe eg $5-2\times\frac{6}{7}$ oe $(=1\ \&\ \frac{23}{7})$	$(y=)\frac{5-1}{2}$ oe, $\frac{5-\frac{23}{7}}{2}(=2\ \&\ \frac{6}{7})$			M1 Dep on previous M1 for correct method to find both other values or correct other values
	Working required		(1, 2) $(\frac{23}{7}, \frac{6}{7})$		A1 oe (allow (3.2(8), 0.85(7)) oe 2 sf or better rounded or truncated) dep on M2
					Total 5 marks

22	eg $2(5-y)^2+3y^2=210$ $\sqrt{\frac{210-3y^2}{2}}=5-y$ oe	Eg $2x^2+3(5-x)^2=210$ $\sqrt{\frac{210-2x^2}{3}}=5-x$ oe		5	M1 substitution of $x=\pm5\pm y$ or $y=\pm5\pm x$ into $2x^2+3y^2=210$ or a correct equation formed by using $x=\pm5\pm y$ or $y=\pm5\pm x$ to obtain an equation in x only or y only
	eg $5y^2-20y-160\ (=0)$ **or** $y^2-4y-32\ (=0)$	eg $5x^2-30x-135\ (=0)$ **or** $x^2-6x-27\ (=0)$			M1 dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of $ax^2+bx+c\ (=0)$ where **at least 2** coefficients (a or b or c) are correct
	eg $(y-8)(y+4)\ (=0)$ $y=\frac{--4\pm\sqrt{(-4)^2-4\times1\times-32}}{2\times1}$ eg $(y-2)^2-2^2=-32$ (allow incorrect labels for x/y)	eg $(x-9)(x+3)\ (=0)$ $x=\frac{--6\pm\sqrt{(-6)^2-4\times1\times-27}}{2\times1}$ eg $(x-3)^2-3^2-27=0$ (allow incorrect labels for x/y)			M1 (dep on first M1) for a complete method to solve their 3-term quadratic equation ($ax^2+bx+c=0$); correct factorisation or substitution into formula (allow one sign error and some simplification – allow as far as $\frac{4\pm\sqrt{16+128}}{2}$ or $\frac{6\pm\sqrt{36+108}}{2}$) or completing the square or for seeing $x=9$, $x=-3$ **or** $y=8$, $y=-4$
	eg $x+8=5$ and $x+-4=5$ (correct labels for x/y)	eg $y=5-9$ and $y=5--3$ (correct labels for x/y)			M1ft dep on previous M1 for substituting **their** 2 found values of x or y in a suitable equation (allow use of quadratic equation) **or** fully correct values for the other variable must see substitution for incorrect x/y values
	working required		(9, –4) (–3, 8)		A1 (dep on M2)
					Total 5 marks

22	eg $x^2+(3x-1)^2=3x-1+11$	eg $\left(\frac{y+1}{3}\right)^2+y^2=y+11$		5	M1 for substitution of $y=3x-1$ (or $x=\frac{\pm y\pm 1}{3}$) into $x^2+y^2=y+11$ to obtain an equation in x only (or y only)
	$10x^2-9x-9(=0)$ oe **or** $10x^2-9x=9$ oe **or** $10x^2=9+9x$ oe	$10y^2-7y-98(=0)$ oe **or** $10y^2-7y=98$ oe **or** $10y^2=98+7y$ oe			M1ft dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of $ax^2+bx+c\ (=0)$ where at least 2 coefficients (a or b or c) are correct
	$(5x+3)(2x-3)(=0)$ **or** $(x=)\frac{9\pm\sqrt{(-9)^2-4\times10\times(-9)}}{2\times10}$ **or** $10\left[\left(x-\frac{9}{20}\right)^2-\left(\frac{9}{20}\right)^2\right]-9(=0)$ **or** $x=-0.6$ and $x=1.5=\frac{3}{2}$	$(5y+14)(2y-7)(=0)$ **or** $(y=)\frac{7\pm\sqrt{(-7)^2-4\times10\times(-98)}}{2\times10}$ **or** $10\left[\left(y-\frac{7}{20}\right)^2-\left(\frac{7}{20}\right)^2\right]-98(=0)$ **or** $y=-2.8=-\frac{14}{5}$ and $y=3.5=\frac{7}{2}$			M1ft dep on first M1 method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{9\pm\sqrt{81+360}}{20}$ **or** $\frac{7\pm\sqrt{49+3920}}{20}$ **or** if factorising allow brackets which expanded give 2 out of 3 terms correct) **or** correct values for x **or** correct values for y (Allow incorrect labels for x or y for this mark only)
	$(y=)\ 3\times$ "-0.6" $-1\ (=-2.8)$ **and** $(y=)\ 3\times$ "1.5" $-1\ (=3.5)$	$(x=)\ \frac{"-2.8"+1}{3}(=-0.6)$ **and** $(x=)\frac{"3.5"+1}{3}(=1.5)$			M1ft dep on previous M1 for substituting **their** 2 found values of x or y into one of the two given equations **or** fully correct values for the other variable
	Working required		$x=-0.6$ $y=-2.8$ $x=1.5$ $y=3.5$		A1 oe dep on M2 for 4 correct values correctly labelled or correctly shown as coordinates
					Total 5 marks

22	$(y-2)^2+y^2+y=3$	$x^2+(x+2)^2+x+2=3$		5	M1	substitution of linear equation into quadratic – allow one sign error in substituted expression
	$2y^2-3y+1[=0]$ oe (any form with 3 terms)	$2x^2+5x+3[=0]$ oe (any form with 3 terms)			M1	Dep on M1 simplified to a 3 term quadratic with 2 or 3 of 3 terms correct
	$(2y-1)(y-1)$ [= 0] $\frac{-(-3)\pm\sqrt{(-3)^2-4\times2\times1}}{2\times2}$ $2[(y-\frac{3}{4})^2-\frac{9}{16}]+1=0$ oe (leading to y values of $\frac{1}{2}$ and 1) (allow x used for y here)	$(2x+3)(x+1)$ [= 0] $\frac{-5\pm\sqrt{5^2-4\times2\times3}}{2\times2}$ $2[(x+\frac{5}{4})^2-\frac{25}{16}]+3=0$ oe (leading to x values of $-\frac{3}{2}$ and -1) (allow y used for x)			M1ft	dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\frac{3\pm\sqrt{9-8}}{4}$ or $\frac{-5\pm\sqrt{25-24}}{4}$) or if completing the square then as far as shown on LHS OR the correct values for x OR the correct values for y
	eg $(x=)\text{"}\frac{1}{2}\text{"}-2$ oe $\text{"}1\text{"}-2$ oe	$(y=)\text{"}-\frac{3}{2}\text{"}+2$ oe, $\text{"}-1\text{"}+2$ oe			M1	dep on previous M1 for correct method to find both other values or **a correct pair of values**
	Working required		$x=-\frac{3}{2}, y=\frac{1}{2}$ $x=-1,\ y=1$		A1	oe dep on M2 for all 4 values
						Total 5 marks

22	eg $x^2+3(x+2)+(x+2)^2=7$	eg $(y-2)^2+3y+y^2=7$		5	M1	for substitution of $y=x+2$ (or $x=\pm y\pm 2$) into $x^2+3y+y^2=7$ to obtain an equation in x only (or y only)
	eg $2x^2+7x+3(=0)$ $2x^2+7x=-3$	eg $2y^2-y-3(=0)$ $2y^2-y=3$			M1ft	dep on previous M1 for multiplying out and collecting terms, forming a three term quadratic in any form of ax^2+bx+c (= 0) where at least 2 coefficients (a or b or c) are correct
	eg $(2x+1)(x+3)(=0)$ or $x=\frac{-7\pm\sqrt{(7)^2-4\times2\times3}}{2\times2}$ or $\left(x+\frac{7}{4}\right)^2-\left(\frac{7}{4}\right)^2=-\frac{3}{2}$ $\left(x=-\frac{1}{2}\text{ and }x=-3\right)$	eg $(y+1)(2y-3)(=0)$ or $y=\frac{-(-1)\pm\sqrt{(-1)^2-4\times2\times-3}}{2\times2}$ or $\left(y-\frac{1}{4}\right)^2-\left(\frac{1}{4}\right)^2=\frac{3}{2}$ $\left(y=-1\text{ and }y=\frac{3}{2}\right)$			M1ft	dep on first M1 method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{-7\pm\sqrt{49-24}}{4}$ **or** $\frac{1\pm\sqrt{1+24}}{4}$ **or** if factorising allow brackets which expanded give 2 out of 3 terms correct) **or** correct values for x **or** correct values for y
	$y="-\frac{1}{2}"+2\left(=\frac{3}{2}\right)$ **and** $y="-3"+2(=-1)$	$x="-1"-2(=-3)$ **and** $x="\frac{3}{2}"-2\left(=-\frac{1}{2}\right)$			M1ft	dep on previous M1 for substituting **their** 2 found values of x or y into one of the two given equations **or** fully correct values for the other variable (correct labels for x / y) **or** for one correct pair of values
	Working required		$x=-\frac{1}{2}\text{ and }y=\frac{3}{2}$ $x=-3\text{ and }y=-1$		A1	oe dep on M2 (allow coordinates)
						Total 5 marks

If they find the values of y but think they are the values of x then the maximum mark is 3

22	$x^2+(-2x+3)^2=41$	$\left(\frac{-y+3}{2}\right)^2+y^2=41$		5	M1	substitution of $y=\pm 2x\pm 3$ (or $x=\frac{\pm y\pm 3}{2}$) into $x^2+y^2=41$ to obtain an equation in x only (or y only)
	eg $5x^2-12x-32(=0)$ oe **or** $5x^2-12x=32$	eg $5y^2-6y-155(=0)$ **or** $5y^2-6y=155$			M1 ft	dep on previous M1 for multiplying out and collecting terms, forming a **three** term quadratic in any form of $ax^2+bx+c\ (=0)$ where at least 2 coefficients (a or b or c) are correct
	$(5x+8)(x-4)(=0)$ **or** $(x=)\frac{12\pm\sqrt{(-12)^2-4\times5\times(-32)}}{2\times5}$ **or** $5\left[\left(x-\frac{6}{5}\right)^2-\left(\frac{6}{5}\right)^2\right]-32(=0)$ (should give $(x=)-\frac{8}{5}, 4$)	eg $(5y-31)(y+5)(=0)$ **or** $\frac{6\pm\sqrt{(-6)^2-4\times5\times(-155)}}{2\times5}$ **or** $5\left[\left(y-\frac{3}{5}\right)^2-\left(\frac{3}{5}\right)^2\right]-155(=0)$ (should give $(y=)\frac{31}{5}, -5$)			M1 ft	dep on M1 method to solve **their** 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as eg $\frac{12\pm\sqrt{144+640}}{10}$ **or** $\frac{6\pm\sqrt{36+3100}}{10}$ **or** if factorising allow brackets which expanded give 2 out of 3 terms correct) **or** correct values for x **or** correct values for y
	eg $2\times4+y=3$ **and** $2\times-\frac{8}{5}+y=3$	eg $2x+\frac{31}{5}=3$ **and** $2x-5=3$			M1 ft	dep on previous M1 for substituting **their** 2 found values of x or y into one of the two given equations or their rearranged equation used in the substitution **or** for one correct pair of values
	Working required if the correct answers come from incorrectly using $y = 2x - 3$ oe award M4A0.		$x=-\frac{8}{5}, y=\frac{31}{5}$, $x=4,\ y=-5$		A1	oe dep on M2 for all 4 values (allow coordinates)
	If they find the values of y but think they are the values of x then the maximum mark is 3					**Total 5 marks**

22	$(y-4)^2-(y-4)+y^2=10$ or $x^2-x+(x+4)^2=10$		6	M1	for substituting linear equation into the quadratic equation
	$2y^2-9y+10=0$ or $2x^2+7x+6=0$			A1	for a correct equation in the form $ax^2 + bx + c = 0$ or $ax^2 + bx = -c$ or equations of the same form but in y
	$(2y-5)(y-2)=0$ or $\frac{--9\pm\sqrt{(-9)^2-(4\times2\times10)}}{2\times2}$ or $(2x+3)(x+2)=0$ or $\frac{-7\pm\sqrt{7^2-(4\times2\times6)}}{2\times2}$			M1ft	For solving *their* 3 term quadratic equation using any correct method. If factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\frac{-7\pm\sqrt{49-48}}{4}$ or eg $\left(x+\frac{7}{4}\right)^2-\frac{1}{16}=0$ oe $\frac{9\pm\sqrt{81-80}}{4}$ or eg $\left(y-\frac{9}{4}\right)^2-\frac{1}{16}=0$ oe
	(- 1.5, 2.5) and (- 2, 2)			A1	for both pairs of coordinates oe eg $\left(\frac{-3}{2},\frac{5}{2}\right)$ accept coordinates listed as pairs, ie x_1, y_1, x_2, y_2
	$\sqrt{('-1.5'-'-2')^2+('2.5'-'2')^2}$			M1	dep on M1 for finding length of AB
		$\frac{\sqrt{2}}{2}$		A1	dep M3
					Total 6 marks

19	$y = x - 3$	$x = y + 3$		6	B1 for correct rearrangement of linear equation
	eg $3x^2 - (x-3)^2 + x(x-3) = 9$	eg $3(3+y)^2 - y^2 + y(3+y) = 9$			M1 substitution of their linear equation into quadratic in x or y alone(even if B0 scored)
	eg $3x^2 + 3x - 18\ (= 0)$ **or** $x^2 + x - 6\ (= 0)$	eg $3y^2 + 21y + 18\ (= 0)$ **or** $y^2 + 7y + 6\ (= 0)$			M1ft from their substitution (dep on previous M1) for a complete correct method to get a 3-term or 2-term quadratic expression in the form $ax^2 + bx\ (+c)\ (= 0)$ [allow $ax^2 + bx = c$]
	eg $(x-2)(x+3)\ (= 0)$ $x = \frac{-1 \pm \sqrt{1^2 - 4\times1\times-6}}{2\times1}$ eg $\left(x - \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 = 6$	eg $(y+1)(y+6)\ (= 0)$ $y = \frac{-7 \pm \sqrt{7^2 - 4\times1\times6}}{2\times1}$ eg $\left(y - \frac{7}{2}\right)^2 - \left(\frac{7}{2}\right)^2 = -6$			M1 (dep on M1) for a complete method to solve their 3-term or 2- term quadratic equation ($ax^2 + bx\ (+c) = 0$) – correct factorisation or substitution into formula or completing square (allow one sign error and some simplification – allow as far as $\frac{-1 \pm \sqrt{1+24}}{2}$ or $\frac{-7 \pm \sqrt{49-24}}{2}$) or for seeing $x = 2$, $x = -3$ **or** $y = -1$, $y = -6$
	$x = -3$, $x = 2$ **and** $y = -1$, $y = -6$ or one correct midpoint coordinate ie $x = -\frac{1}{2}$ **or** $y = -\frac{7}{2}$				A1 (dep on M2) for $x = 2$, $x = -3$ **and** $y = -1$, $y = -6$ **or** one correct midpoint ie $x = -\frac{1}{2}$ or $y = -\frac{7}{2}$
	Working required		$\left(-\frac{1}{2}, -\frac{7}{2}\right)$		A1 (dep on M2) oe
					Total 6 marks

9	$-4x \leq 11-3$ **or** $-4x \leq 8$ **or** $-x \leq 2$ **or** $3-11 \leq 4x$ **or** $-8 \leq 4x$		2	M1	allow equals sign or condone incorrect inequality sign for M1 only
		$x \geq -2$		A1	allow $-2 \leq x$ SCB1 for x and -2 with an incorrect sign between them or -2 as an answer
					Total 2 marks

10	$3 \div 2$ (=1.5 or $\frac{3}{2}$) **or** eg $\frac{5--1}{4(-0)}$ **or** $c = -1$		3	M1	for correct method to find gradient or the correct value of c for gradient, may see a correct calculation **or** $\frac{3}{2}$ oe **or** $1.5x$ (+ c) oe for value of c, allow $c = -1$, $y = -1$, ($L =$) $mx - 1$ oe
	$y =$ "1.5"x (+ c) **or** $y = mx - 1$ **or** eg $y - 5 = m(x - 4)$			M1	for use of $y = mx + c$ with either m or c correct (NB: $m \neq 0$) **or** for ($L =$) $1.5x - 1$ oe
		$y = \frac{3}{2}x - 1$		A1	oe eg $y = 1.5x - 1$
					Total 3 marks

International GCSE Maths

Apart from Q2, 17, 18d, 20, & 24 (where the mark scheme states otherwise) the correct answer, unless obtained from an incorrect method, should be taken to imply a correct method

Question		Working	Answer	Mark		Notes
1	(a)		$x > -3$	1	B1	Accept $-3 < x$
	(b)	$4y - y \leq 8 + 13$		2	M1	Arranging y's on one side and the numbers on the other side. (allow $4y - y = 8 + 13$ oe or $4y - y < 8 + 13$ oe or $4y - y > 8 + 13$ oe or $4y - y \geq 8 + 13$ oe)
			$y \leq 7$ oe		A1	Allow $y \leq 21/3$
						Total 3 marks

2		$\frac{17}{3}(-)\frac{11}{4}$ or $5\frac{8}{12}(-)2\frac{9}{12}$ $\frac{68}{12} - \frac{33}{12}$ or $4\frac{20}{12} - 2\frac{9}{12}$ $\frac{35}{12} = 2\frac{11}{12}$ Alt: $3\,(+)(\frac{2}{3} - \frac{3}{4})$ $3\,(+)(\frac{8}{12} - \frac{9}{12})$ $3 - \frac{1}{12} = 2\frac{11}{12}$ Alt: $4\frac{5}{3}(-)\,2\frac{3}{4}$ $2\,(+)(\frac{5}{3} - \frac{3}{4})$ $2\,(+)(\frac{20}{12} - \frac{9}{12})$ $= 2\frac{11}{12}$		3	M1 M1 A1 M1 M1 A1 M1 M1 A1	Sight of $\frac{17}{3}$ and $\frac{11}{4}$ or $5\frac{8}{12}$ and $2\frac{9}{12}$ or $\frac{68n}{12n} - \frac{33n}{12n}$ Dep on M2 Dep on M2 Dep on M2
						Total 3 marks

10			$x \geq -1$ oe $x + y \leq 4$ oe $y \geq \frac{1}{3}x - 2$ oe	3	B3 for all 3 correct inequalities (B2 for two correct inequalities B1 for one correct inequality) (SC B3 for $x \leq -1$, $x + y \geq 4$ and $y \leq \frac{1}{3}x - 2$ oe) (If no marks gained B1 for understanding of equation $x + y = 4$ e.g. $y > 4 - x$) Accept < for ≤ and > for ≥ throughout
					Total 3 marks

11		6000×1.015^2 (= 6181.35) **or** $6000 + (0.015 \times 6000) + (0.015 \times (6000 +$ '90')) (= 6181.35) **or** $(1.015)^2$ (= 1.030225) **or** $\frac{6311.16}{6000}$ (= 1.05186)		3	M1 for working out the total amount after **two** years **or** working out the compound interest multiplier after two years **or** working out the compound interest multiplier after three years
		6311.16 ÷ '6181.35' (= 1.021) (×100) **or** $\frac{6311.16 - \text{'6181.35'}}{\text{'6181.35'}}$ (= 1.021) (×100) **or** '1.05186' ÷ '1.030225' (= 1.021) (×100)			M1 (dep on M1) for a complete method to find the compound interest multiplier (×100)
			2.1		A1 awrt 2.1
					Total 3 marks

9	(a)			2	M1	for $(x \pm 6)(x \pm 7)$
			$(x + 6)(x - 7)$		A1	for $(x + 6)(x - 7)$ or $(x - 7)(x + 6)$ isw roots given if candidate solves the quadratic = 0
	(b)	$3x - 8x < 3 - 15$ or $15 - 3 < 8x - 3x$		3	M1	accept as equation or with the wrong inequality sign.
		$-5x < -12$ or $12 < 5x$			M1	accept as equation or with the wrong inequality sign.
			$x > 2.4$		A1	Accept $2.4 < x$ or $x > \frac{12}{5}$ oe allow $(-\infty, 2.4)$ award M1 M1 A0 for 2.4 with = sign or no inequality or incorrect inequality sign.
						Total 5 marks

10	(a)		0	1	B1	condone 150^0
	(b)		-2	1	B1	condone 3^{-2}
						Total 2 marks

11	See appendix 1		3	M1	for $y = x$ correctly drawn solid or dashed line accepted
				M1	indep for $x = 4$ **and** $y = -2$ correctly drawn solid or dashed line accepted
		Correct region identified		A1	for correct region identified region may be shaded or left unshaded Condone missing label if region is clear and no contradictory labels
					Total 3 marks

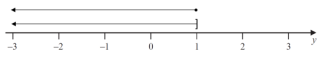
6	$x \times 1.05 = 1.26$ oe eg $(x =)\ 1.26 \div 1.05$ oe $(= 1.2)$	or 30×1.26 $(= 37.80)$	or $30 \div 1.05$ $(= 28.57)$		3	M1
	30 × "1.2"	"37.80" ÷ 1.05	"28.57…" × 1.26			M1
				36		A1 cao If no marks awarded, SC B1 for one operation used correctly, even with another incorrect operation. eg $1.26 \times 0.95 \times 30$ oe or $1.26 \times 1.05 \times 30$ oe or $1.26 \div 0.95 \times 30$ oe
						Total 3 marks

7		$y \geq 1$ oe $x \leq 3$ oe $y \leq 3x - 2$ oe	3	B1 B1 B1	Allow $1 \leq y \leq 7$ Allow $1 \leq x \leq 3$ Condone < and > in place of ≤ and ≥ throughout. SC B1 if no marks awarded, recognition of lines $x = 3$ **and** $y = 1$. Allow incorrect inequality and condone use of equals signs eg $y < 1$, $x = 3$ may be seen on diagram.
					Total 3 marks

13		$y \geq -3$ oe $x + y \leq 1$ oe $y \leq 2x + 2$ oe	3	B3 for all 3 correct inequalities (B2 for 2 correct inequalities B1 for 1 correct inequality) Allow < instead of ≤ and > instead of ≥
				Total 3 marks

International GCSE Maths

Apart from Questions 10, 14, 15, 22, 24 the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Q	Working	Answer	Mark	Notes
1 (a)		−2, −1, 0, 1, 2	2	B2 for −2, −1, 0, 1, 2 with no additions or repeats (B1 for 4 of −2, −1, 0, 1, 2 with no additions or repeats **or** for 6 values with no more than one incorrect value e.g. all of −2, −1, 0, 1, 2, 3 **or** for 5 values with one error)
(b)		Closed circle at $x = 1$ and a line with an arrow to the left	1	B1 for a closed circle at $x = 1$ and a line with an arrow of any length to the left Allow] for a closed circle Allow a line without an arrow if it reaches to at least −3
				Total 3 marks

2	0.65 × 300 oe			M1
		195		A1 (SCB1 for 105)
				Total 2 marks

12	216 or 2.16 or 10^{120} or 10^{122} or $6^3 \times 10^{40\times3}$		3	M1	or for digits 216
	216×10^{120} oe or or 2.16×10^n where $n \neq 122$			M1	
		2.16×10^{122}		A1	
					Total 3 marks

13		$x \geq -1$	1	B1	oe condone > in place of ≥
		$y \geq x$	1	B1	oe condone > in place of ≥
		$x + 2y \leq 8$	1	B1	oe condone < in place of ≤
				SCB1	if all inequalities reversed
					Total 3 marks

14	$12 \times \tan 5$ (=1.05) **or** $\tan 5 = \frac{'y'}{12}$ **or** $12\tan5$ **or** $\tan 85 = \frac{12}{'y'}$ **or** $\frac{12}{\tan 85}$ $\frac{y}{\sin 5} = \frac{12}{\sin 85}$ oe **or** (y =) 1.04986… oe		3	M1	oe correct expression using tan or the sine rule or $\sqrt{\left(\frac{12}{\cos 5}\right)^2 - 12^2}$ (= 1.04986…)
	(AB =) 2.6 + "1.05" oe			M1	
		3.65		A1	allow awrt 3.65
					Total 3 marks

15	5 5 7 8 10 12 13 14 16 21 23		3	M1	For ordering the numbers Allow one error or omission in the list.
	16 & 7 identified for LQ and UQ			M1	For identifying 16 and 7 – may also have identified the median (12)
		9		A1	
					Total 3 marks

11		$2x+y\le 6$ $2y\le 5x+1$ $3y+2x\ge 4$	3	B3 oe for all three correct (B2 oe for any two correct) (B1 oe for any one correct) $2x+y\le 6$ equivalent to $y\le -2x+6$ oe $2y\le 5x+1$ equivalent to $y\le 2.5x+0.5$ oe $3y+2x\ge 4$ equivalent to $y\ge -\frac{2}{3}x+\frac{4}{3}$ oe Allow the following inequalities $2x+y<6$ oe $2y<5x+1$ oe $3y+2x>4$ oe
				Total 3 marks

12	(a)		$\frac{9}{10}$	1	B1 oe
	(b)		-6	1	B1
					Total 2 marks

Question	Working	Answer	Mark	Notes
22	$(6x-5)(x+7)(=0)$ **or** $\frac{-37\pm\sqrt{37^2-4\times6\times-35}}{2\times6}$ $6\left[\left(x+\frac{37}{12}\right)^2-\left(\frac{37}{12}\right)^2\right]$... oe		3	M1 A correct method to solve the quadratic equation $6x^2+37x-35(=0)$ using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error in substitution and some simplification – allow as far as $\frac{-37\pm\sqrt{1369+840}}{12}$) or completing the square as far as shown on left
	$\frac{5}{6}$ oe **and** -7			A1 dep on M1 correct critical values (allow 0.83…)
	Working must be seen for both accuracy marks as asked for in question	$-7\le x\le\frac{5}{6}$		A1 dep on M1 oe eg $-7\le x\le0.83\ldots$, $\left[-7,\frac{5}{6}\right]$ Accept $x\le\frac{5}{6}$, $x\ge-7$
				Total 3 marks

2	(a)		Triangle drawn at (−1, −3) (−1, −4) (−3, −3)	2	B2	for a correct triangle with correct orientation and position If not B2 then award B1 for a correct triangle drawn with correct orientation in wrong position or triangle drawn with 2 out of 3 correct vertices
	(b)		Triangle drawn at (−4, 4) (−4, 5) (−2, 4)	1	B1	cao
						Total 3 marks

3	(a)		−3, −2, −1, 0, 1	2	B2	for −3, −2, −1, 0, 1 If not B2 then award B1 for 4 correct values and no incorrect values (eg −3, −2, −1, 0) **or** for 6 values with no more than one incorrect value (eg −4, −3, −2, −1, 0, 1)
	(b)		$x > -1$	1	B1	accept $-1 < x$
						Total 3 marks

19	(i)		(0, 4)	1	B1
	(ii)		(5, 12)	1	B1
	(iii)		(5, –3)	1	B1
					Total 3 marks

20	$(10x + 21)(x - 1)$ or $\frac{-11 \pm \sqrt{(11)^2 - 4 \times 10 \times -21}}{2 \times 10}$ $10\left[\left(x + \frac{11}{20}\right)^2 - \frac{121}{400}\right] - 21 (= 0)$ oe		3	M1	A correct method to solve the quadratic; correct factors or correct substitution into the formula or can be simplified as far as $\frac{-11 \pm \sqrt{121 + 840}}{20}$ or correctly completing the square. $(10)(x + 2.1)(x - 1)$ is not a correct factorisation – it is working backwards from calculator answers.
	$(x =) 1, (x =) -2.1$			A1	dep on M1 for correct critical values
	Working required	$-2.1 < x < 1$		A1	dep on M1 oe eg $x > -2.1$ (and) $x < 1$ (do not penalise 'or') or $\frac{-21}{10} < x < 1$ etc including the open interval (–2.1, 1) or]–2.1, 1[
					Total 3 marks

Question	Working	Answer	Mark	Notes
19	$(2x - 3)(2x + 5)$ or $\frac{-4 \pm \sqrt{4^2 - 4\times4\times-15}}{2\times4}$ or $4\left[\left(x+\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2\right] - 15 (= 0)$ or $4\left(x+\frac{4}{2\times4}\right)^2 - \frac{4^2}{4\times4} + -15 (= 0)$		3	M1 for a correct method to solve the quadratic equation $4x^2 + 4x - 15 = 0$ Allow $(4x - 6)(x + 2.5)$ or $(4x + 10)(x - 1.5)$ or $(4x - 6)(4x + 10)$ leading to $(x - 1.5)(x + 2.5)$ or $(4x - 6)(4x + 10)$ leading to correct values of x Do not allow $(x - 1.5)(x + 2.5)$ without previous working (If using formula allow some simplification – allow as far as $\frac{-4 \pm \sqrt{16 + 240}}{8}$)
	1.5, – 2.5 oe			A1 oe dep on M1
		$-2.5 < x < 1.5$		A1 oe dep on M1 Allow $x > -2.5$ (and) $x < 1.5$ oe Allow any variable as long used all the way through
				Total 3 marks

21		eg $(2x+3)(x-5)$ oe **or** $\frac{--7\pm\sqrt{(-7)^2-4\times2\times(-15)}}{2\times2}$ oe **or** $2\left[\left(x-\frac{7}{4}\right)^2-\left(\frac{7}{4}\right)^2\right]-15$ oe		3	M1	for a **correct** method to find the critical values Minimum evidence for quadratic formula is a two-term discriminant, eg $\frac{7\pm\sqrt{49+120}}{4}$ (must have the ±) Allow $(x+1.5)(2x-10)$ as a correct factorisation, but do **not** allow $\left(x+\frac{3}{2}\right)(x-5)$ unless preceeded by division of the quadratic by 2	Allow M1A1 for the correct critical values **AND** evidence of another algebraic method that has led to these: eg $x(2x+3)-5(2x+3)$ **and** the correct critical values **or** $2x(x-5)+3(x-5)$ **and** the correct critical values **or** $(2x+3)(2x-10)$ **and** the correct critical values
		$(x=)-\frac{3}{2}$ **and** $(x=)5$			A1	dep on M1 for correct critical values oe	
		Working required	$x<-\frac{3}{2}$, $x>5$		A1	dep on M1 for correct inequalities (must be separate inequalities) allow interval notation eg $\left(-\infty,-\frac{3}{2}\right)\cup(5,\infty)$ **or** $\left(-\infty,-\frac{3}{2}\right),(5,¥)$ **or** $]-\infty,-\frac{3}{2}[\ \cup\ ]5,\infty[$ **or** $]-\infty,-\frac{3}{2}[\ ,\ ]5,\infty[$ Acceptable notation: allow a comma, space, "or", "and" or "∪" to link the two regions Do **not** allow as a single inequality $-\frac{3}{2}>x>5$	
							Total 3 marks

Question	Working	Answer	Mark	Notes
19	8.35, 8.45, 6.25, 6.35, 0.265, 0.275		3	M1 For sight of 8.35, 8.45, 6.25, 6.35, 0.265 or 0.275
	$(a=)\dfrac{8.45-6.25}{0.265}$			M1 $a=\dfrac{UB-LB_1}{LB_2}$ Where $8.4<UB\leq 8.45$ **and** $6.25\leq LB_1<6.3$ **and** $0.265 \leq LB_2 < 0.27$
		8.3		A1 8.3(018867...) dep on M2
				Total 3 marks

Question	Working	Answer	Mark	Notes
20	eg $(4x + 3)(x - 2)$ or $(x=)\ \frac{-(-5)\pm\sqrt{(-5)^2-4\times4\times(-6)}}{2\times4}$		4	M1 first step to finding the critical values
	$(x=)\ -\frac{3}{4}$ and 2			A1 for two correct critical values
				M1 (dep on two critical values having been found) for a diagram showing the inequalities **OR** $x < a$ and $x > b$ where a is their lower critical value and b is their upper critical value **OR** $x > 2$ **OR** $x < \frac{-3}{4}$ **OR** $\frac{-3}{4} > x > 2$
		$x < -\frac{3}{4}$ $x > 2$		A1 for both correct inequalities
				Total 4 marks

10	(a)		$y = 5x - 3$ oe	2	B2 fully correct equation eg $y = 5x + -3$ or $y - -3 = 5(x - 0)$ If not B2 then B1 for $y = 5x$ or $y = 5x + a$ or $y = bx - 3$ or (L=) $5x - 3$
	(b)	$x \geq 0$, $x \leq 2$, $y \geq 1$, $y \leq 3$ or	$0 \leq x \leq 2$ $1 \leq y \leq 3$	2	B2 fully correct oe (B1 for 2 or 3 out of 4 inequalities correct) (Treat double−ended inequalities as two separate inequalities) (SC B2 $y > 3$, $y < 1$, $x < 0$, $x > 2$) Accept <, ≤, > and ≥ throughout
					Total 4 marks

Question	Working	Answer	Mark	Notes
8	$20\,000 \times 0.81^3$ oe			M2 M1 for $20\,000 \times 0.81$ oe (= 16 200) or $20\,000 \times 1.19$ oe (= 23 800) or $20\,000 \times 1.19^3$ oe (= 33 703.18)
		10 629		A1 Accept 10 628 → 10 629
				Total 3 marks

9	$30 = \frac{27}{1.2x}$		3	M1 Or for $\frac{27}{30}$ (= 0.9)
	$1.2x = \frac{27}{30}$ or $36x = 27$ or $22.5 \div 30$			M1
		0.75 oe		A1
				Total 3 marks

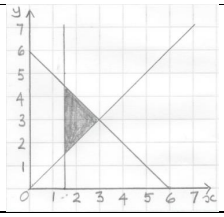
10	(a)		3.74×10^7	2	B2 B1 for 37 400 000 (oe but not in standard form) or 3.74×10^n ($n \neq 7$) or 3.7×10^7 or 3.8×10^7
	(b)		11	1	B1 Allow 11 →11.1
					Total 3 marks

11	(a)		−1, 0, 1, 2, 3, 4	2	B2 B1 for −2, −1, 0, 1, 2, 3, 4 or −1, 0, 1, 2, 3
	(b)		$y \leq 6$ oe $x + y \geq 5$ oe $y \geq x - 3$ oe	2	B2 for 3 correct inequalities B1 for 2 correct inequalities SC B2 for $y \geq 6$ oe and $x + y \leq 5$ oe and $y \leq x - 3$ oe (In all cases allow < in place of ≤, and > in place of ≥)
					Total 4 marks

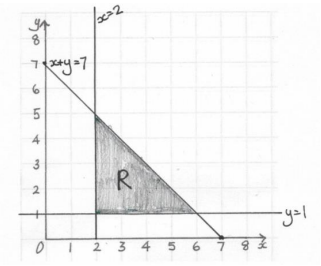
2	$a = 7$		4	B1
	$\frac{b + \text{their } a}{2} = 8.5$ oe **or** $b = 10$			M1 ft their value of a **or** for setting up an equation for b **or** $b = 10$
	$\frac{\text{their } a + \text{their } a + \text{their } b + c}{4} = 9$ oe or $(c =) 9 \times 4 - (2 \times \text{their } a + \text{their } b)$ oe			M1 for a calculation involving c using their values **or** for a calculation leading to c using their values
		7, 10, 12		A1
				Total 4 marks

3	a		Correct number line	2	B2 for a fully correct number line e.g. shaded circle at −2, unshaded circle at 1 and a line drawn between them B1 for a shaded circle at −2 **or** an unshaded circle at 1 **or** circles at −2 and 1 with line in between but shading incorrect
	b		−3, −2, −1, 0, 1, 2	2	B2 fully correct values with no extras B1 for 5 correct values and none incorrect **or** all 6 correct values with no more than one additional incorrect value
					Total 4 marks

3	(a)	$520 - 465$ (= 55) **or** $\frac{520}{465}$ (=1.118…)	11.8	3	M1	
		$\frac{"55"}{465} \times 100$ **or** $100 \times$("1.118" – 1) oe			M1	
					A1	11.8 or better (11.827956...)
	(b)	0.12×550 oe (= 66)	484	3	M1 oe	M2 for 0.88×550 oe
		550 – "66"			M1	
					A1	
						Total 6 marks

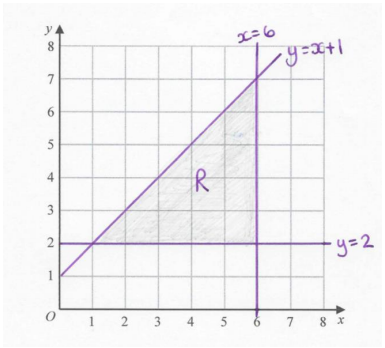
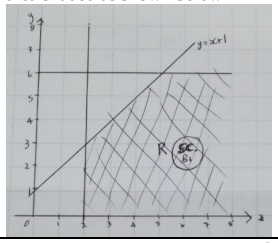
4	(a)(i)		Correct line	1	B1	For $x = 1.5$ drawn
	(ii)		Correct line	1	B1	For $y = x$ drawn
	(iii)		Correct line	1	B1	For $x + y = 6$ drawn
	(b)		Correct region	1	B1	dep on B3 for correctly indicating the region **R** accept unlabelled or unshaded if clear. Shading can be 'in' or 'out'.
						Total 4 marks

7	(a)		$-2, -1, 0, 1, 2$	2	B2	(B1 for 4 correct values and no incorrect values (eg –1, 0, 1, 2) **or** for 6 values with no more than one incorrect value (eg –2, –1, 0, 1, 2, 3))
	(b)	$7t - 2t \leq 31 + 3$ **or** $5t \leq 34$ **or** $-3 - 31 \leq 2t - 7t$ **or** $-34 \leq -5t$ oe		2	M1	t terms on one side and numbers on the other. Condone = rather than ≤ or any other sign for this mark.
		Working required	$t \leq 6.8$		A1	oe (dep on M1) eg $t \leq \frac{34}{5}$ **or** $t \leq 6\frac{4}{5}$ **or** $6.8 \geq t$ Must have correct sign on answer line (sight of correct answer in working space and just 6.8 oe on answer line gains M1 only)
						Total 4 marks

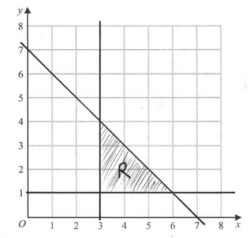
2	(a)(i) (ii) (iii)	 Line length 2cm + but shaded area must be enclosed for the mark in (b)		3	B1 B1 B1	$y = 1$ drawn $x = 2$ drawn $x + y = 7$ drawn Allow dashed lines or solid lines for graphs **condone lack of labels if unambiguous**
	(b)			1	B1	correct region indicated – shaded in or out – labelled **R** or clear intention to be the required region (ft only for one vertical line, one horizontal line and one line with a negative gradient)
						Total 4 marks

6	(a)		$8c^{12}d^{21}$	2	B2	(B1 for 2 correct terms as part of a product)
	(b)		5	1	B1	
	(c)		$4a^2b(4b^2 + 5a)$	2	B2	B1 for any correct partial factorisation with at least 2 factors, **or** the correct common factor with no more than 1 error inside the bracket
	(d)(i)	$(x \pm 11)(x \pm 2)$		2	M1	for $(x \pm 11)(x \pm 2)$ **or** for $(x + a)(x + b)$ with $ab = -22$ or $a + b = 9$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x + 11)(x - 2)$		A1	for correct factors
	(ii)		$-11, 2$	1	B1ft	ft dep on factorising in the form $(x + p)(x + q)$
						Total 8 marks

7		$x \leq 1$	4	B1	accept $x < 1$
		$y \geq -2$		B1	accept $y > -2$
	$y = 2x + c$ or $y = mx + 4$			M1	allow = or < or ≤ or > or ≥
	Correct answer scores full marks (unless from obvious incorrect working)	$y \leq 2x + 4$		A1	oe, allow $y < 2x + 4$ oe SCB2 for the correct inequalities with all inequality signs the wrong way round
					Total 4 marks

2 (a)(i)		$y = 2$ drawn	3	B1	Lines (can be solid, dotted or dashed) must be at least 2 cm long and need not be labelled
(ii)		$x = 6$ drawn		B1	
(iii)		$y = x + 1$ drawn		B1	
(b)			1	B1ft	Correct region indicated ft dep on at least B2 scored in (a) and a vertical line, a horizontal line and a diagonal line with a positive gradient SCB1 for $y = x + 1$, $y = 6$ and $x = 2$ and area shaded as shown below 
					Total 4 marks

20	eg $(3x+4)(2x-5)$ **or** $(x=)\dfrac{--7\pm\sqrt{(-7)^2-4\times6\times(-20)}}{2\times6}$ oe **or** $6\left[\left(x-\dfrac{7}{12}\right)^2-\left(\dfrac{7}{12}\right)^2\right]-20$ oe		4	M1	first step to finding the critical values - if factorising (in the form $(ax + b)$ where a and b are integers), allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as $\dfrac{7\pm\sqrt{49+480}}{12}$ oe **or** $6\left(x-\dfrac{7}{12}\right)^2-\dfrac{529}{24}$ oe or $\left(x-\dfrac{7}{12}\right)^2-\dfrac{529}{144}$ oe
	$(x=)\ -\dfrac{4}{3}$ and $\dfrac{5}{2}$ oe			A1	dep on M1 for two **correct** critical values Accept –1.3…… May use $<$, $\leq$, $>$ or $\geq$ instead of =
				M1ft	(dep on M1 and two critical values found) for $x < a$ and $x > b$ where a is their lower critical value and b is their upper critical value **or** $x > \dfrac{5}{2}$ oe **or** $x < -\dfrac{4}{3}$ oe **or** $-\dfrac{4}{3} > x > \dfrac{5}{2}$ oe
	Working required	$x < -\dfrac{4}{3}$ $x > \dfrac{5}{2}$		A1	oe dep on previous M1 Accept –1.3…… or $\left(-\infty,-\dfrac{4}{3}\right),\left(\dfrac{5}{2},(+)\infty\right)$ or $\left(-\infty,-\dfrac{4}{3}\right)\cup\left(\dfrac{5}{2},(+)\infty\right)$ Do not ISW
					Total 4 marks

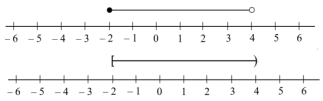
7	(a)(i) (ii) (iii)	 Line length 2 cm + but shaded area must be enclosed for the mark in (b)		3	B1 $x = 3$ drawn B1 $y = 1$ drawn B1 $x + y = 7$ drawn Allow dashed lines or solid lines for graphs of minimum length 2 squares condone lack of labels if unambiguous
	(b)	**If unlabelled, award:** $x = 3$ and $y = 3$ B1 B0 $y = 1$ and $x = 1$ B0 B1 $x = 3$ and $x = 1$ and $y = 1$ B0 B1 $x = 3$ and $y = 1$ and $y = 3$ B1 B0 $x = 3$ and $x = 1$, $y = 1$ and $y = 3$ B0 B0		1	B1 correct region shaded – shaded in or out – labelled **R** or clear intention to be the required region (ft only for one vertical line (not $x = 0$), one horizontal line (not $y = 0$) and one line with a negative gradient eg $x = 1$, $y = 3$ and $x + y = 7$)
					Total 4 marks

5	(a)(i)		2, 3, 4, 6, 8, 9, 10, 12	1	B1
	(ii)		1, 2, 4, 5, 7, 8, 10, 11	1	B1
	(b)(i)		$\varnothing$	1	B1
	(ii)		$\notin$	1	B1
					Total 4 marks

6	(a)		$-2 < x \leq 1$	2	B2 accept $1 \geq x > -2$ **or** $x > -2, x \leq 1$ if not B2 then B1 for $-2 < x$ **or** $x \leq 1$ **or** $-2 \leq x < 1$ **or** $-2 \leq x \leq 1$ **or** $-2 < x < 1$ Condone use of a variable other than x but not 0
	(b)	$7a - 3a \leq 28 + 5$ **or** $4a \leq 33$ **or** $-5 - 28 \leq 3a - 7a$ **or** $-33 \leq -4a$		2	M1 for a terms on one side and numbers on the other. Condone = rather than $\leq$ or any other sign for this mark.
		Working required	$a \leq 8.25$		A1 (dep on M1) oe eg $a \leq \frac{33}{4}$ **or** $a \leq 8\frac{1}{4}$ **or** $8.25 \geq a$ must have correct sign on answer line (sight of correct answer in working space and just 8.25 on answer line gains M1 only).
					Total 4 marks

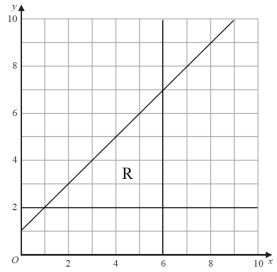
Question		Working	Answer	Mark	Notes	
7			47.5	4	M1	Forming a right-angled triangle with angle 125 – 90 marked or 55 marked
		$\tan'35' = \frac{x}{15}$ or $\tan'55' = \frac{15}{x}$ or $\frac{x}{\sin 35} = \frac{15}{\sin 55}$			M1	
		$x = 15 \times \tan$ '35' (= 10.5...) or $x = \frac{15}{\tan'55'}$ (= 10.5…) or $x = \frac{15}{\sin 55} \times \sin 35$ (= 10.5…)			M1	
		10.5 + 37			A1	awrt 47.5
8	(a)		$3k^3m$	2	B2	B1 for an answer in the form ak^xm^y with 2 correct from $a = 3$, $x = 3$, $y = 1$
	(b)	$7 + 1 < 4x \leq 17 + 1$ or $\frac{7}{4} < x - \frac{1}{4} \leq \frac{17}{4}$	$2 < x \leq 4.5$	3	M1	or one side of the inequality correct, e.g. 2 or 4.5
		$(7+1) \div 4 < x \leq (17+1) \div 4$ or $\frac{7}{4} + \frac{1}{4} < x \leq \frac{17}{4} + \frac{1}{4}$			M1	
					A1	Accept $x > 2$, $x \leq 4.5$

17	$(3x + 2)(2x - 4) < 3x + 27$oe eg $6x^2 - 8x - 8 < 3x + 27$			M1	condone incorrect symbol
	eg $6x^2 - 11x - 35 < 0$			M1	expanding and rearranging to get a correct 3 term quadratic, condone incorrect symbol
	$(2x - 7)(3x + 5)$ (= 0) or $\frac{11 \pm \sqrt{(-11)^2 - 4 \times 6 \times (-35)}}{2 \times 6}$			M1	first step to find the critical values dep on M1 for solving their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as the equivalent of $\frac{11 \pm \sqrt{121 + 840}}{12}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$-\frac{5}{3}, \frac{7}{2}$			A1	oe the positive critical value only or both critical values (if both they must be correct)
		$2 < x < \frac{7}{2}$	5	A1	accept $2 \leq x < \frac{7}{2}$ may be seen as two separate inequalities $x > 2$ ($x \leq 2$) **and** $x < \frac{7}{2}$
					Total 5 marks

9	(i)	$-7+3 \leq 2x < 5+3$ oe or $\frac{-7}{2} \leq x - \frac{3}{2} < \frac{5}{2}$ oe or $-7+3 \leq 2x$ oe **and** $2x < 5+3$ oe or (x =) -2 or (x =) 4		3	M1 or one side of the inequality correct, i.e.. $x \geq -2$ oe or $x < 4$ Condone = rather than ≤ or < or any other sign for the M marks.
		$\frac{-7+3}{2} \leq x < \frac{5+3}{2}$ or $\frac{-7}{2} + \frac{3}{2} \leq x < \frac{5}{2} + \frac{3}{2}$ or $\frac{-7+3}{2} \leq x$ oe **and** $x < \frac{5+3}{2}$ or (x =) -2 and (x =) 4			M1
		Correct answer scores full marks (unless from obvious incorrect working)	$-2 \leq x < 4$		A1 allow $x \geq -2$ and $x < 4$ Allow [−2, 4)
	(ii)			2	M1 ft for drawing a line from −2 to 4 or (indep) for a closed circle or [at −2 or (indep) for an open circle or) or [at 4 Only allow a follow through for a double ended inequality in (i)
			Correct diagram		A1 ft for correct diagram Only allow a follow through for a double ended inequality in (i)
					Total 5 marks

22	$(2x + 3)(x – 1) < 75$		5	B1	For writing the correct inequality sign with a correct calculation or correct value – this could be initially or saying that $x < 6$ at the end
	$2x^2 + x – 78 < 0$			M1	rearranged to form correct quadratic < 0 (allow = 0 or other incorrect inequality sign) oe
	$(x – 6)(2x + 13)$ (< 0) **or** $x = \frac{-1 \pm \sqrt{(1)^2 - (4 \times 2 \times -78)}}{2 \times 2}$ **or** $2\left(x + \frac{1}{4}\right)^2 - 2\left(\frac{1}{4}\right)^2 - 78 = 0$			M1	first step to find critical values from the correct quadratic
		$x = 6$		A1	$x = 6$ identified as critical value, ignore –6.5 if given
		$1 < x < 6$		A1	correct inequality
					Total 5 marks

3	(a)	$4y > 12 - 5$		2	M1 Allow $y = \frac{7}{4}$ oe or $y > -\frac{7}{4}$ or $y < \frac{7}{4}$
			$y > \frac{7}{4}$		A1 oe
	(b)	$12x - 10$ **or** $2(6x - 5) = 4x - 7$ **or** $6x - 5 = \frac{4}{2}x - \frac{7}{2}$ oe		3	M1 for removal of fraction **and** multiplying out LHS **or** rearranging to remove the fraction **or** separating fraction (RHS) in an equation
		$12x - 4x = -7 + 10$ oe **or** $6x - \frac{4}{2}x = -\frac{7}{2} + 5$ oe			M1 ft (dep on 4 terms) for terms in x on one side of equation and number terms on the other
			$\frac{3}{8}$		A1 (dep M1) oe
					Total 5 marks

7	(a)		$y = -3x + 5$ oe	2	B2 fully correct equation eg $y = -3x + 5$ or $y - 5 = -3(x - 0)$ If not B2 then B1 for $y = -3x + a$ with $a \neq 5$ or $y = bx + 5$ ($b \neq 0, -3$) or ($L =$) $-3x + 5$
	(b)	Lines (solid or dashed) $x = 6$ **and** $y = 2$ drawn		3	B1 The lines $x = 6$ and $y = 2$ should extend far enough to intersect with each other.
		Line (solid or dashed) $y = x + 1$ drawn			B1 The line should extend from at least $x = 1$ to $x = 6$ **or** far enough to intersect with their horizontal and vertical lines.
		Region R shown (shaded or not shaded)  	Correct region identified		B1 dep on B2
					Total 5 marks

7	(a)		1	1	B1 cao
	(b)		-6	1	B1 Allow 3^{-6}
					Total 2 marks

8	(a)	$-4x > 17 - 9$ or $-4x > 8$ or $9 - 17 > 4x$ or $-8 > 4x$ or $\frac{9}{4} - x > \frac{17}{4}$ oe or $-\frac{9}{4} + x < -\frac{17}{4}$ oe		2	M1 for a correct first step Condone = rather than > or any other sign for this mark.
		Correct answer scores full marks (unless from obvious incorrect working)	$x < -2$		A1 oe eg $-2 > x$ (sight of correct answer in working space and just (x =) –2 on answer line gains M1 only)
	(b)		$y \geq 2$ $x \leq 6$ $y \leq x$	3	B3 for all 3 correct Allow $2 \leq y, 6 \geq x$ and $x \geq y$ B2 for 2 correct B1 for 1 correct Allow < and > signs SCB2: $y \leq 2$, $y \geq x$ and $x \geq 6$ (for all 3) Allow < and > signs
		Correct answer scores full marks (unless from obvious incorrect working)			**Total 5 marks**

8	(a)	$8x-3x\geq -10+4$ or $5x\geq -6$ or $10-4\geq -8x+3x$ or $6\geq -5x$		2	M1 for x terms on one side and numbers on the other. Condone = rather than ≤ or any other sign for this mark.
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$x \geqslant -\frac{6}{5}$		A1 oe eg $-\frac{6}{5} \leqslant x$ Must have correct sign on answer line (sight of correct answer in working space and just −1.2 on answer line gains M1 only)
	(b)		$y\geq 2$	3	B1 oe eg $y-2\geq 0$ allow > in place of ≥
			$x\leq 7$		B1 oe eg $x-7\leq 0$ allow < in place of ≤
			$y\leq x$		B1 oe eg $y-x\leq 0$ allow < in place of ≤
					SCB1 for $y=2$, $x=7$ and $y=x$ SCB2 for $y\leq 2$, $x\geq 7$ and $y\geq x$ or $y<2, x>7$ and $y>x$ Allow < in place of ≤ or vice versa
					Total 5 marks

Question		Working	Answer	Mark	Notes
9*	(a)	$-3t - 2t < 15 - 7$ or $-5t < 8$ oe or $7 - 15 < 2t + 3t$ or $-8 < 5t$ oe or $t = -1.6$ or $t < -1.6$		2	M1 for correctly isolating terms in t on one side and number terms on the other side (use of = or any inequality symbol or variable is permitted)
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$t > -1.6$		A1 oe eg $-1.6 < t$ or $t > -\frac{8}{5}$ or $-\frac{8}{5} < t$ oe Must have correct inequality symbol on answer line NB Sight of correct answer in working space and just $(t =) -1.6$ oe on answer line gains M1 only
	(b)		$x \geq 2$	3	B1 oe allow $x > 2$ or $2 < x$
			$y \geq 3$		B1 oe allow $y > 3$ or $3 < y$
			$x + y \leq 9$		B1 oe allow $x + y < 9$ or $y < 9 - x$ or $9 > x + y$ SC B2 for all of $x \leq 2$, $y \leq 3$, $x + y \geq 9$ oe or $x < 2$, $y < 3$, $x + y > 9$ SC B1 for all of $x = 2$, $y = 3$, $x + y = 9$ oe
					Total 5 marks

Question	Working	Answer	Mark	Notes
18	eg $9 \times 6 = 8 \times PD$ oe		2	M1 A correct equation involving *PD*
		6.75		A1 oe
				Total 2 marks

19	(a)	eg $\frac{2(4-3x)}{10} - \frac{5(3x-5)}{10} = -3$ oe or $2(4-3x) - 5(3x-5) = -3 \times 2 \times 5$		3	M1 Correct fractions over common denominator as an equation or Multiplying both sides by 10
		$8 - 6x - 15x + 25 = -30$ oe			M1 A correct equation with no denominators or brackets
			3		A1 dep on M1
	(b)	$(5y + 8)(y - 5)$ (≤ 0) or $(y =) \frac{--17 \pm \sqrt{(-17)^2 - 4 \times 5 \times -40}}{2 \times 5}$		3	M1 Correct method to solve 3 term quadratic – factorising or correct use of formula
		-1.6, 5 oe			A1 Correct critical values
			$-1.6 \leq y \leq 5$ oe		A1 Condone change of variable in place of *y* throughout this question.
					Total 6 marks

20	(ASF =) $\frac{13^2}{9^2}$ or $\frac{9^2}{13^2}$		4	M1 Correct SF for area. Accept 1.44^2 (= 2.07 or 2.09) or better for ASF or 0.69^2 (= 0.47 or 0.48) or better for ASF
	eg $A +$ "$(\frac{13^2}{9^2})$" $A = 1800$			M1ft Dep on previous M1
	eg "$\frac{250}{81}$" $A = 1800$			M1ft
		583.2		A1 Awrt 583
				Total 4 marks

10	(a)	$(y\pm6)(y\pm8)$ or $y(y+6)-8(y+6)$ or $y(y-8)+6(y-8)$		2	M1 or for $(y \pm a)(y \pm b)$ where $ab = -48$ or $a + b = -2$
			$(y+6)(y-8)$		A1 oe Allow any letter for y
	(b)		$x \leq 3$	1	B1 allow $3 \geq x$ Allow any letter for x
	(c)	$6-14>12w-7w$ oe or $7w-12w>14-6$ oe		3	M1 Condone = rather than > or any other sign for this mark.
		$-8>5w$ or $-5w>8$ or $-w>\frac{8}{5}$ or $w>-\frac{8}{5}$ or $w=-\frac{8}{5}$ oe			M1 Condone = rather than > or any other sign for this mark.
		Correct answer scores full marks (unless from obvious incorrect working)	$w<-\frac{8}{5}$		A1 oe accept $-\frac{8}{5}>w$ Must have correct sign on answer line dep on M1 (sight of correct answer in working space and just $(w=)-\frac{8}{5}$ oe on answer line gains M2 only)
					Total 6 marks

5	(a)	$8x^2 + 20x - 6x^2 + 9x$	$2x^2 + 29x$	2	M1	3 correct terms or all 4 terms condoning incorrect signs
					A1	
	(b)	eg $y^5 \times y^n = y^{19}$ or $y^{-1} \times y^n = y^{13}$ or $5 + n - 6 = 13$	14	2	M1	Use of 1 rule of indices or a correct linear equation in n
					A1	Accept y^{14}
	(c)(i)	$7t - 2t < 7 + 8$ oe eg $5t < 15$ oe	$t < 3$	2	M1	Terms in t on one side and number terms the other side – may be in an equation or the incorrect inequality sign or an answer of $t = 3$ or eg $t \geq 3$
					A1	
	(ii)		open circle at $t = 3$ and a line with an arrow to the left	1	B1ft	ft their inequality Allow a line without an arrow if it reaches to at least −5, with an arrow it can be any length
						Total 7 marks

15 (a)	eg $\frac{2(4x+5)-3(3-2x)}{6}(=13)$ oe or $\frac{2(4x+5)}{6}-\frac{3(3-2x)}{6}(=13)$ $2(4x + 5) - 3(3 - 2x) = 13 \times 3 \times 2$ oe		4	M1	Writing fractions over a common denominator or removing denominator If the student has removed the denominator at this stage then a correct method must be shown or implied	Allow one error in removal of brackets
	eg $8x + 10 - 9 + 6x = 78$ oe eg $14x + 1 = 78$			M1ft	ft dep on previous M1 removing brackets and fractions correctly in an equation	
	eg $8x + 6x = 78 - 10 + 9$ oe eg $14x = 77$			M1ft	ft dep on previous M1 terms in x on one side and number terms the other	
		5.5		A1	oe eg $\frac{11}{2}$ **dep on M2**	
(b)	$(2y + 5)(y - 6)$ or $\frac{--7\pm\sqrt{(-7)^2-4\times2\times-30}}{2\times2}$ $2\left[\left(y-\frac{7}{4}\right)^2-\frac{49}{16}\right]-30(=0)$ oe		3	M1	A correct method to solve the quadratic - allow factorisation that gives 2 out of 3 terms correct when expanded or use of quadratic formula – if using formula, allow one sign error and allow if simplified as far as $\frac{7\pm\sqrt{49+240}}{4}$ or use of completing the square with one sign error as far as shown	
	$(y =) 6, (y =) -2.5$			A1	Correct critical values **dep on M1**	
		$-2.5 \square y \square 6$		A1	oe eg $y \ldots -2.5$ (and) $y \ldots 6$ or $[-2.5, 6]$ (do not penalise change of variable eg y to x) **dep on M1**	
						Total 7 marks