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

Graphs (A4)

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

110 questions · 396 marks · Mark schemes included

Past papers June 2017 - June 2025 · 4 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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4. Q3	GCSE Paper 2H June 2018	3	8
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QUESTIONS

110 questions · 396 marks · 4 sub-topics

SUB-TOPIC A4a

COORDINATES & STRAIGHT-LINE GRAPHS

Sub-topic A4a · 27 questions · 100 marks · lowest tariff first



- 6 The equation of the line L_1 is $y = 3x - 2$
The equation of the line L_2 is $3y - 9x + 5 = 0$

Show that these two lines are parallel.

(Total for Question 6 is 2 marks)

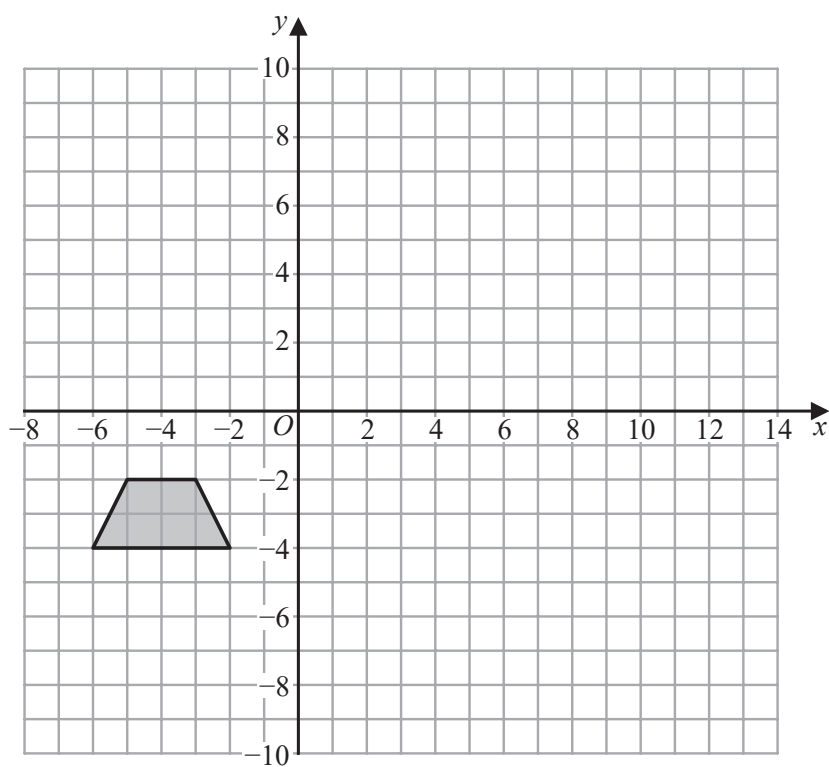


- 12 The equation of the line L_1 is $y = 2x + 3$
The equation of the line L_2 is $5y - 10x + 4 = 0$

Show that these two lines are parallel.

(Total for Question 12 is 2 marks)

13



Enlarge the shaded shape by scale factor -2 with centre of enlargement $(0, 0)$

(Total for Question 13 is 2 marks)



- 8 Chanda buys a necklace for £120
She sells the necklace for £135

Work out her percentage profit.

.....%

(Total for Question 8 is 3 marks)

- 9 Here are the equations of two straight lines.

$$y = \frac{1}{2}x - 6 \qquad 6y = 3x + 7$$

Oscar says that these lines are parallel.

Is Oscar correct?

You must give a reason for your answer.

.....

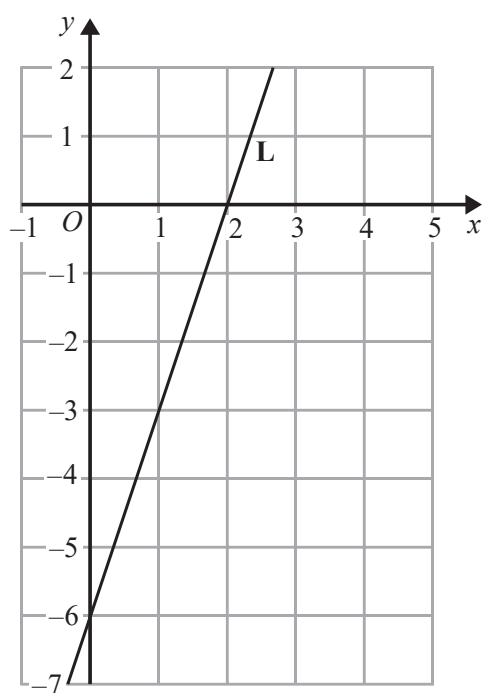
.....

.....

(Total for Question 9 is 2 marks)



3 The line **L** is shown on the grid.



Find an equation for **L**.

(Total for Question 3 is 3 marks)



- 6 A is the point with coordinates $(5, 9)$
 B is the point with coordinates $(d, 15)$

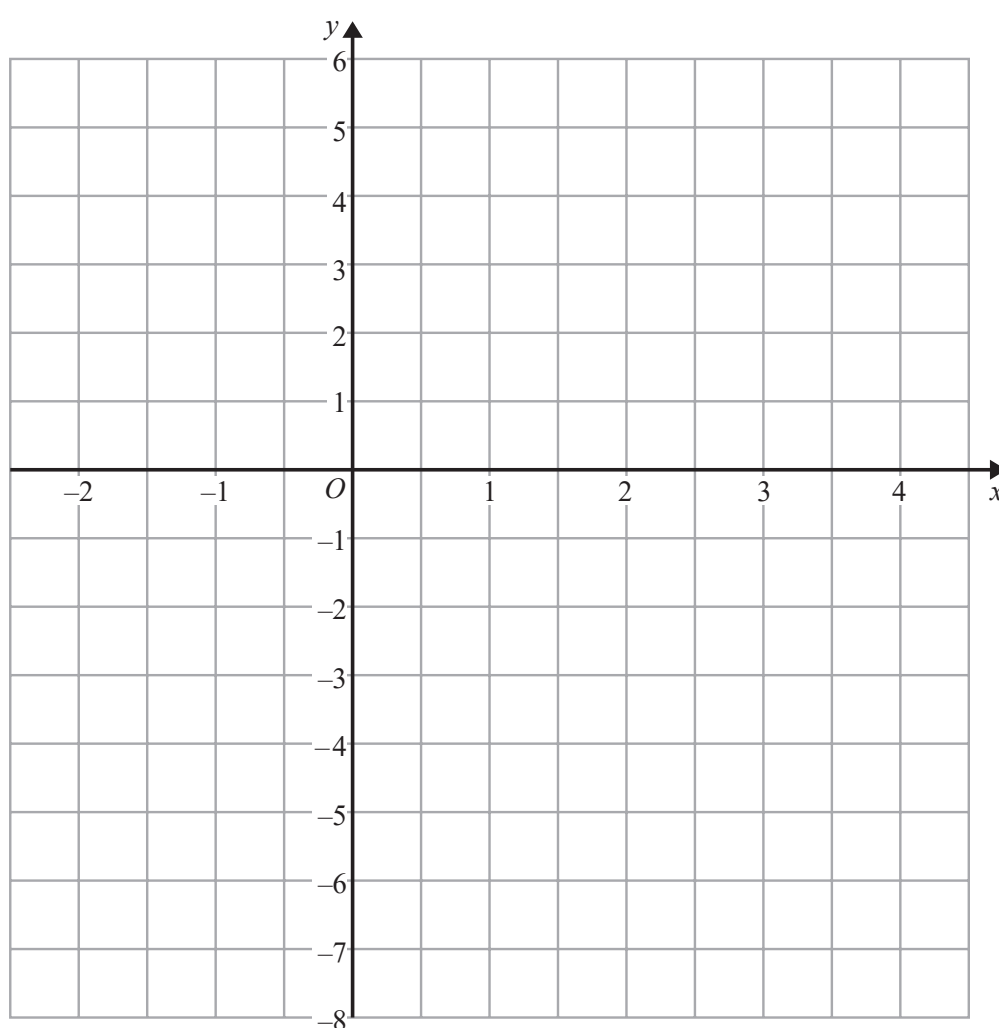
The gradient of the line AB is 3

Work out the value of d .

(Total for Question 6 is 3 marks)



- 2 On the grid below, draw the graph of $y = 2x - 3$ for values of x from -2 to 4



(Total for Question 2 is 3 marks)



- 16** The straight line **L** has the equation $3y = 4x + 7$
The point *A* has coordinates $(3, -5)$

Find an equation of the straight line that is perpendicular to **L** and passes through *A*.

(Total for Question 16 is 3 marks)



- 14 Sally plays two games against Martin.
In each game, Sally could win, draw or lose.

In each game they play,
the probability that Sally will win against Martin is 0.3
the probability that Sally will draw against Martin is 0.1

Work out the probability that Sally will win **exactly** one of the two games against Martin.

.....
(Total for Question 14 is 3 marks)

- 15 The straight line L_1 has equation $y = 3x - 4$
The straight line L_2 is perpendicular to L_1 and passes through the point (9, 5)
Find an equation of line L_2

.....
(Total for Question 15 is 3 marks)



- 15 The equation of line L_1 is $y = 2x - 5$
The equation of line L_2 is $6y + kx - 12 = 0$

L_1 is perpendicular to L_2

Find the value of k .

You must show all your working.

$k = \dots\dots\dots$

(Total for Question 15 is 3 marks)



12 The straight line **L** has equation $2y = 3x - 7$

Find an equation of the straight line perpendicular to **L** that passes through $(6, -5)$

.....
(Total for Question 12 is 3 marks)

13 Solid **A** and solid **B** are similar.

The ratio of the height of solid **A** to the height of solid **B** is $2:5$

The volume of solid **A** is 12 cm^3

Work out the volume of solid **B**.

..... cm^3
(Total for Question 13 is 3 marks)



- 12** A is the point with coordinates $(7, 13)$
 B is the point with coordinates $(-3, 21)$
 C is the point with coordinates $(15, 23)$

M is the midpoint of AB .

N is the midpoint of BC .

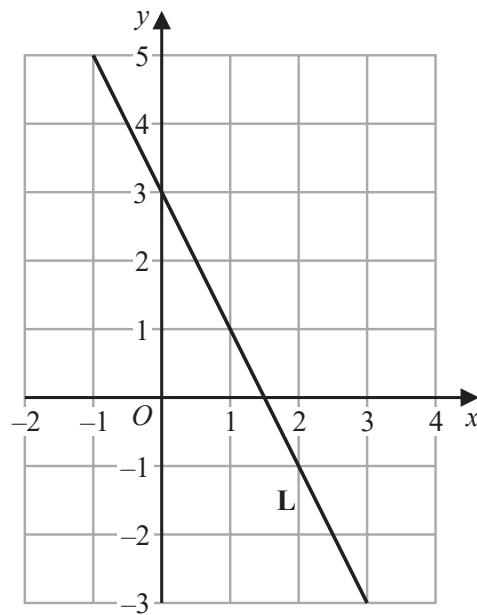
Work out the distance between M and N .

Give your answer correct to 1 decimal place.

(Total for Question 12 is 3 marks)



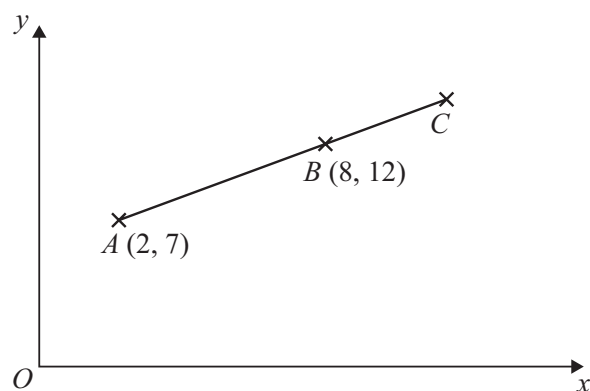
- 9 The line **L** is shown on the grid.



Find an equation for **L**.

(Total for Question 9 is 3 marks)

7 ABC is a straight line.



Point A has coordinates $(2, 7)$

Point B has coordinates $(8, 12)$

$$BC = \frac{1}{2} AB$$

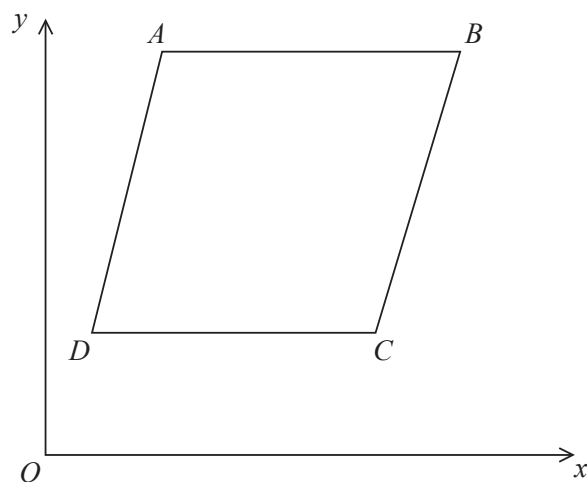
Find the coordinates of point C .

(....., ...)

(Total for Question 7 is 3 marks)



18



$ABCD$ is a rhombus.

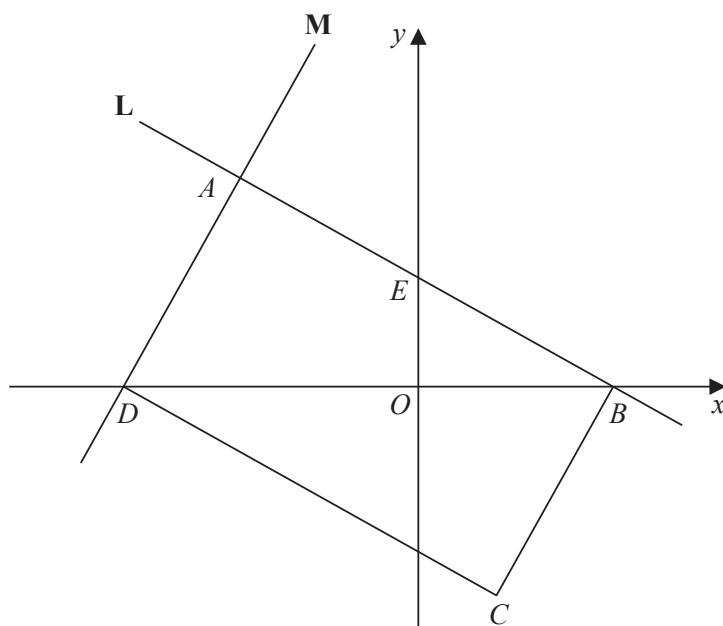
The coordinates of A are $(5, 11)$

The equation of the diagonal DB is $y = \frac{1}{2}x + 6$

Find an equation of the diagonal AC .

(Total for Question 18 is 4 marks)

19



$ABCD$ is a rectangle.

A , E and B are points on the straight line L with equation $x + 2y = 12$

A and D are points on the straight line M .

$$AE = EB$$

Find an equation for M .

(Total for Question 19 is 4 marks)



19 A triangle has vertices P , Q and R .

The coordinates of P are $(-3, -6)$

The coordinates of Q are $(1, 4)$

The coordinates of R are $(5, -2)$

M is the midpoint of PQ .

N is the midpoint of QR .

Prove that MN is parallel to PR .

You must show each stage of your working.

(Total for Question 19 is 4 marks)



18 The straight line L_1 passes through the points with coordinates (4, 6) and (12, 2)

The straight line L_2 passes through the origin and has gradient -3

The lines L_1 and L_2 intersect at point P .

Find the coordinates of P .

(..... , ...)

(Total for Question 18 is 4 marks)



- 5 The points L , M and N are such that LMN is a straight line.

The coordinates of L are $(-3, 1)$

The coordinates of M are $(4, 9)$

Given that $LM : MN = 2 : 3$,

find the coordinates of N .

(....., ...)

(Total for Question 5 is 4 marks)

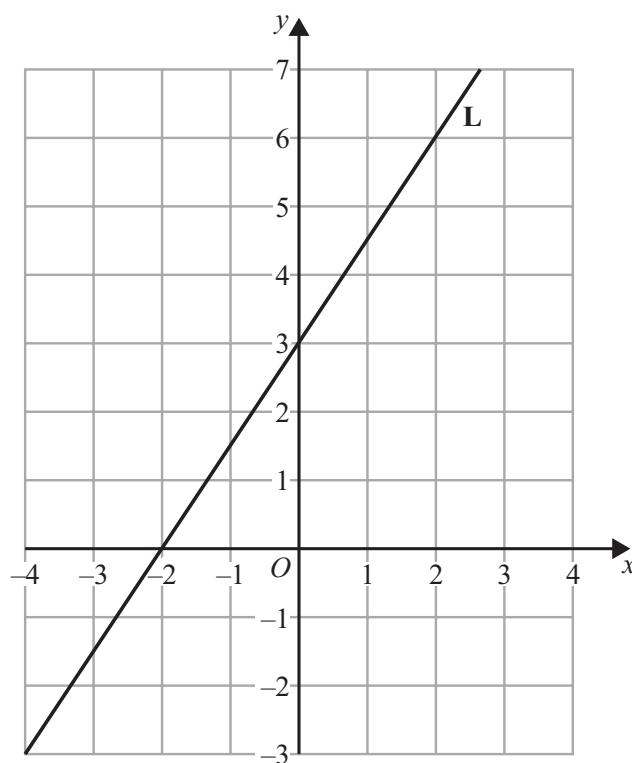
- 6 A new phone cost £679
The value of the phone decreases at a rate of 4% per year.
Work out the value of the phone at the end of 3 years.

£.....

(Total for Question 6 is 3 marks)



6 Here is a straight line **L** drawn on a grid.



(a) Find an equation for **L**.

.....
(3)

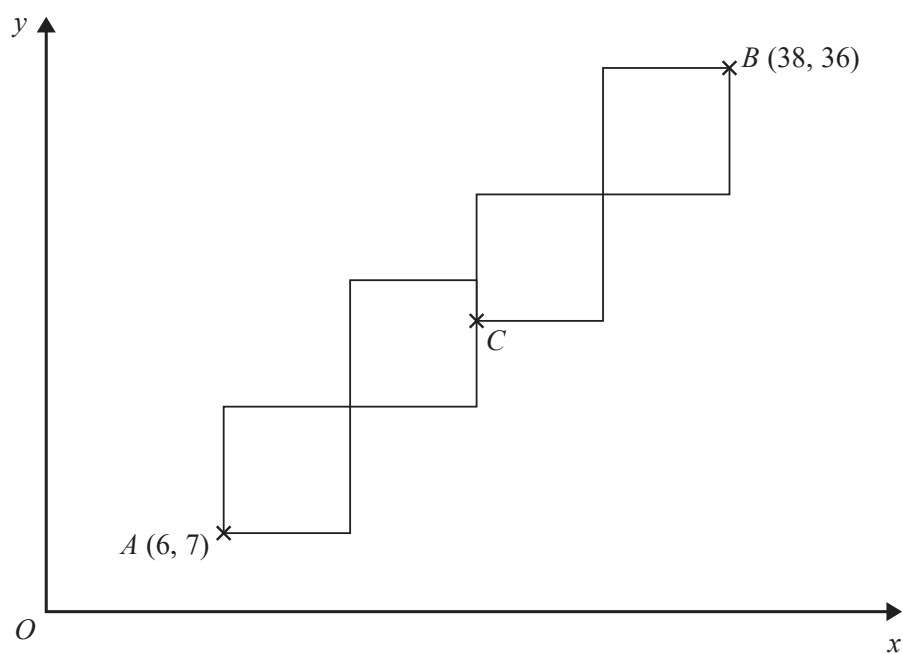
M is a different straight line with equation $y = 5x$

(b) Write down the equation of a straight line parallel to **M**.

.....
(1)

(Total for Question 6 is 4 marks)

- 6 A pattern is made from four identical squares.
The sides of the squares are parallel to the axes.



Point A has coordinates (6, 7)
Point B has coordinates (38, 36)
Point C is marked on the diagram.

Work out the coordinates of C.

(....., ...)

(Total for Question 6 is 5 marks)

- 19 The point P has coordinates $(3, 4)$
The point Q has coordinates (a, b)

A line perpendicular to PQ is given by the equation $3x + 2y = 7$

Find an expression for b in terms of a .

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



25 The straight line **L** has equation $3x + 2y = 17$

The point *A* has coordinates (0, 2)

The straight line **M** is perpendicular to **L** and passes through *A*.

Line **L** crosses the *y*-axis at the point *B*.

Lines **L** and **M** intersect at the point *C*.

Work out the area of triangle *ABC*.

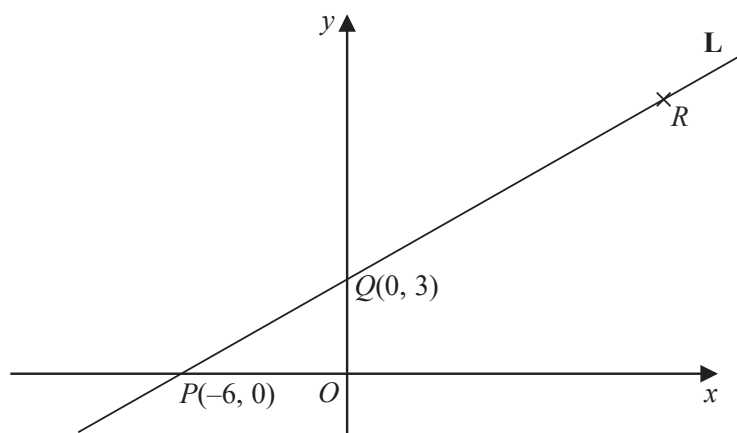
You must show all your working.

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



11 Here is a sketch of the line **L**.



The points $P(-6, 0)$ and $Q(0, 3)$ are points on the line **L**.

The point R is such that PQR is a straight line and $PQ:QR = 2:3$

(a) Find the coordinates of R .

(..... , ...)
(2)

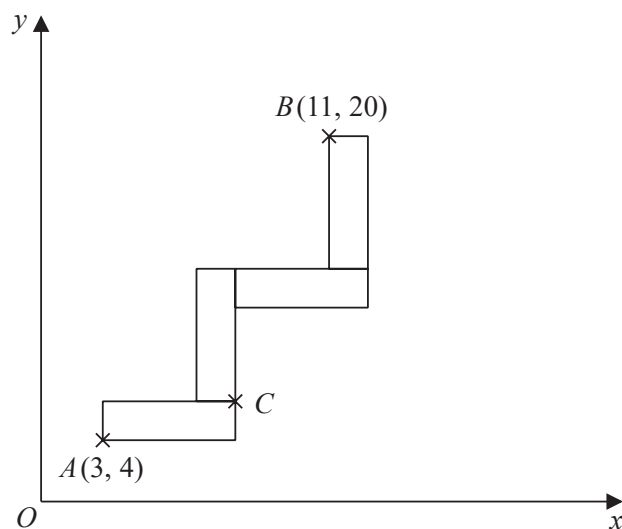
(b) Find an equation of the line that is perpendicular to **L** and passes through Q .

.....
(3)

(Total for Question 11 is 5 marks)



- 13 A pattern is made from four identical rectangles.
The sides of the rectangles are parallel to the axes.



Point A has coordinates $(3, 4)$
Point B has coordinates $(11, 20)$
Point C is marked on the diagram.

Work out the coordinates of C .
You must show all your working.

(....., ...)

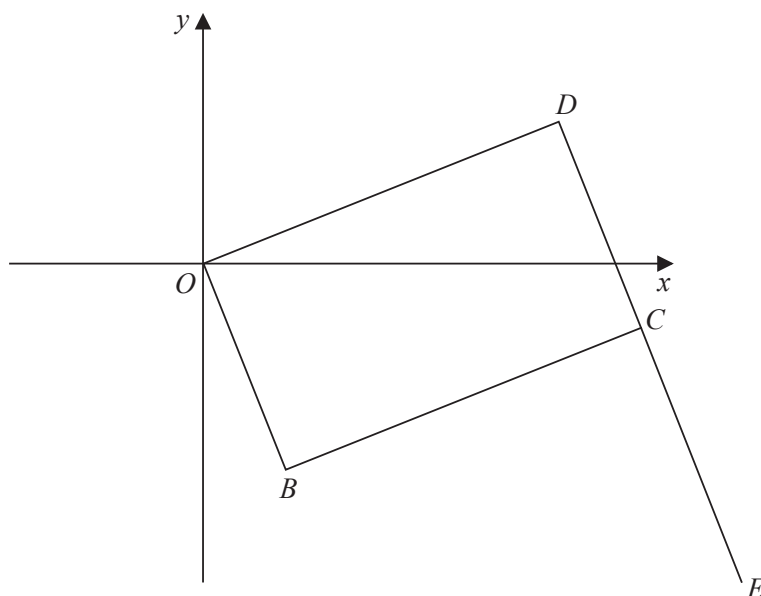
(Total for Question 13 is 5 marks)

- 21** The point P has coordinates $(-4, 5)$
The point Q has coordinates $(6, -6)$
The point R has coordinates $(k, k + 3)$
Given that angle PRQ is a right angle,
find the possible values of k .
You must show all your working.

(Total for Question 21 is 5 marks)



- 16 $OBCD$ is a rectangle.
 DCE is a straight line.



B has coordinates $(2, -4)$
 E has coordinates $(12, -6.5)$

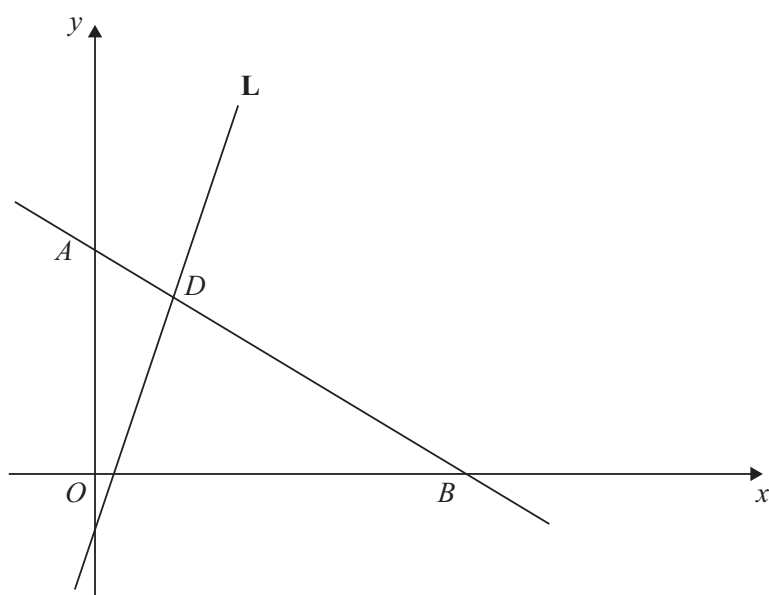
Work out the coordinates of D .
You must show all your working.

(..... , ...)

(Total for Question 16 is 5 marks)



20



In the diagram

A is the point $(0, 8)$

B is the point $(16, 0)$

The point D divides the line segment AB in the ratio $1 : 3$

The line L passes through D .

The gradient of L is $\sqrt{3}$

L passes through the point with coordinates $(-2, f)$

Show that $f < -4$

(Total for Question 20 is 5 marks)



SUB-TOPIC A4b

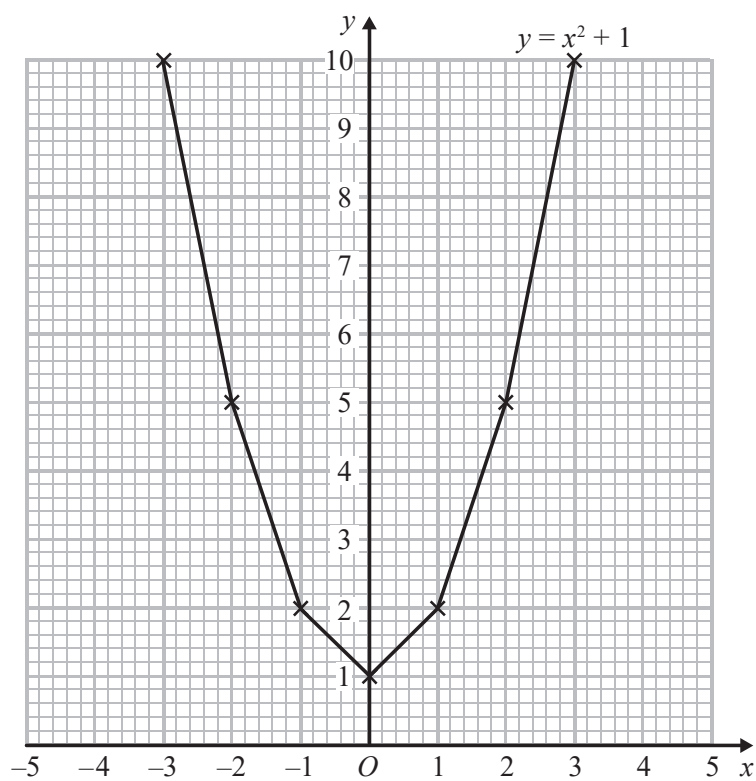
QUADRATIC & OTHER GRAPHS

Sub-topic A4b · 29 questions · 104 marks · lowest tariff first



7 Brogan needs to draw the graph of $y = x^2 + 1$

Here is her graph.



Write down one thing that is wrong with Brogan's graph.

.....

.....

(Total for Question 7 is 1 mark)

16 Here are the first five terms of a quadratic sequence.

10 21 38 61 90

Find an expression, in terms of n , for the n th term of this sequence.

.....
(Total for Question 16 is 3 marks)

17 Write down the coordinates of the turning point on the graph of $y = (x + 12)^2 - 7$

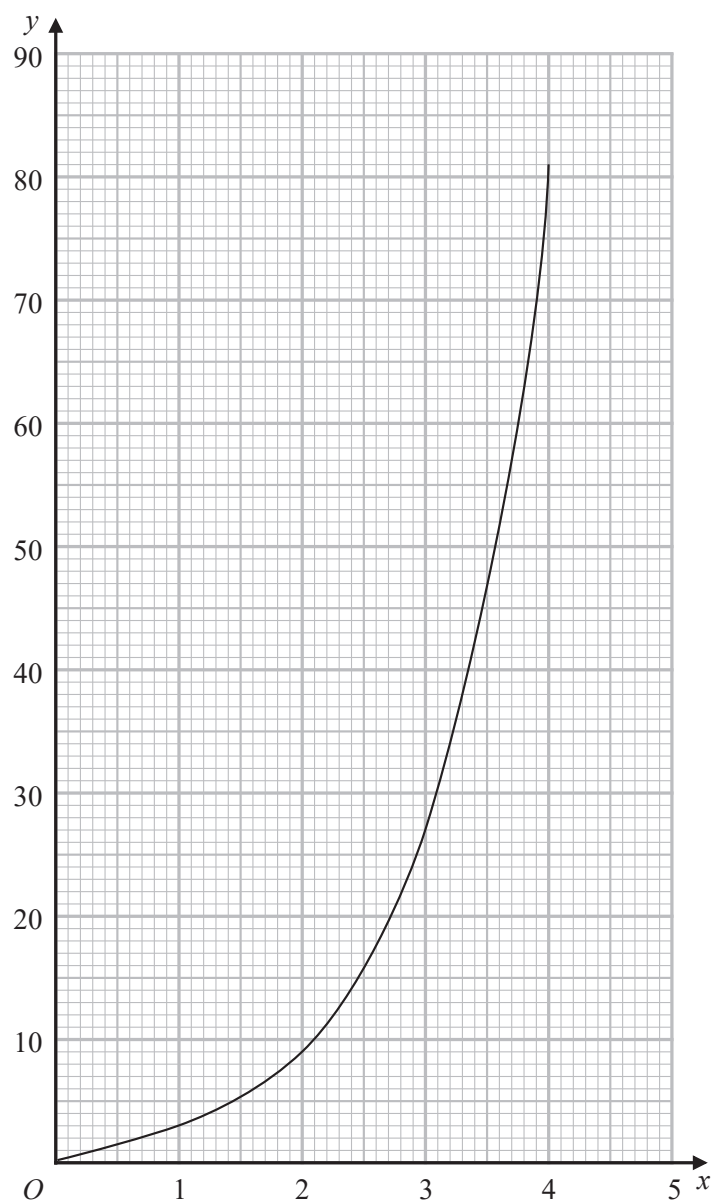
(....., ...)

(Total for Question 17 is 1 mark)



19 Sana needs to draw the graph of $y = 3^x$ for $0 \leq x \leq 4$

She draws the graph shown on the grid.



Write down one thing Sana has done wrong.

.....

.....

.....

(Total for Question 19 is 1 mark)

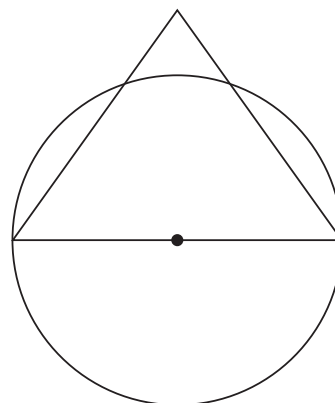


- 13 The diagram shows a circle and an equilateral triangle.

One side of the equilateral triangle is a diameter of the circle.
The circle has a circumference of 44 cm.

Work out the area of the triangle.

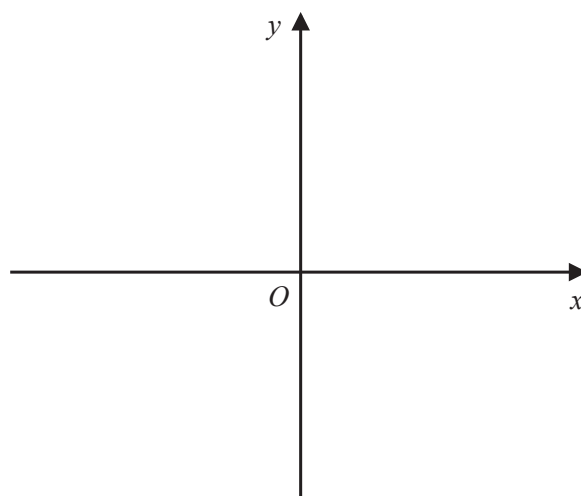
Give your answer correct to 3 significant figures.



.....cm²

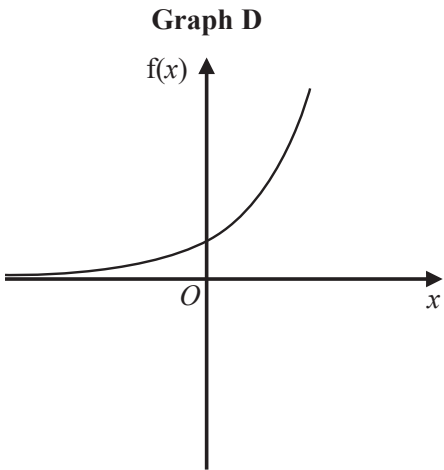
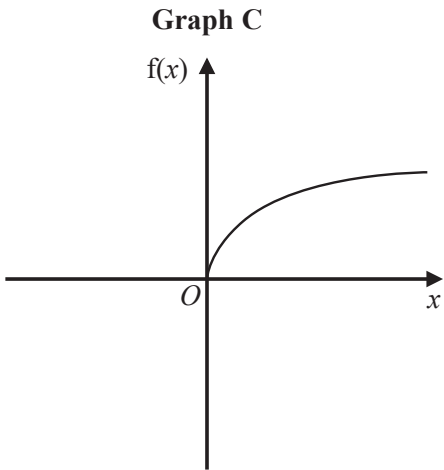
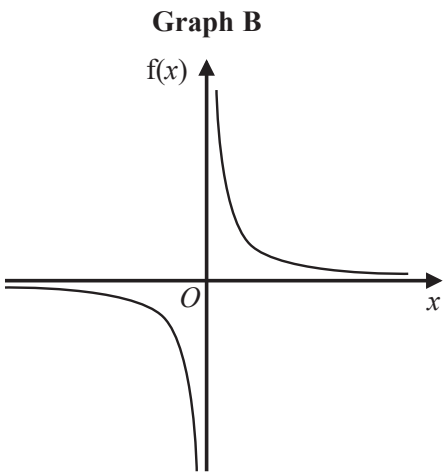
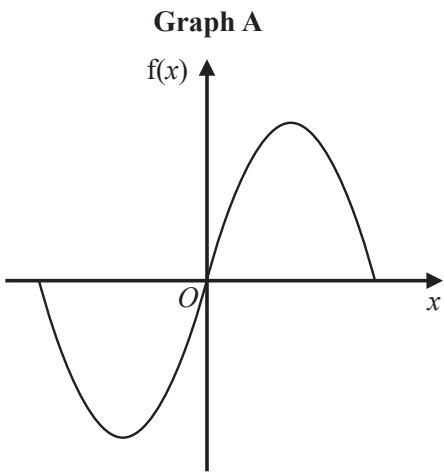
(Total for Question 13 is 3 marks)

- 14 On the grid, sketch the curve with equation $y = 2^x$
Give the coordinates of any points of intersection with the axes.



(Total for Question 14 is 2 marks)

17 Here are four graphs.



The graphs represent four different types of function f .
Match each description of the function in the table to the letter of its graph.

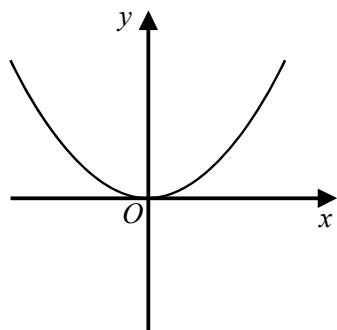
Description of function	Graph
$f(x)$ is inversely proportional to x	
$f(x)$ is a trigonometrical function	
$f(x)$ is an exponential function	
$f(x)$ is directly proportional to $\sqrt{x}$	

(Total for Question 17 is 2 marks)

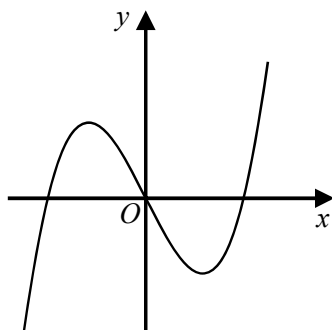


5 Here are six graphs.

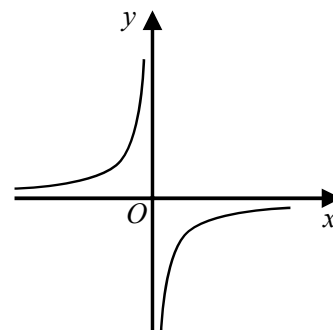
A



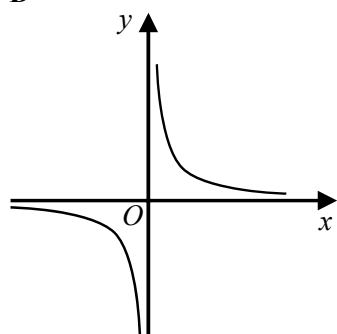
B



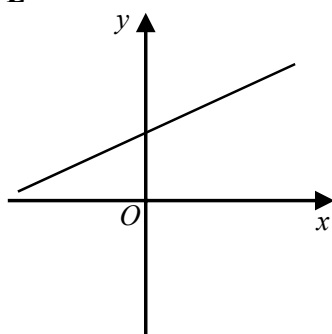
C



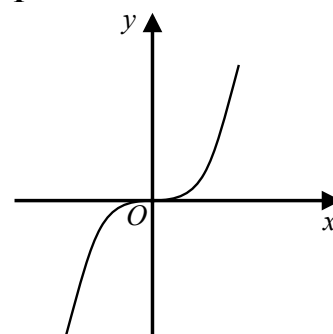
D



E



F



Write down the letter of the graph that could have the equation

(a) $y = x^3$

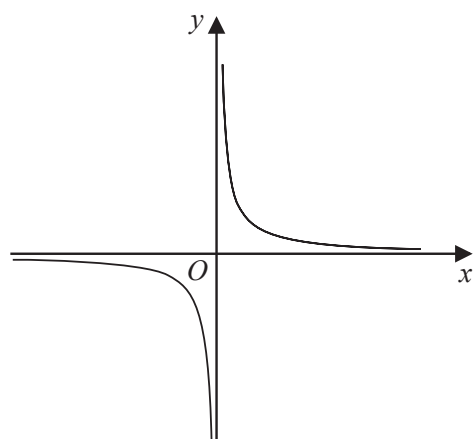
.....
(1)

(b) $y = \frac{1}{x}$

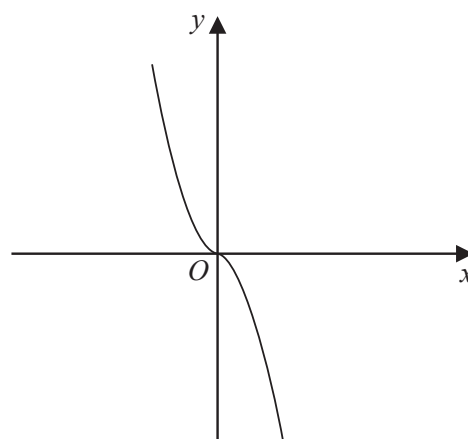
.....
(1)

(Total for Question 5 is 2 marks)

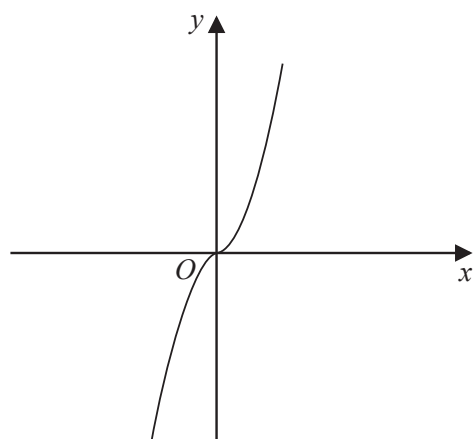
3 The diagram shows four graphs.



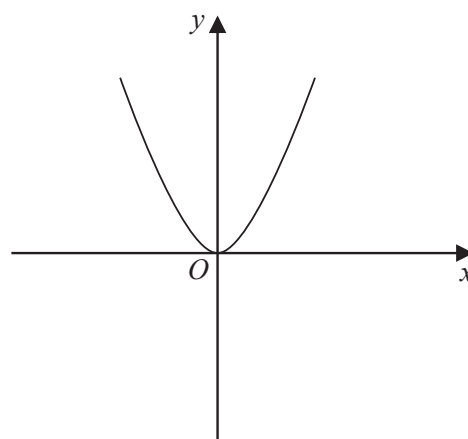
Graph A



Graph B



Graph C



Graph D

Each of the equations in the table is the equation of one of the graphs.

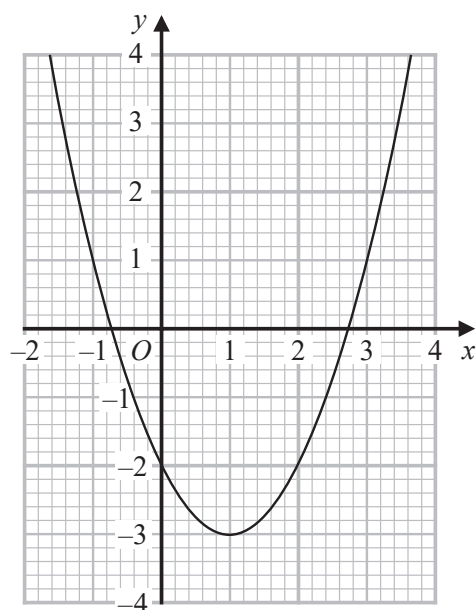
Complete the table.

Equation	Letter of graph
$y = -x^3$	
$y = x^3$	
$y = x^2$	
$y = \frac{1}{x}$	

(Total for Question 3 is 2 marks)



7 Here is the graph of $y = x^2 - 2x - 2$



(a) Write down the coordinates of the turning point on the graph of $y = x^2 - 2x - 2$

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

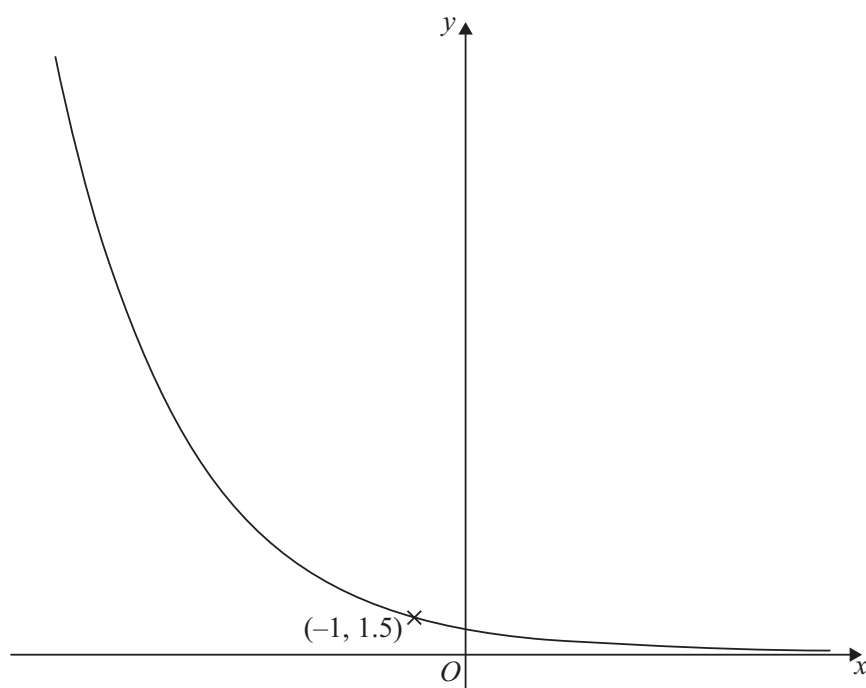
(b) Write down an estimate for one of the roots of $x^2 - 2x - 2 = 0$

.....
(1)

(Total for Question 7 is 2 marks)



17 Here is a sketch of part of the graph of $y = k^x$ where k is a positive constant.



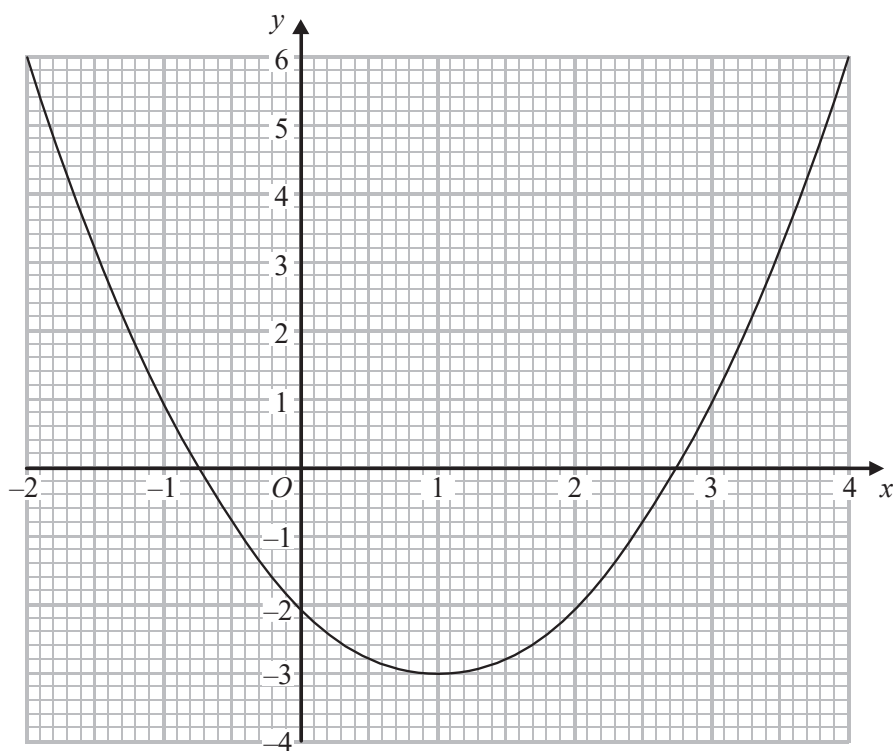
The graph passes through the point with coordinates $(-1, 1.5)$

Find the value of k .

$k = \dots\dots\dots$

(Total for Question 17 is 2 marks)

11 The graph of $y = f(x)$ is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

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

(b) Write down estimates for the roots of $f(x) = 0$

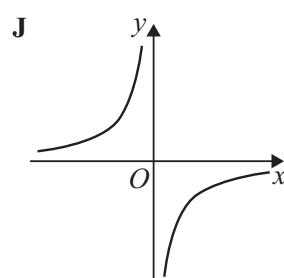
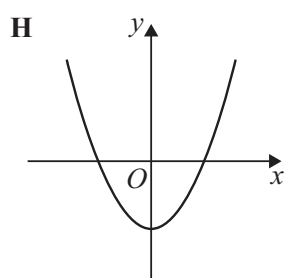
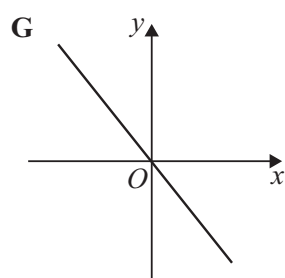
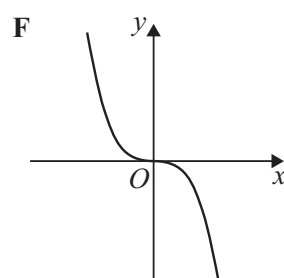
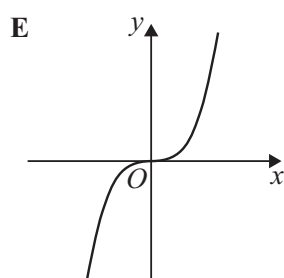
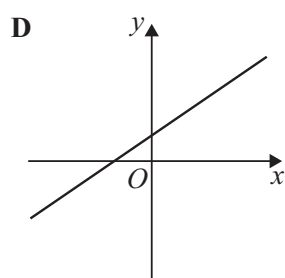
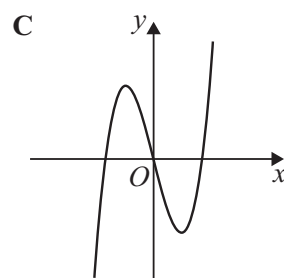
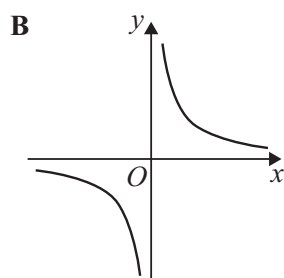
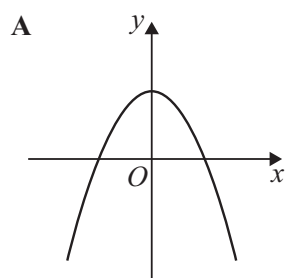
.....
(1)

(c) Use the graph to find an estimate for $f(1.5)$

.....
(1)

(Total for Question 11 is 3 marks)

12 Here are some graphs.



Write down the letter of the graph that could have the equation

(i) $y = x^2 - 4$

.....
(1)

(ii) $y = -x^3$

.....
(1)

(iii) $y = -\frac{5}{x}$

.....
(1)

(Total for Question 12 is 3 marks)



20 The curve **C** has equation $y = 2x^2 - 12x + 7$

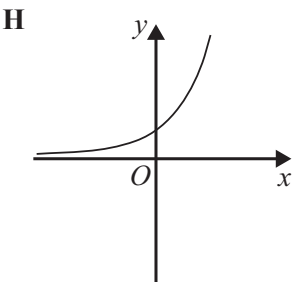
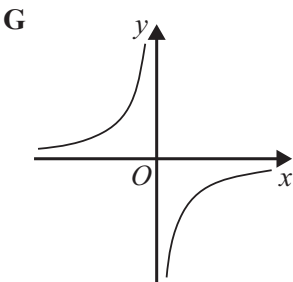
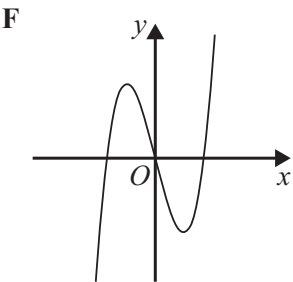
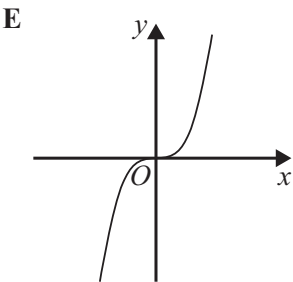
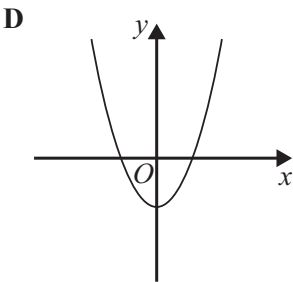
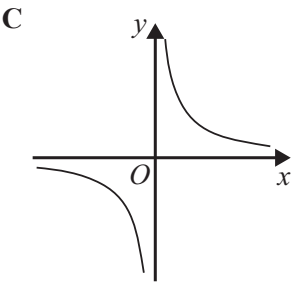
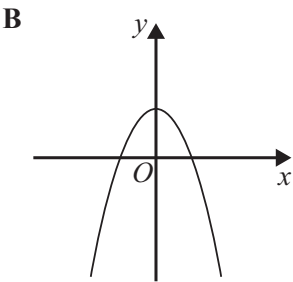
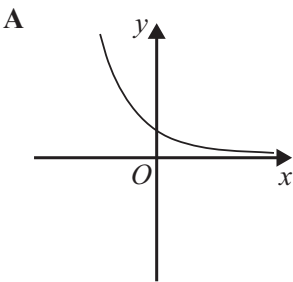
Find the coordinates of the turning point on **C**.

(....., ...)

(Total for Question 20 is 3 marks)



13 Here are some graphs.



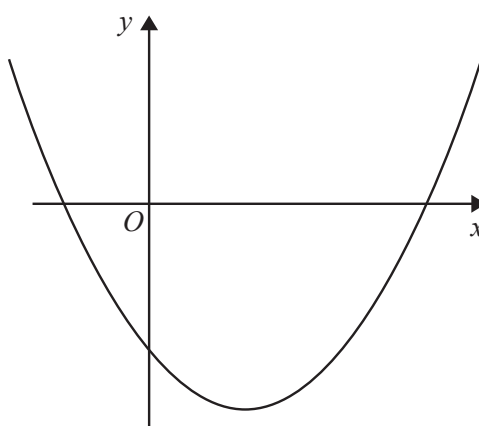
Each equation in the table is the equation of one of the graphs.
Complete the table.

Equation	Letter of graph
$y = x^3$	
$y = \frac{2}{x}$	
$y = 5 - x^2$	
$y = 3^x$	

(Total for Question 13 is 3 marks)



17 Here is a sketch of a curve.



The equation of the curve is $y = x^2 + ax + b$ where a and b are integers.

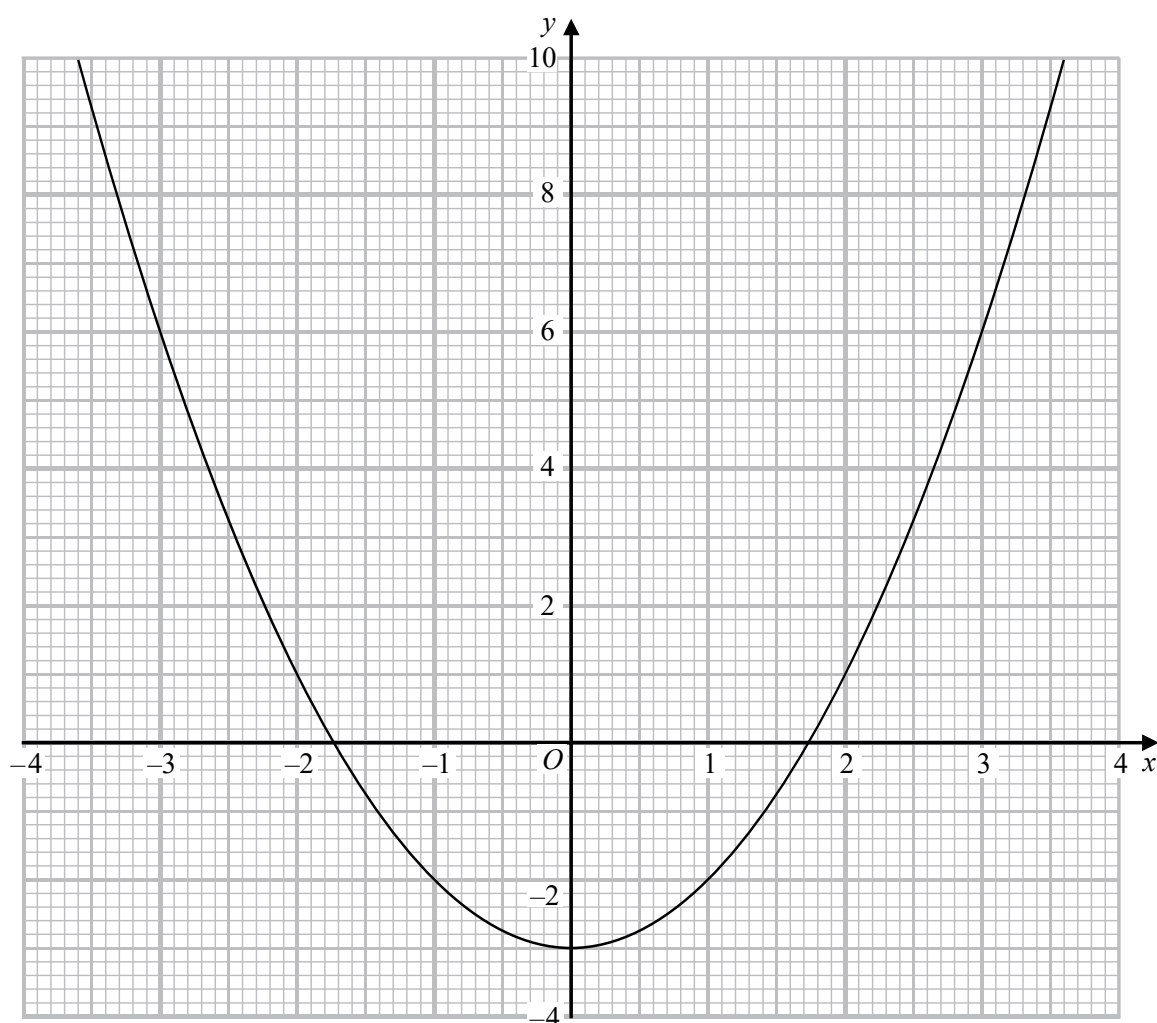
The points $(0, -5)$ and $(5, 0)$ lie on the curve.

Find the coordinates of the turning point of the curve.

(....., ...)

(Total for Question 17 is 4 marks)

17 Here is the graph of $y = x^2 - 3$



Use the graph to find estimates for the solutions to the equation $x^2 - 2x - 2 = 0$
You must show how you get your solutions.

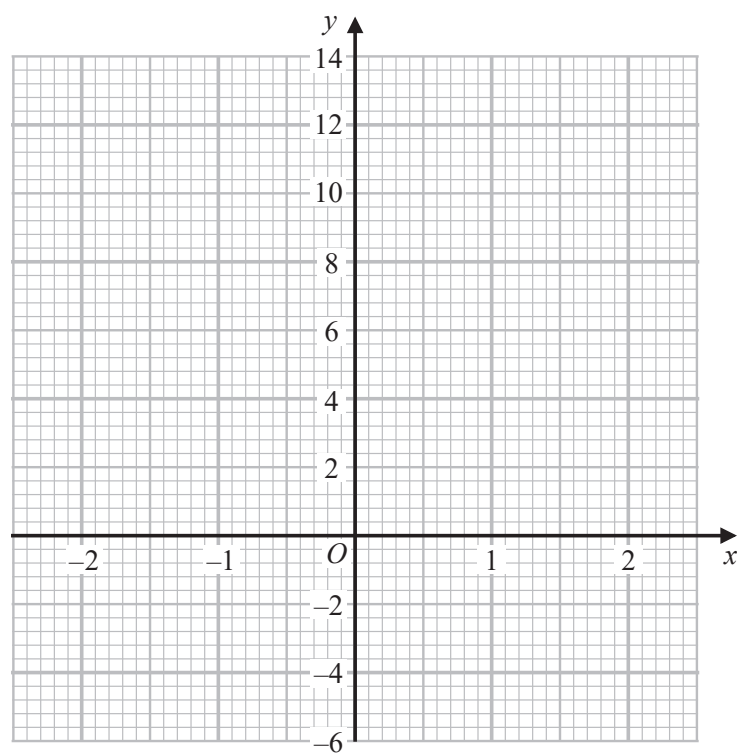
(Total for Question 17 is 4 marks)

- 4 (a) Complete the table of values for $y = 5 - x^3$

x	-2	-1	0	1	2
y		6			

(2)

- (b) On the grid below, draw the graph of $y = 5 - x^3$ for values of x from -2 to 2



(2)

(Total for Question 4 is 4 marks)

- 22 Find the coordinates of the turning point on the curve with equation $y = 9 + 18x - 3x^2$
You must show all your working.

(..... , ...)

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

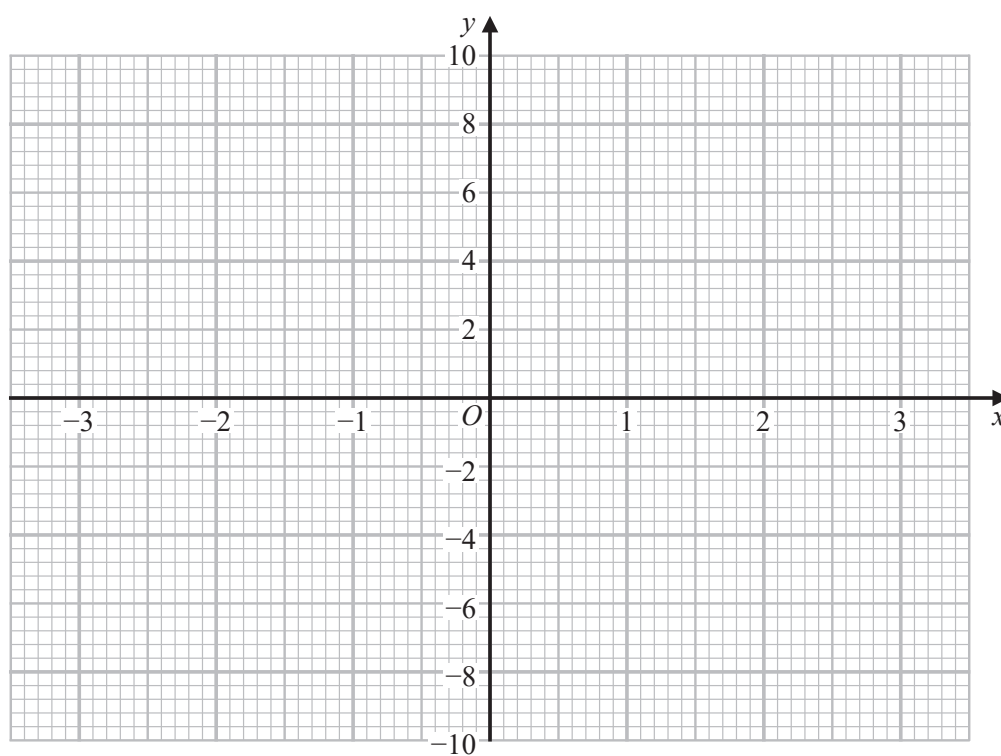


- 9 (a) Complete the table of values for $y = 6x - x^3$

x	-3	-2	-1	0	1	2	3
y	9					4	-9

(2)

- (b) On the grid, draw the graph of $y = 6x - x^3$ for values of x from -3 to 3

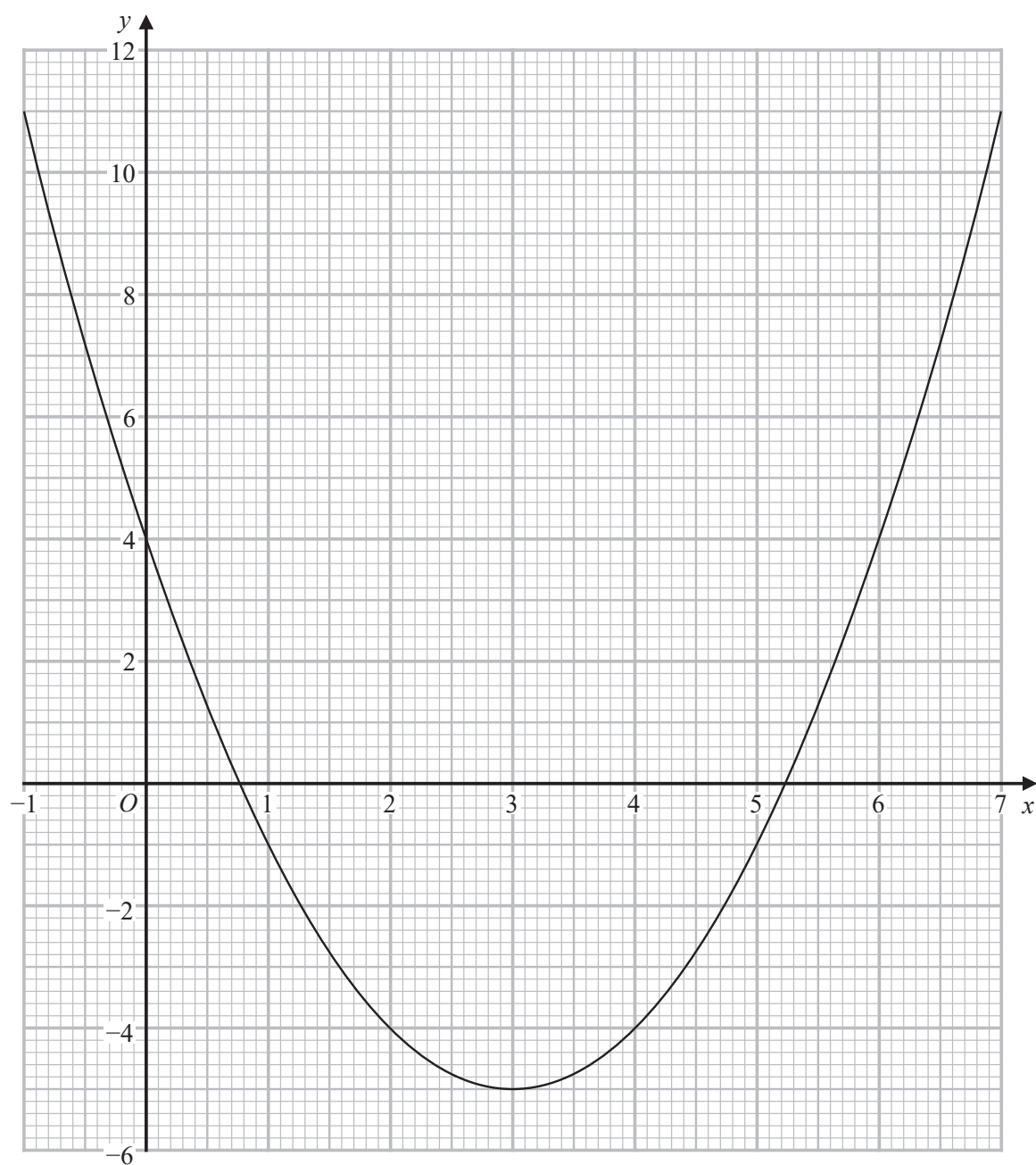


(2)

(Total for Question 9 is 4 marks)



7 Here is the graph of $y = x^2 - 6x + 4$



(a) Write down the y intercept of the graph of $y = x^2 - 6x + 4$

.....
(1)

(b) Write down the coordinates of the turning point of the graph of $y = x^2 - 6x + 4$

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

(c) Use the graph to find estimates for the roots of $x^2 - 6x + 4 = 0$

.....
(2)

(Total for Question 7 is 4 marks)

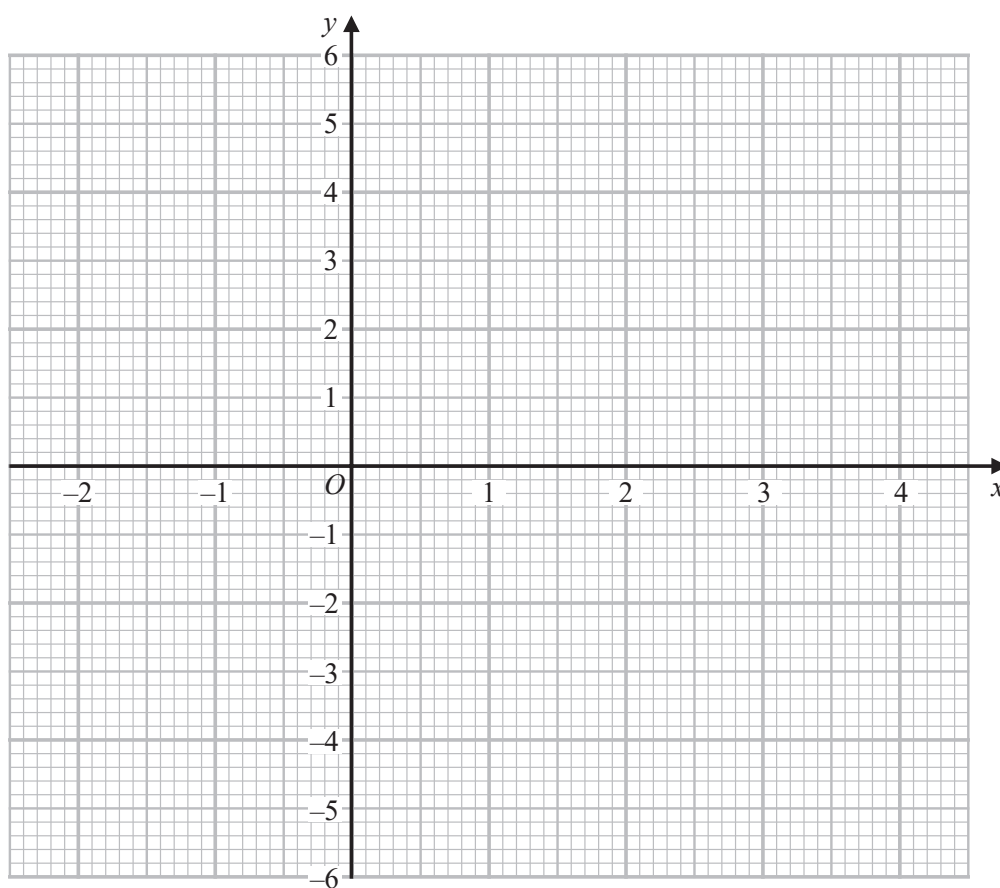


5 (a) Complete the table of values for $y = x^2 - 2x - 3$

x	-2	-1	0	1	2	3	4
y		0			-3		

(2)

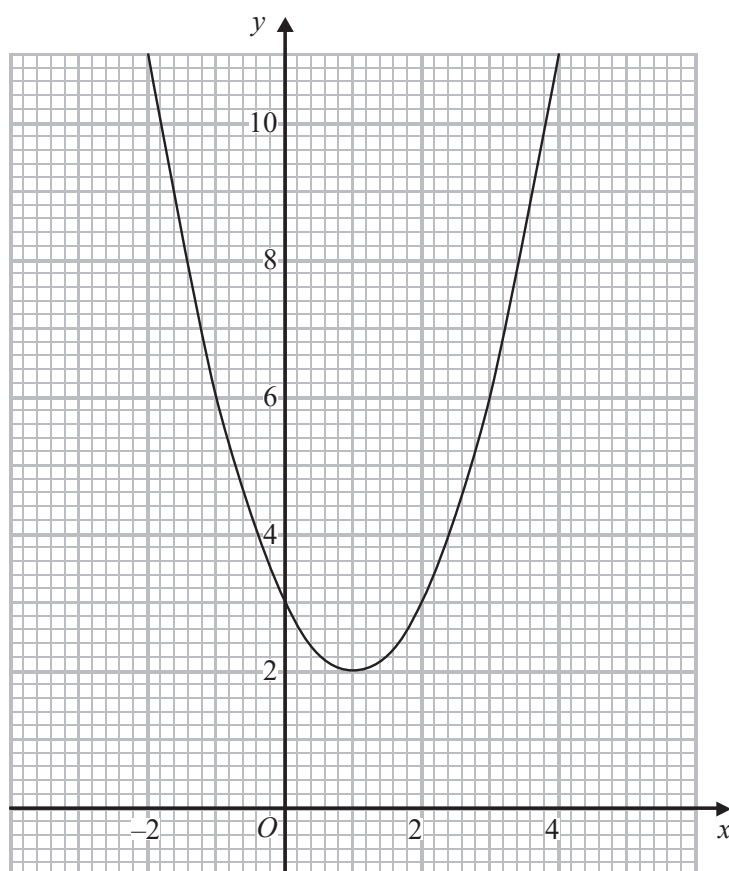
(b) On the grid, draw the graph of $y = x^2 - 2x - 3$ for values of x from -2 to 4



(2)

(Total for Question 5 is 4 marks)

20 The diagram shows part of the graph of $y = x^2 - 2x + 3$



- (a) By drawing a suitable straight line, use your graph to find estimates for the solutions of $x^2 - 3x - 1 = 0$

.....
(2)

P is the point on the graph of $y = x^2 - 2x + 3$ where $x = 2$

- (b) Calculate an estimate for the gradient of the graph at the point P .

.....
(3)

(Total for Question 20 is 5 marks)

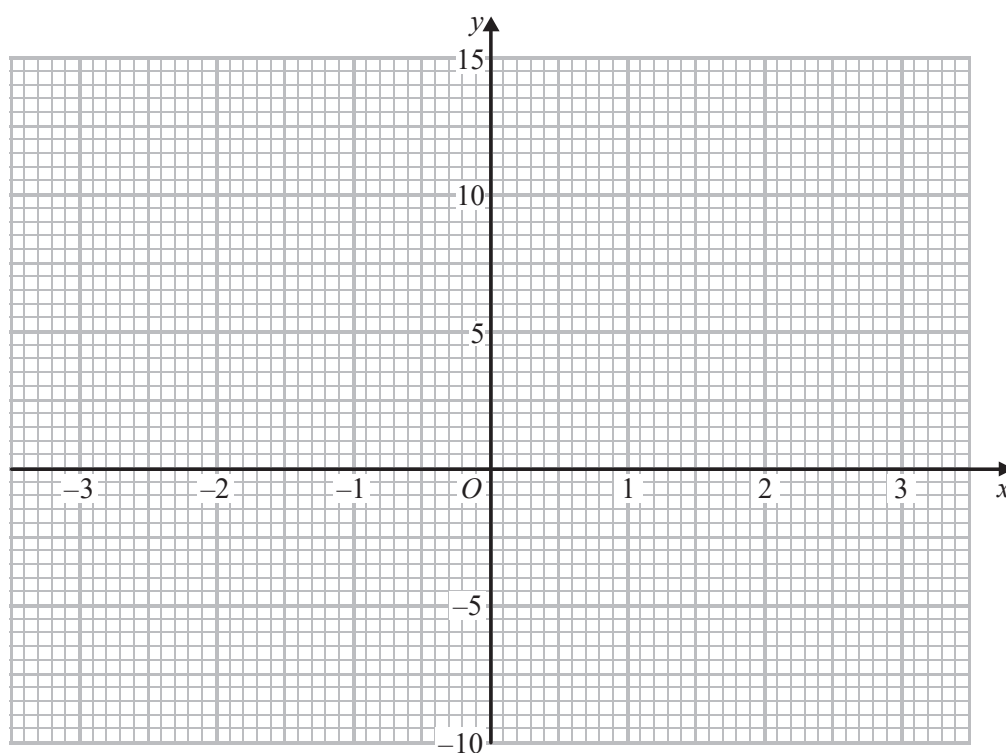


- 3 (a) Complete this table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2	3
y		-2	-4		-2		

(2)

- (b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 3



(2)

- (c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$

(1)

(Total for Question 3 is 5 marks)



21 Sketch the graph of

$$y = 2x^2 - 8x - 5$$

showing the coordinates of the turning point and the exact coordinates of any intercepts with the coordinate axes.

(Total for Question 21 is 5 marks)

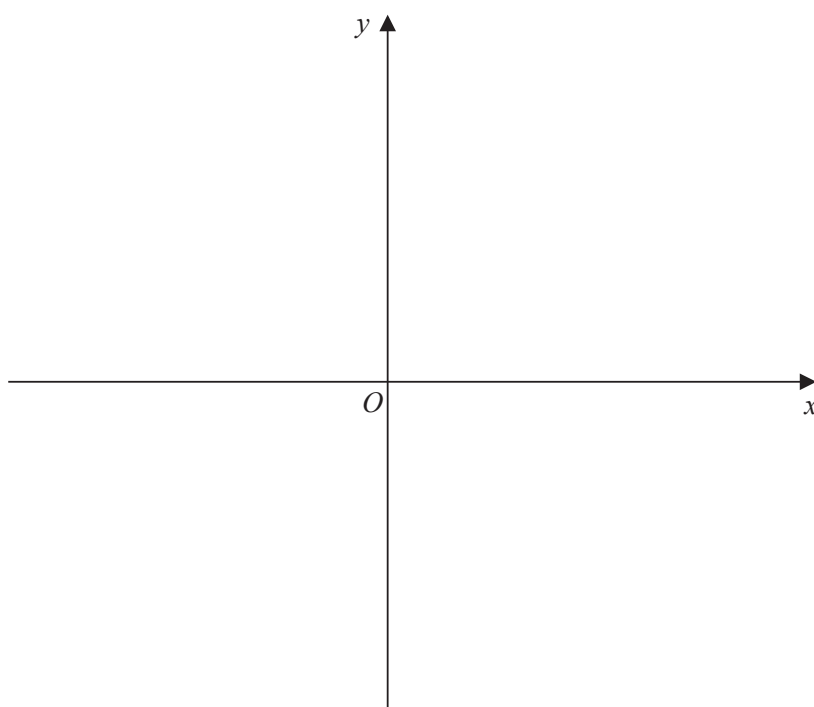


23 Sketch the graph of

$$y = x^2 - 6px - 7 \quad \text{where } p > 0$$

showing the coordinates of the turning point, in terms of p , and the coordinates of the intercept with the y -axis.

You must show all your working.



(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

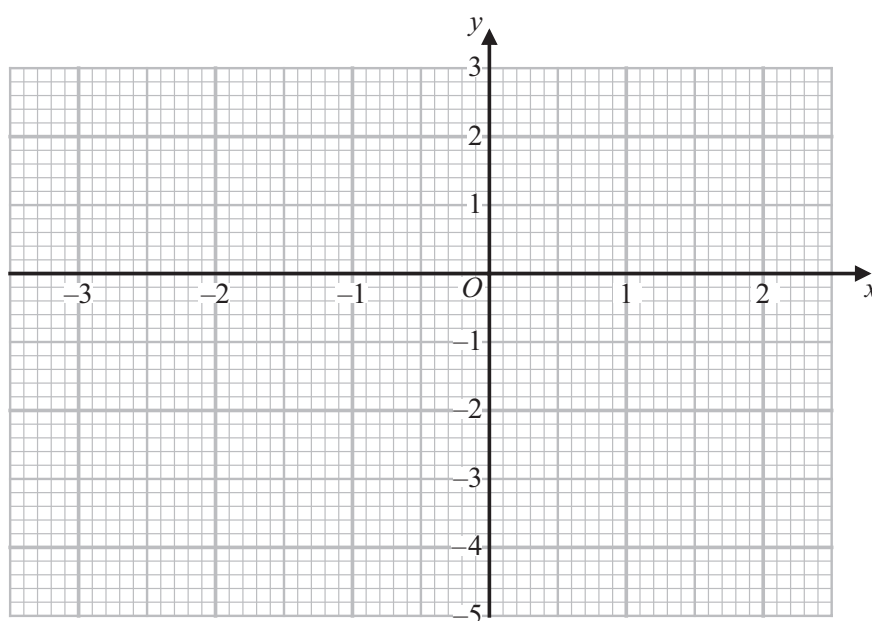


- 3 (a) Complete the table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2
y	2		-4			

(2)

- (b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 2



(2)

- (c) Write down the coordinates of the turning point of the graph of $y = x^2 + x - 4$

(....., ...)

(1)

(Total for Question 3 is 5 marks)



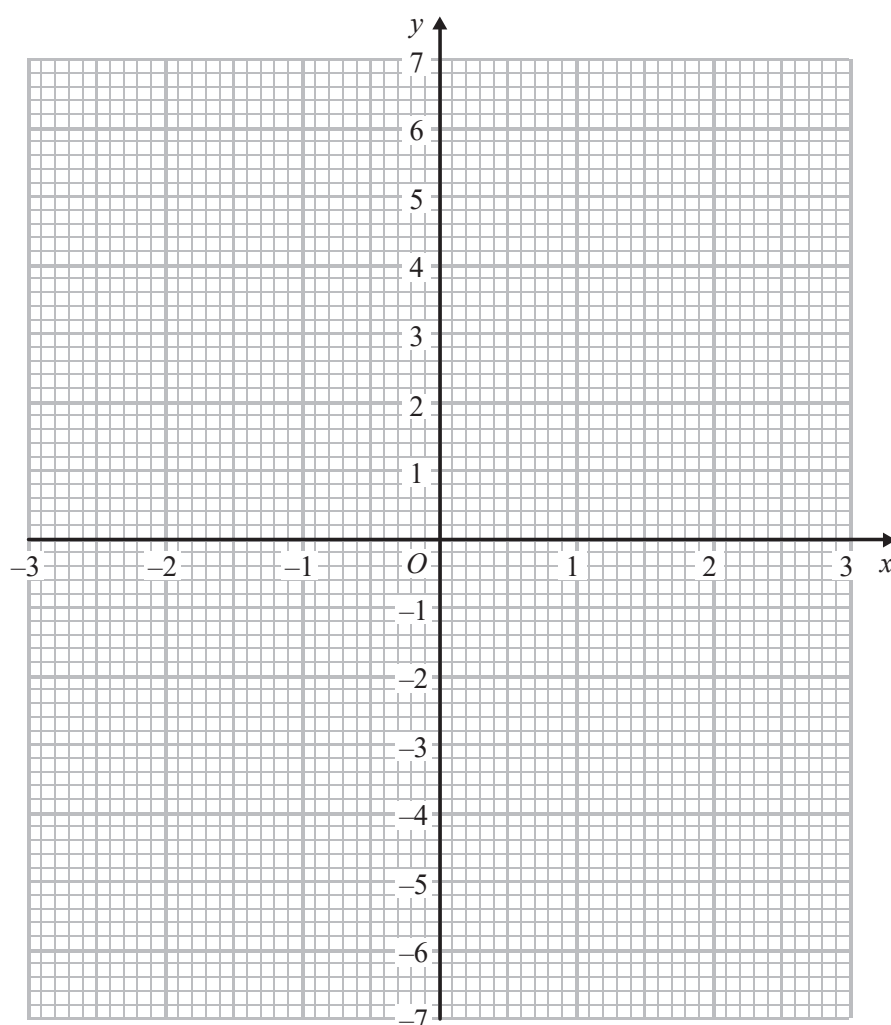
- 5 (a) Complete the table of values for $y = x^2 - x - 6$

x	-3	-2	-1	0	1	2	3
y	6			-6			

(2)

- (b) On the grid, draw the graph of $y = x^2 - x - 6$ for values of x from -3 to 3

(2)



(c) Use your graph to find estimates of the solutions to the equation $x^2 - x - 6 = -2$

.....
(2)

(Total for Question 5 is 6 marks)

6 A force of 70 newtons acts on an area of 20 cm^2

The force is increased by 10 newtons.

The area is increased by 10 cm^2

$\text{pressure} = \frac{\text{force}}{\text{area}}$
--

Helen says,

“The pressure decreases by less than 20%”

Is Helen correct?

You must show how you get your answer.

(Total for Question 6 is 3 marks)



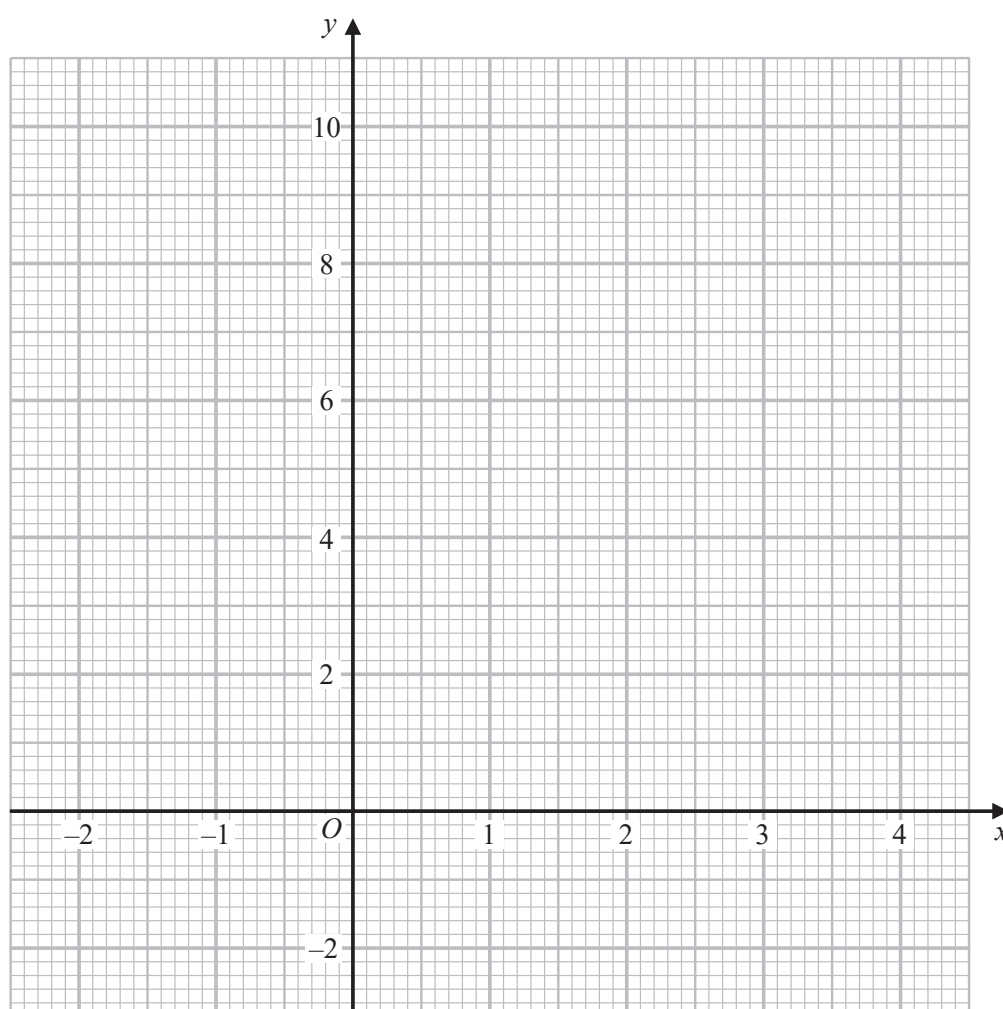
- 4 (a) Complete the table of values for $y = x^2 - 2x + 2$

x	-2	-1	0	1	2	3	4
y	10		2			5	

(2)

- (b) On the grid, draw the graph of $y = x^2 - 2x + 2$ for values of x from -2 to 4

(2)



- (c) Use your graph to find estimates of the solutions of the equation $x^2 - 2x + 2 = 4$

(2)

(Total for Question 4 is 6 marks)

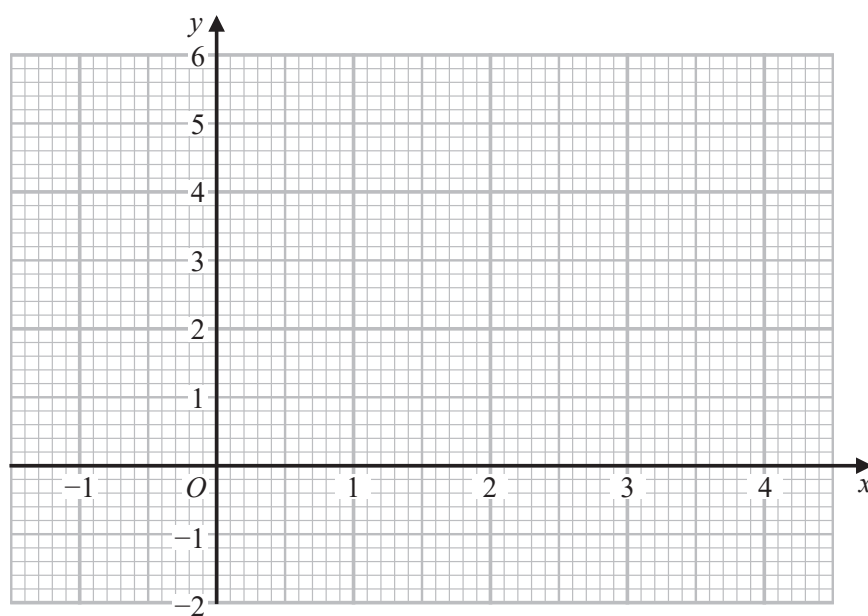


- 6 (a) Complete the table of values for $y = x^2 - 3x + 1$

x	-1	0	1	2	3	4
y		1	-1			

(2)

- (b) On the grid, draw the graph of $y = x^2 - 3x + 1$ for values of x from -1 to 4



(2)

- (c) Using your graph, find estimates for the solutions of the equation $x^2 - 3x + 1 = 0$

(2)

(Total for Question 6 is 6 marks)

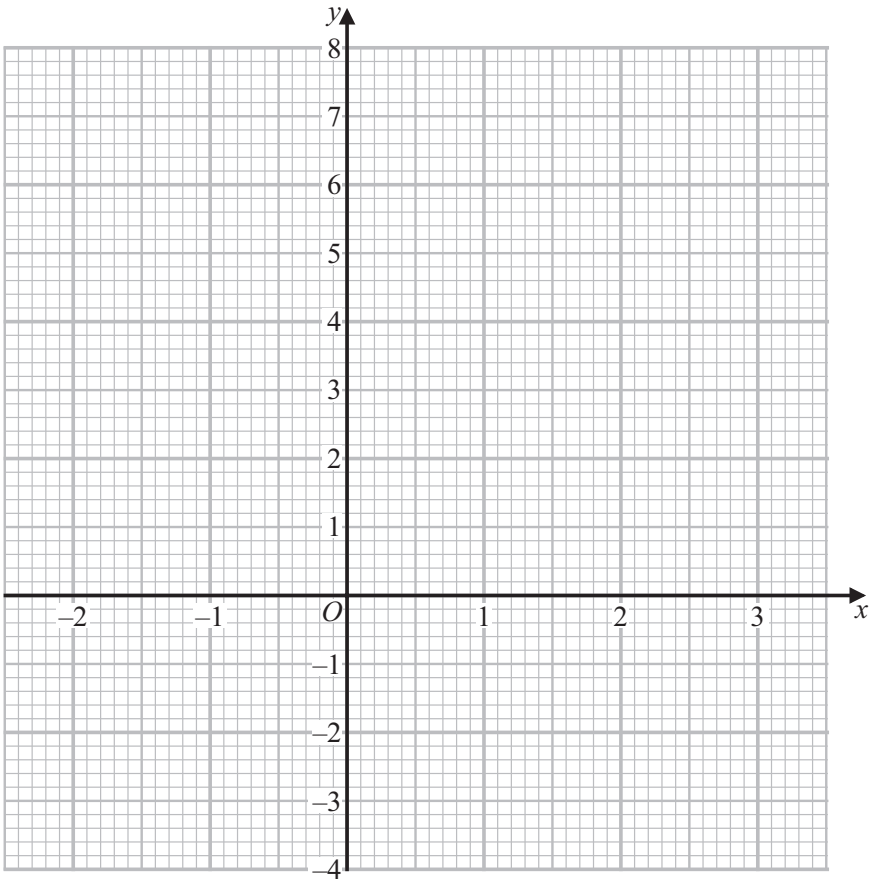


5 (a) Complete the table of values for $y = x^2 - x$

x	-2	-1	0	1	2	3
y	6		0		2	

(2)

(b) On the grid, draw the graph of $y = x^2 - x$ for values of x from -2 to 3



(2)

(c) Use your graph to find estimates for the solutions of the equation $x^2 - x = 4$

(2)

(Total for Question 5 is 6 marks)

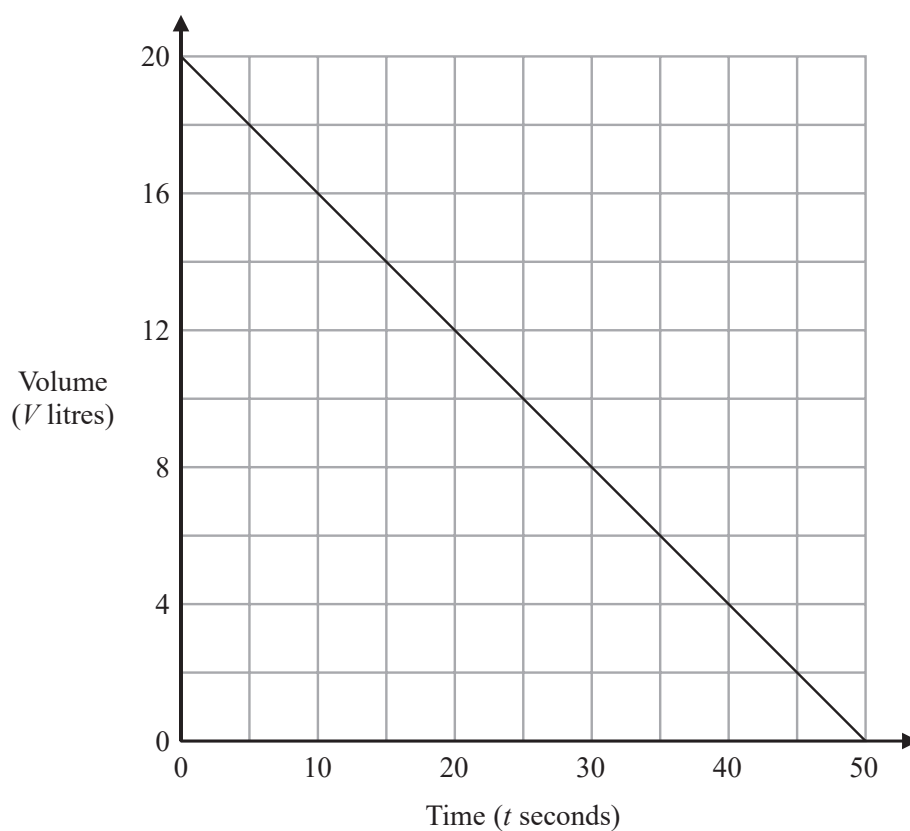
SUB-TOPIC A4c

REAL-LIFE GRAPHS & RATES OF CHANGE

Sub-topic A4c · 21 questions · 82 marks · lowest tariff first



- 7 The graph shows the volume of water, V litres, in a tank at time t seconds.



What does the gradient of this graph represent?

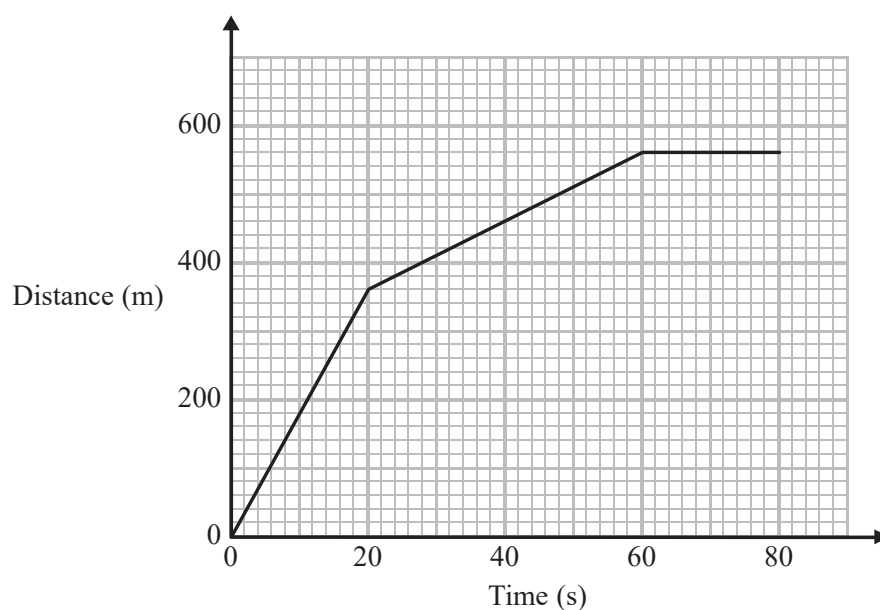
.....

.....

.....

(Total for Question 7 is 1 mark)

10 Here is part of a distance-time graph for a car's journey.



- (a) Between which two times does the car travel at its greatest speed?
Give a reason for your answer.

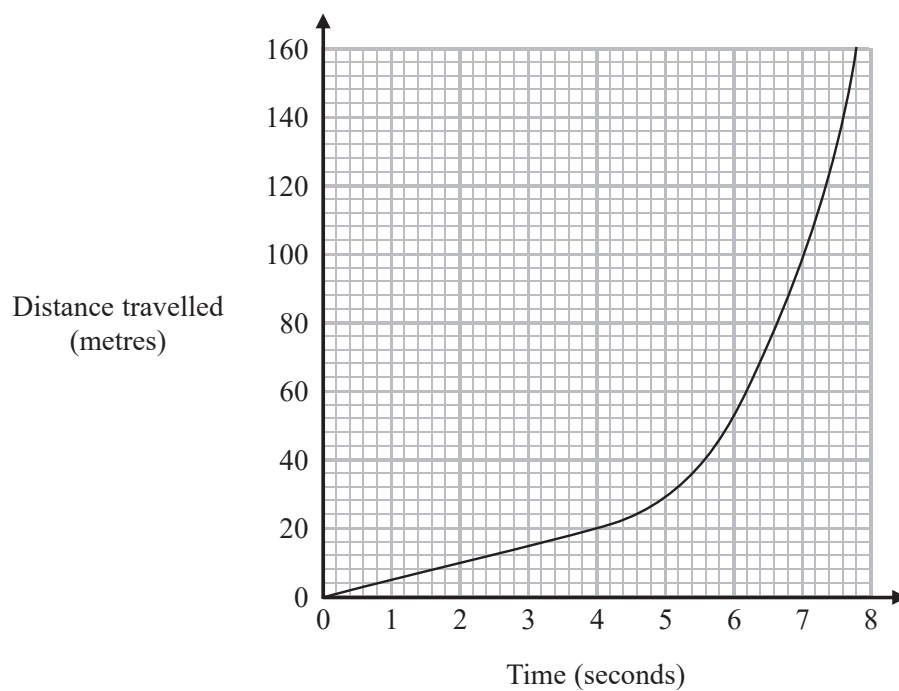
(2)

- (b) Work out this greatest speed.

..... m/s
(1)

(Total for Question 10 is 3 marks)

14 The distance-time graph shows information about part of a car journey.



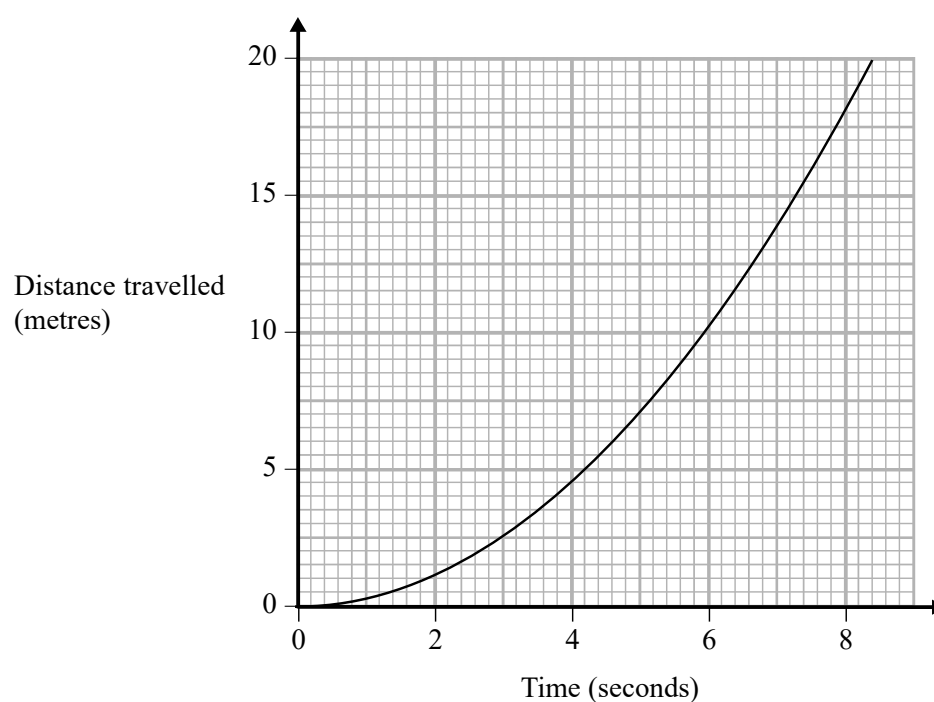
Use the graph to estimate the speed of the car at time 5 seconds.

..... m/s

(Total for Question 14 is 3 marks)



19 The graph shows information about part of a cyclist's journey.

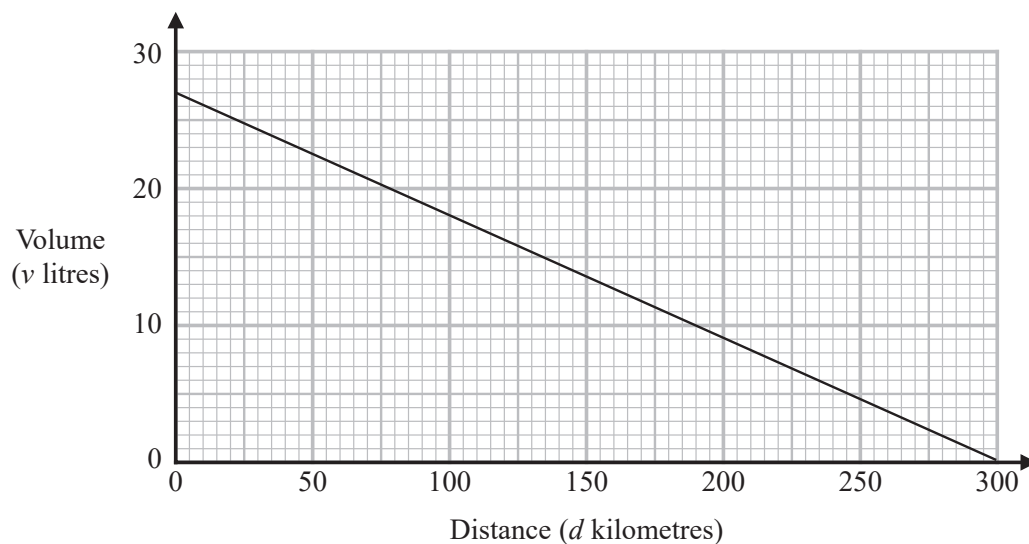


Work out an estimate of the speed, in m/s, of the cyclist at time 6 seconds.

..... m/s

(Total for Question 19 is 3 marks)

- 12 The graph gives information about the volume, v litres, of petrol in the tank of Jim's car after it has travelled a distance of d kilometres.



- (a) Find the gradient of the graph.

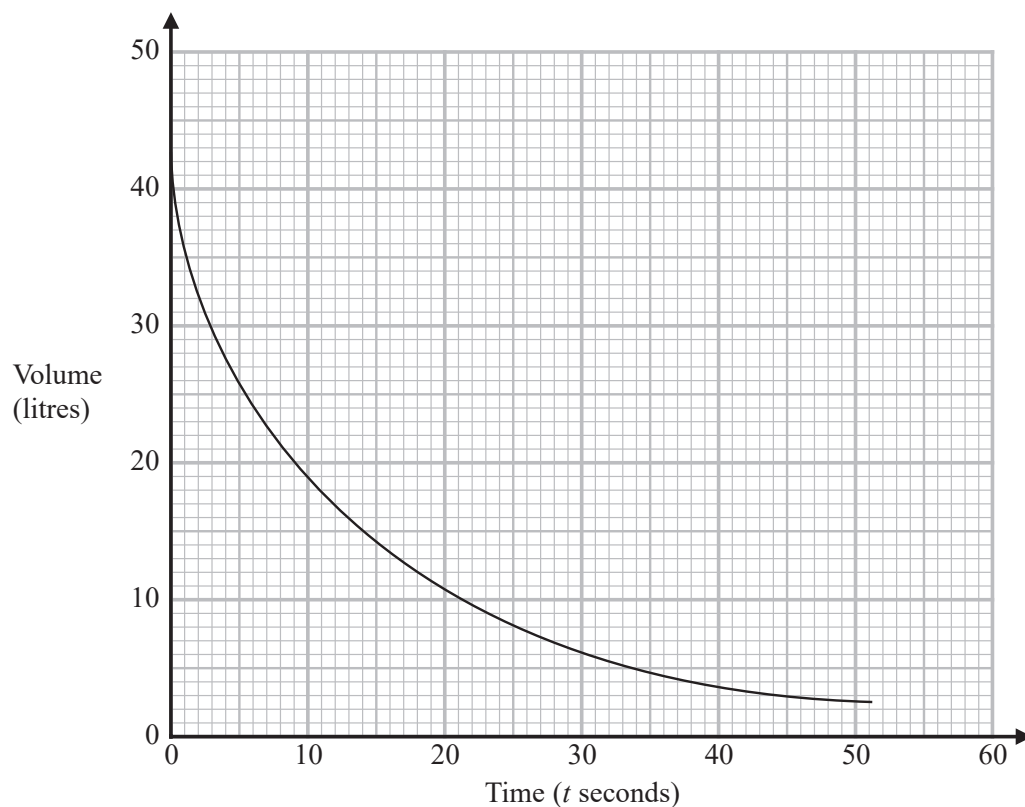
.....
(2)

- (b) Interpret what the gradient of the graph represents.

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

.....
(Total for Question 12 is 3 marks)

- 15 The graph gives the volume of water, in litres, in a container at time t seconds after the water started to flow out of the container.



Using the graph, work out an estimate for the rate at which the water is flowing out of the container when $t = 12$
You must show your working.

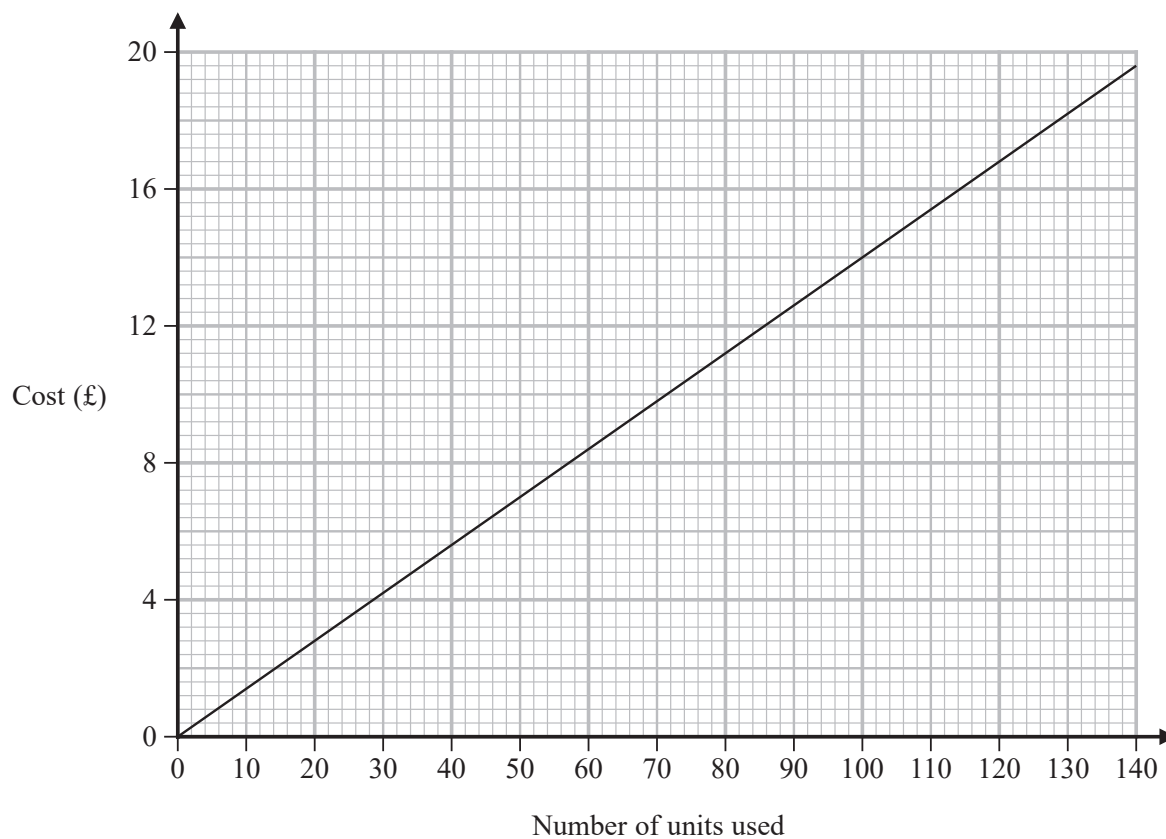
..... litres per second

(Total for Question 15 is 3 marks)



- 8 An electricity company charges the same fixed amount for each unit of electricity used.

David uses this graph to work out the total cost of the electricity he has used.



- (a) Work out the gradient of the straight line.

.....
(2)

- (b) What does the gradient of this line represent?

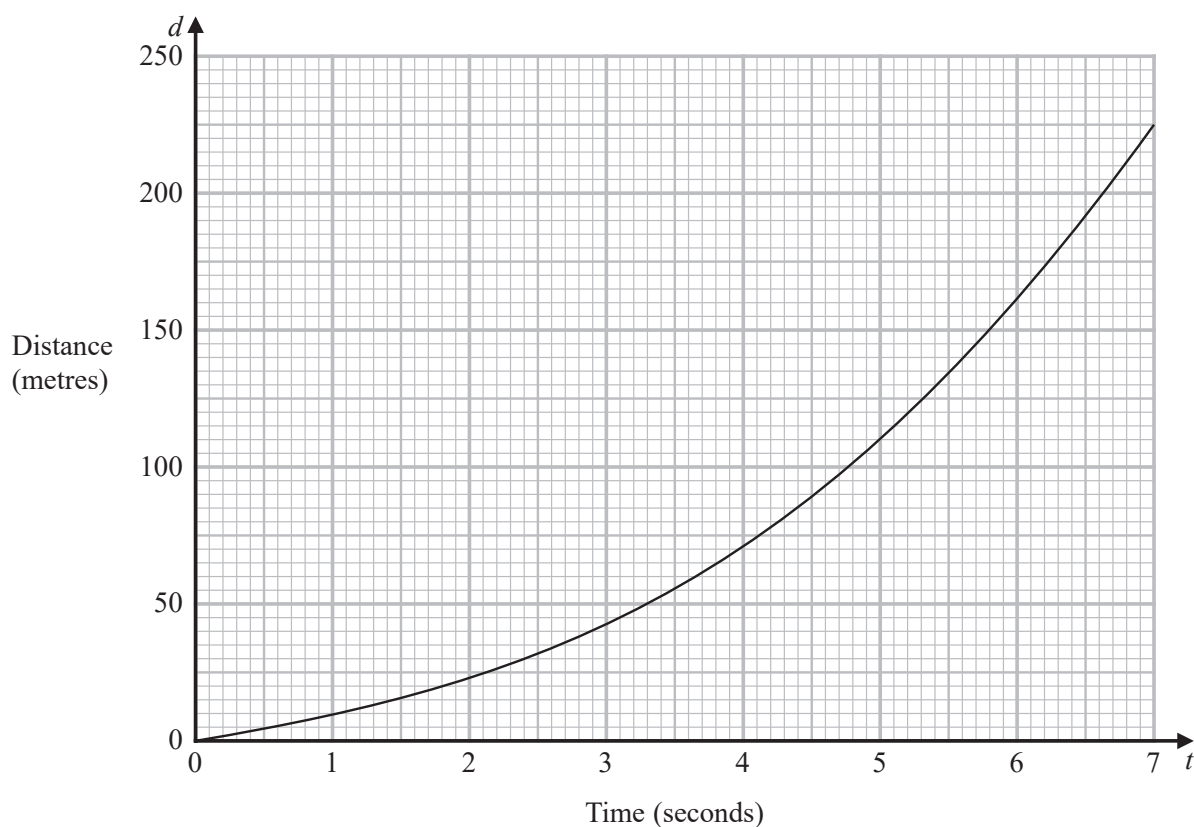
.....
.....
.....
(1)

(Total for Question 8 is 3 marks)



15 An object falls from rest.

Here is the distance-time graph for the distance (d metres) fallen by the object t seconds after it starts to fall.

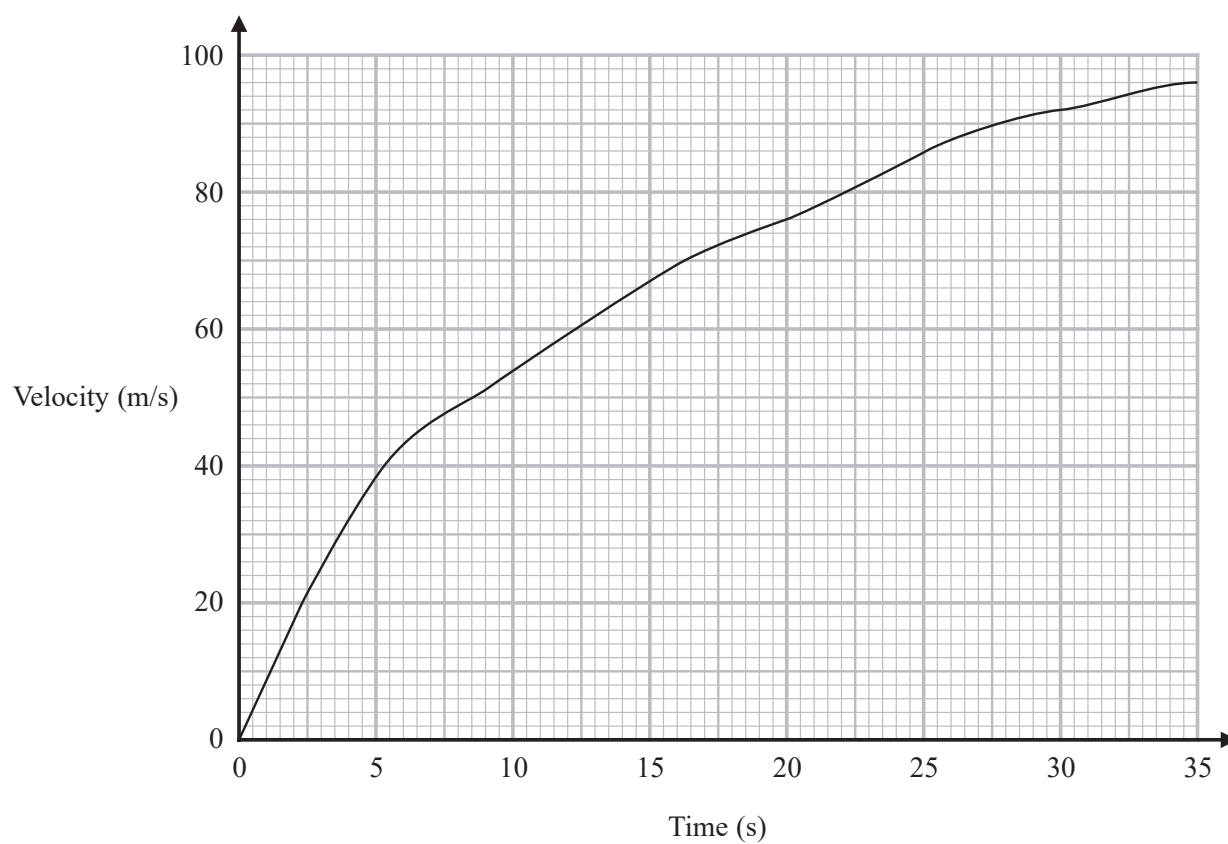


Work out an estimate for the gradient of the graph at $t = 3$
You must show how you get your answer.

(Total for Question 15 is 3 marks)



22 Here is a velocity-time graph for an aeroplane.

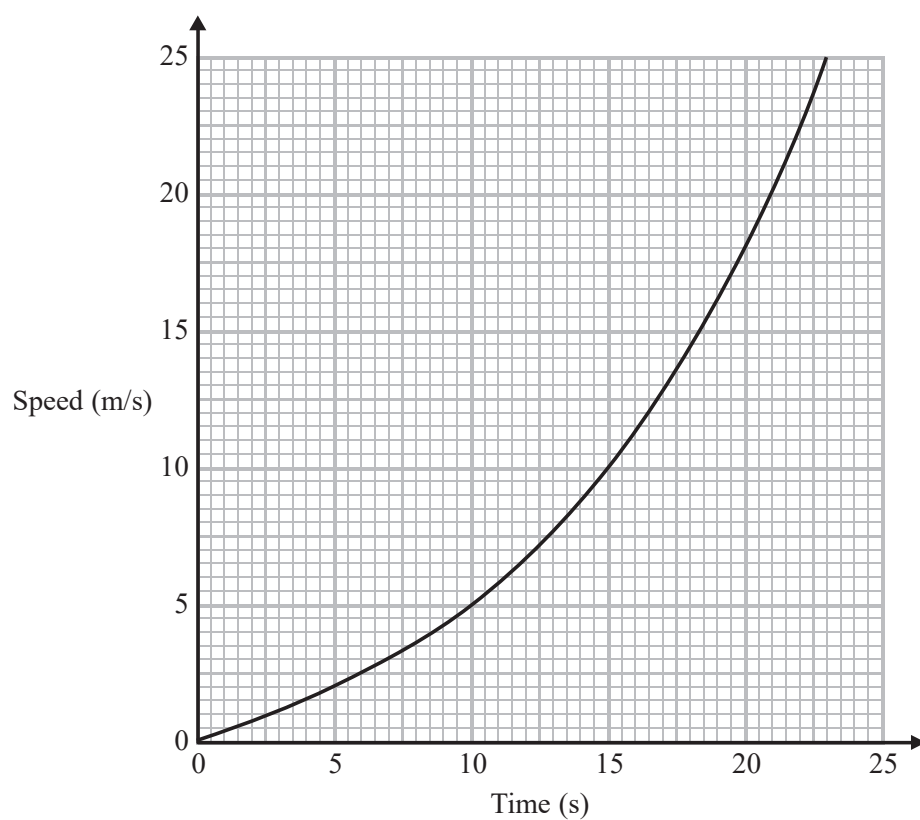


Work out an estimate for the distance the aeroplane travelled in the first 30 seconds.
Use 3 strips of equal width.

..... m

(Total for Question 22 is 3 marks)

18 Here is a speed-time graph for a train.



- (a) Work out an estimate for the distance the train travelled in the first 20 seconds.
Use 4 strips of equal width.

..... m

(3)

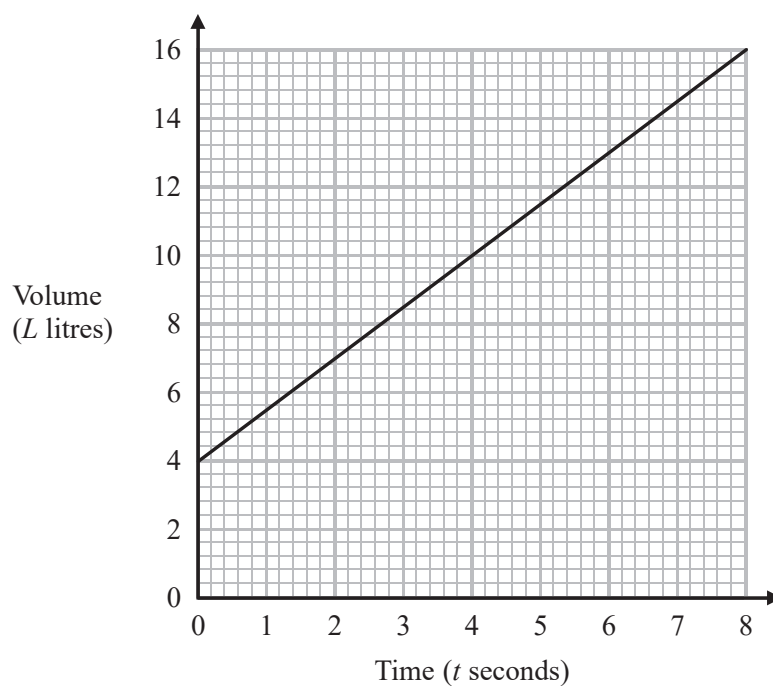
- (b) Is your answer to (a) an underestimate or an overestimate of the actual distance the train travelled?
Give a reason for your answer.

.....
.....

(1)

(Total for Question 18 is 4 marks)

12 The graph shows the volume of liquid (L litres) in a container at time t seconds.



(a) Find the gradient of the graph.

.....
(2)

(b) Explain what this gradient represents.

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

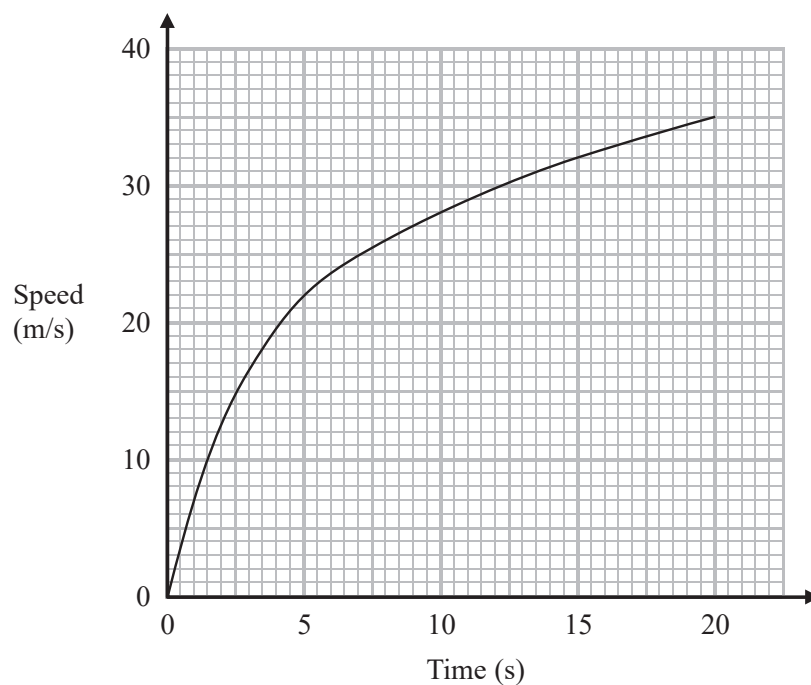
The graph intersects the volume axis at $L = 4$

(c) Explain what this intercept represents.

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

(Total for Question 12 is 4 marks)

- 15 The graph shows the speed of a car, in metres per second, during the first 20 seconds of a journey.



- (a) Work out an estimate for the distance the car travelled in the first 20 seconds.
Use 4 strips of equal width.

..... metres
(3)

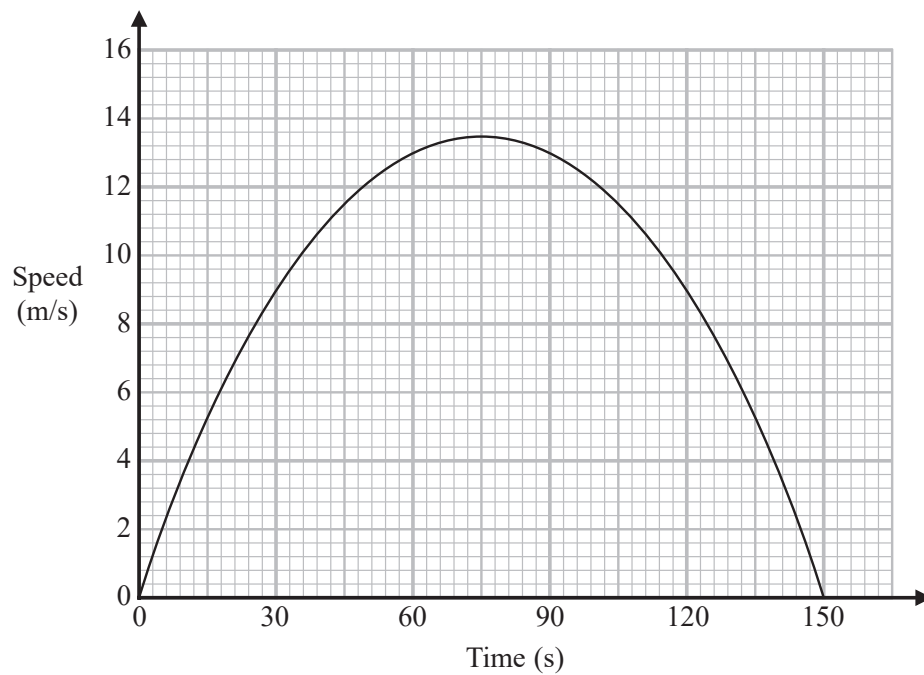
- (b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 20 seconds?
Give a reason for your answer.

(1)

(Total for Question 15 is 4 marks)



16 Here is a speed-time graph for a car.



(a) Work out an estimate for the distance the car travelled in the first 30 seconds.

..... m
(2)

(b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 30 seconds?
Give a reason for your answer.

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

Julian used the graph to answer this question.

Work out an estimate for the acceleration of the car at time 60 seconds.

Here is Julian's working.

$$\text{acceleration} = \text{speed} \div \text{time}$$

$$= 13 \div 60$$

$$= 0.21\dot{6} \text{ m/s}^2$$

Julian's method does not give a good estimate of the acceleration at time 60 seconds.

(c) Explain why.

.....

.....

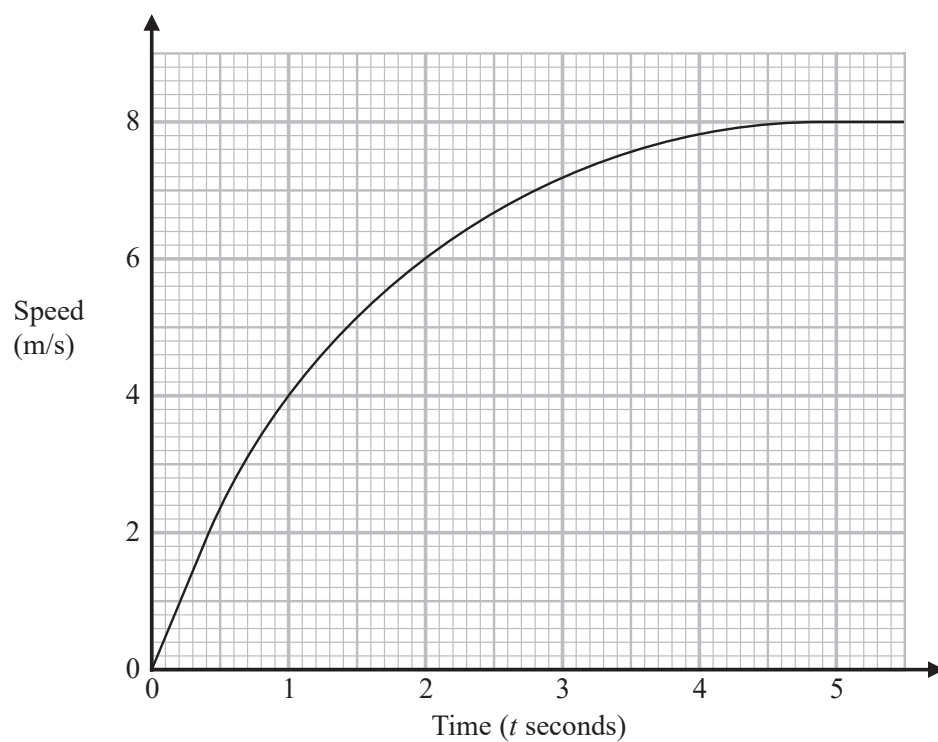
.....

(1)

(Total for Question 16 is 4 marks)



- 21 Here is a speed-time graph showing the speed, in metres per second, of an object t seconds after it started to move from rest.



- (a) Using 3 trapeziums of equal width, work out an estimate for the area under the graph between $t = 1$ and $t = 4$

.....
(3)

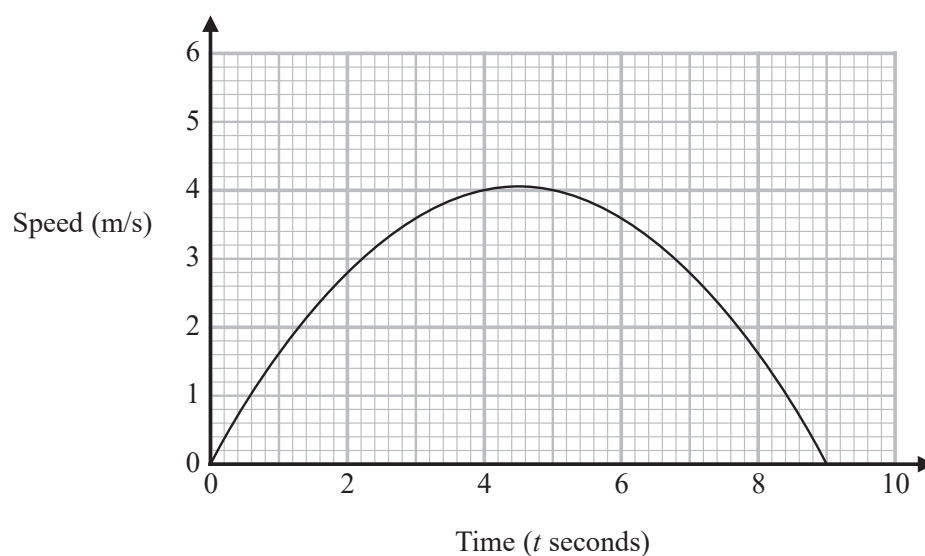
- (b) What does this area represent?

.....
(1)

(Total for Question 21 is 4 marks)



14 Here is a speed-time graph.



(a) Work out an estimate of the gradient of the graph at $t = 2$

.....
(3)

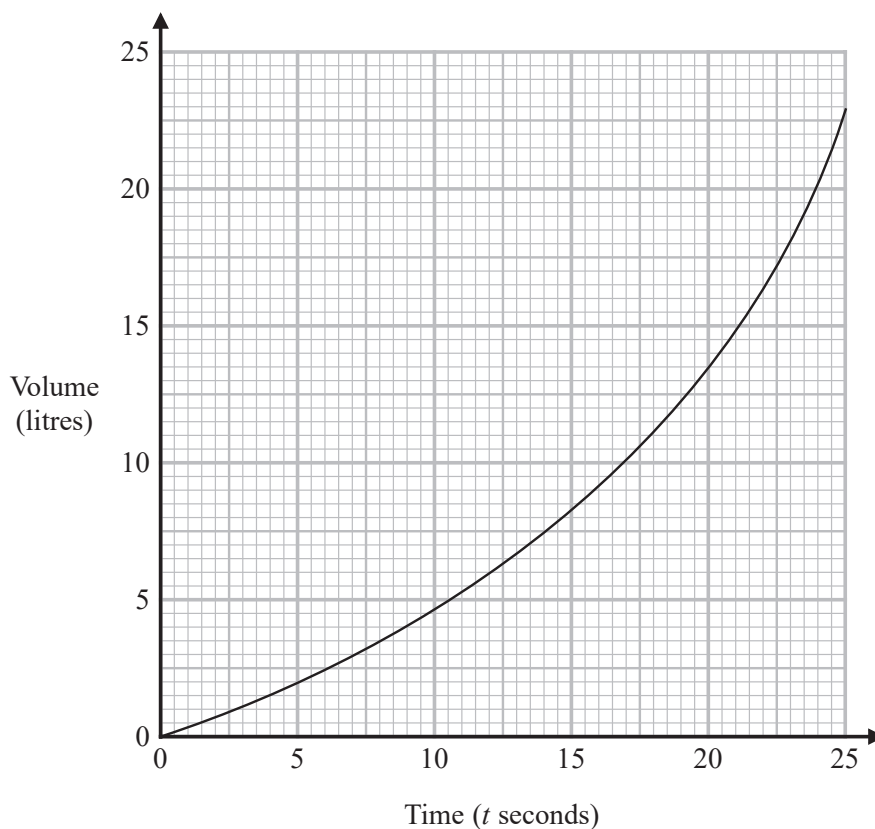
(b) What does the area under the graph represent?

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

(Total for Question 14 is 4 marks)



- 21 The graph below gives the volume, in litres, of water in a container t seconds after the water starts to fill the container.



- (a) Calculate an estimate for the gradient of the graph when $t = 17.5$
You must show how you get your answer.

.....
(3)

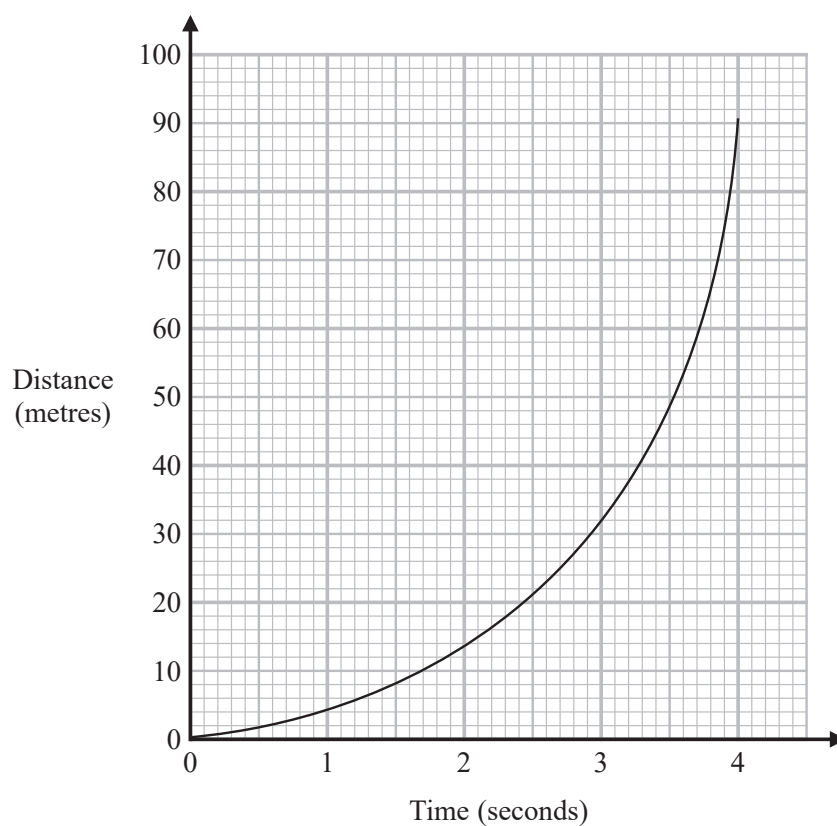
- (b) Describe fully what the gradient in part (a) represents.

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

(Total for Question 21 is 4 marks)



17 Here is a distance-time graph.



- (a) Find an estimate of the gradient of the graph at time 2.5 seconds.
You must show how you get your answer.

.....
(3)

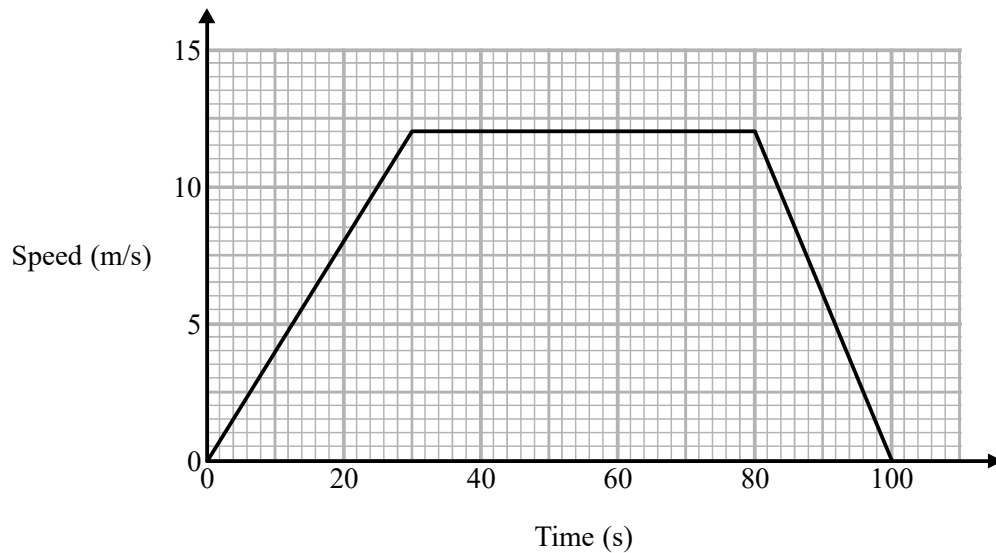
- (b) What does the gradient of the graph represent?

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

(Total for Question 17 is 4 marks)



- 21 Here is a speed-time graph for a train journey between two stations.
The journey took 100 seconds.



- (a) Calculate the time taken by the train to travel half the distance between the two stations.
You must show all your working.

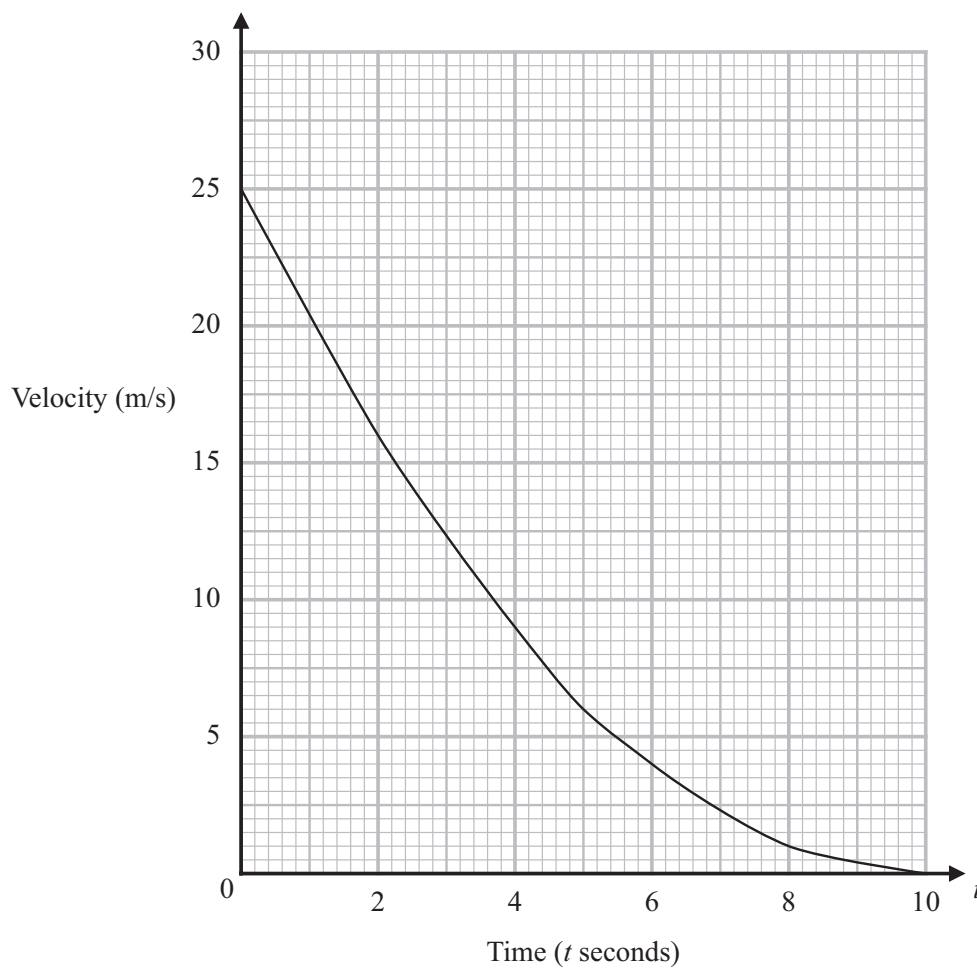
..... seconds
(4)

- (b) Compare the acceleration of the train during the first part of its journey with the acceleration of the train during the last part of its journey.

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

(Total for Question 21 is 5 marks)

- 14 The graph shows the velocity of a car, in metres per second, t seconds after it starts to slow down.



- (a) Calculate an estimate for the acceleration of the car when $t = 5$
You must show all your working.

..... m/s^2
(3)



(b) Work out an estimate for the distance the car travels in the first 6 seconds after it starts to slow down.
Use 3 strips of equal width.

..... m
(3)

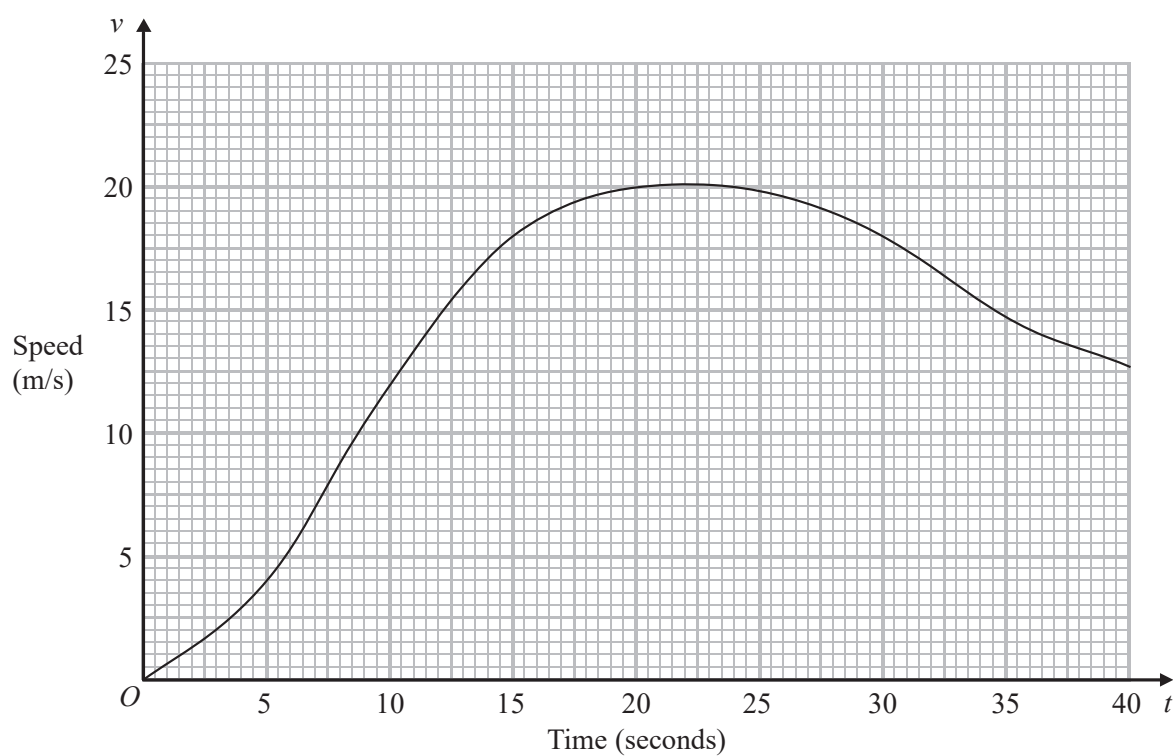
(Total for Question 14 is 6 marks)

15 Given that a is a prime number, rationalise the denominator of $\frac{1}{\sqrt{a} + 1}$
Give your answer in its simplest form.

.....
(Total for Question 15 is 2 marks)

14 A car moves from rest.

The graph gives information about the speed, v metres per second, of the car t seconds after it starts to move.



(a) (i) Calculate an estimate of the gradient of the graph at $t = 15$

.....
(3)

(ii) Describe what your answer to part (i) represents.

.....
(1)



- (b) Work out an estimate for the distance the car travels in the first 20 seconds of its journey.
Use 4 strips of equal width.

.....m

(3)

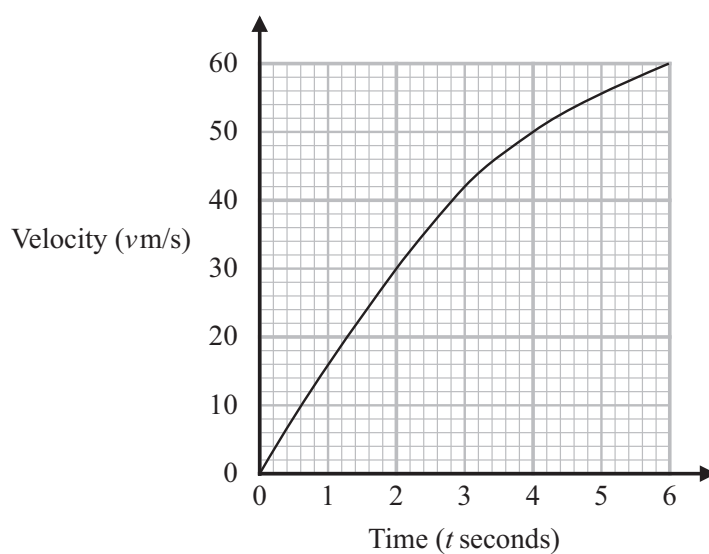
(Total for Question 14 is 7 marks)

- 15 Make m the subject of the formula $f = \frac{3m + 4}{m - 1}$

.....
(Total for Question 15 is 3 marks)



12 The graph shows the velocity, v m/s, of a particle t seconds after it starts to move.



- (a) (i) Work out an estimate of the gradient of the graph at $t = 3$
You must show how you get your answer.

.....
(3)

- (ii) What does this gradient represent?

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



- (b) Work out an estimate for the distance the particle travelled in the first 6 seconds.
Use 3 strips of equal width.

..... m

(3)

(Total for Question 12 is 7 marks)



SUB-TOPIC A4d

GRAPH TRANSFORMATIONS & CIRCLE EQUATIONS

Sub-topic A4d · 33 questions · 110 marks · lowest tariff first



15 The equation of a circle is $x^2 + y^2 = 42.25$

Find the radius of the circle.

(Total for Question 15 is 1 mark)

16 There are only red counters and blue counters in a bag.

Joe takes at random a counter from the bag.

The probability that the counter is red is 0.65

Joe puts the counter back into the bag.

Mary takes at random a counter from the bag.

She puts the counter back into the bag.

(a) What is the probability that Joe and Mary take counters of different colours?

(2)

There are 78 red counters in the bag.

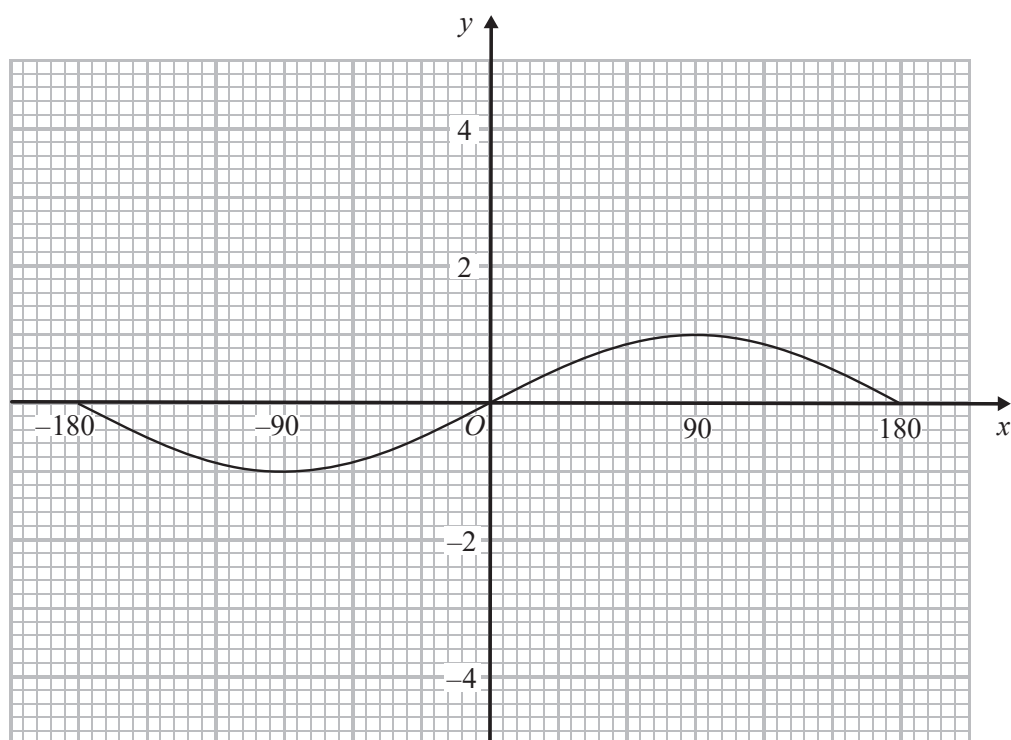
(b) How many blue counters are there in the bag?

(2)

(Total for Question 16 is 4 marks)



18 Here is the graph of $y = \sin x^\circ$ for $-180 \leq x \leq 180$

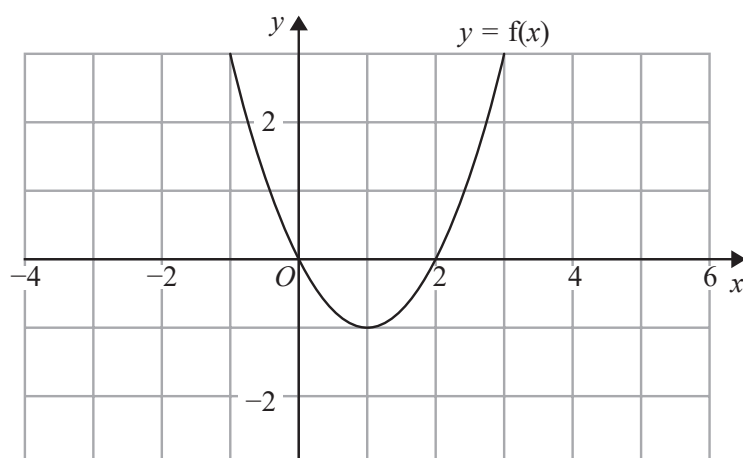


On the grid, sketch the graph of $y = \sin x^\circ - 2$ for $-180 \leq x \leq 180$

(Total for Question 18 is 2 marks)

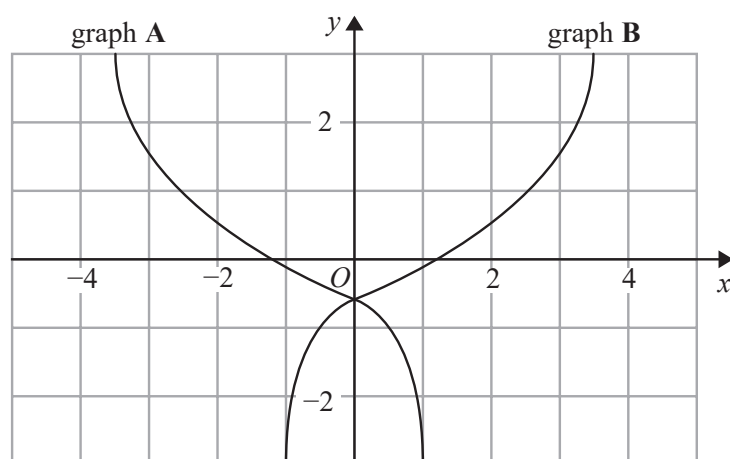


18 The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(x - 2)$

(1)



On the grid, graph A has been reflected to give graph B.

The equation of graph A is $y = g(x)$

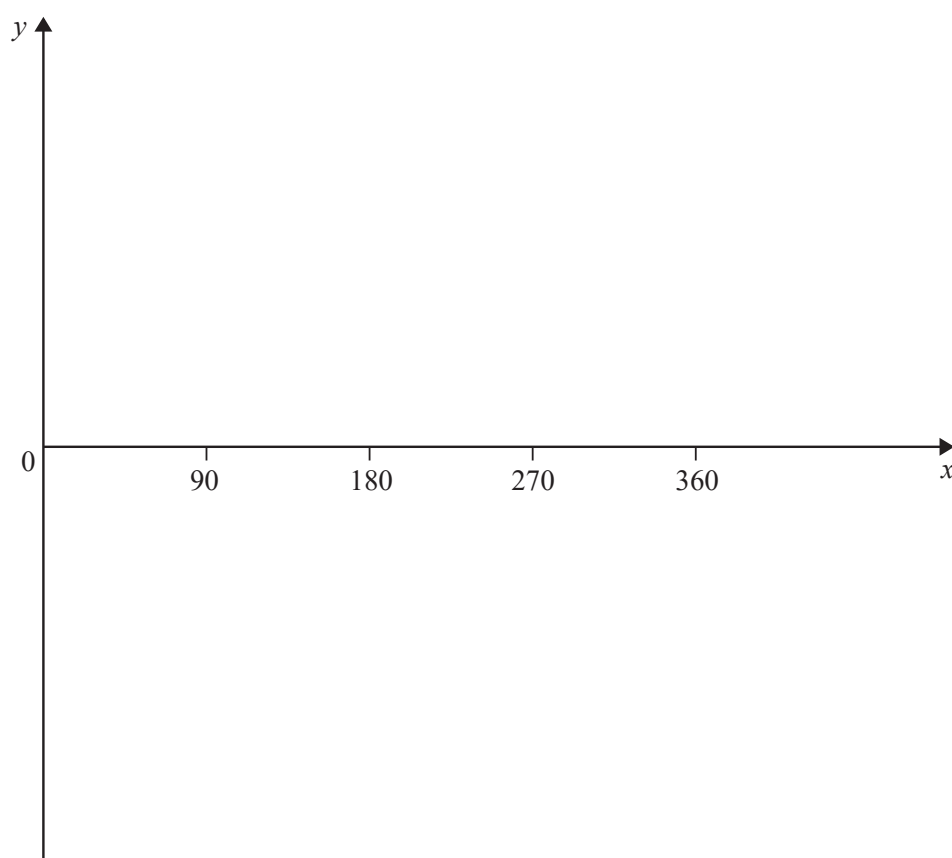
(b) Write down the equation of graph B.

(1)

(Total for Question 18 is 2 marks)



11 Sketch the graph of $y = \tan x^\circ$ for $0 \leq x \leq 360$



(Total for Question 11 is 2 marks)

- 15 The graph of the curve C with equation $y = f(x)$ is transformed to give the graph of the curve S with equation $y = f(-x) - 3$

The point on C with coordinates (7, 2) is mapped to the point Q on S.

Find the coordinates of Q.

(....., ...)

(Total for Question 15 is 2 marks)

- 16 Here are the first six terms of a quadratic sequence.

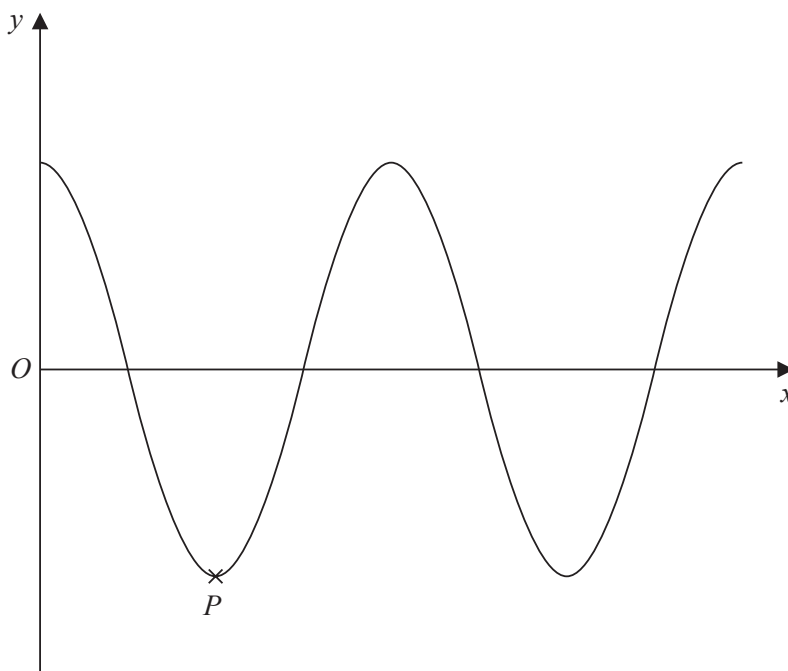
-1 5 15 29 47 69

Find an expression, in terms of n , for the n th term of this sequence.

(Total for Question 16 is 3 marks)



21



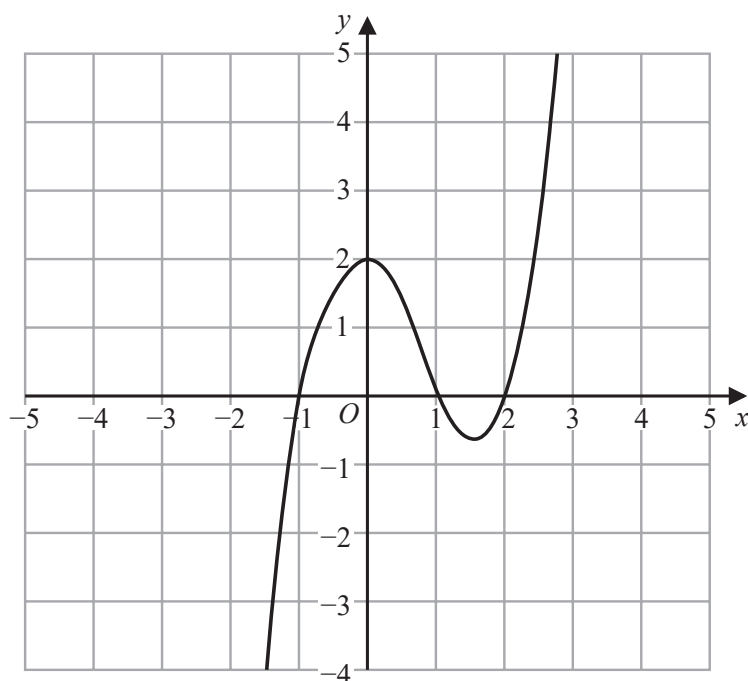
The diagram shows a sketch of part of the curve with equation $y = \cos x^\circ$
 P is a minimum point on the curve.

Write down the coordinates of P .

(..... , ...)

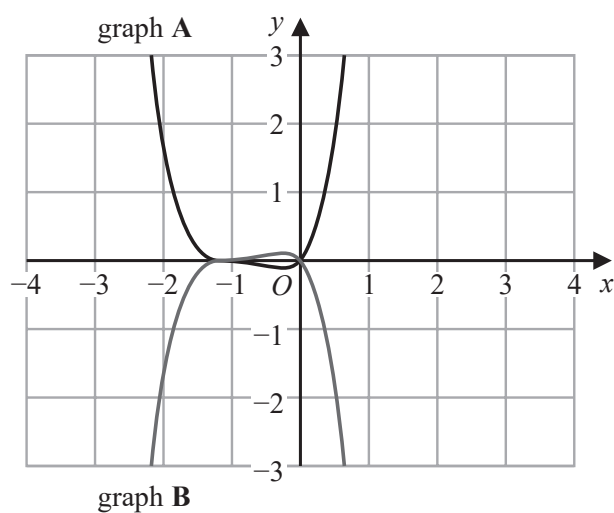
(Total for Question 21 is 2 marks)

23 The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(x + 2)$

(1)



On this grid, graph A has been reflected to give graph B.
The equation of graph A is $y = g(x)$

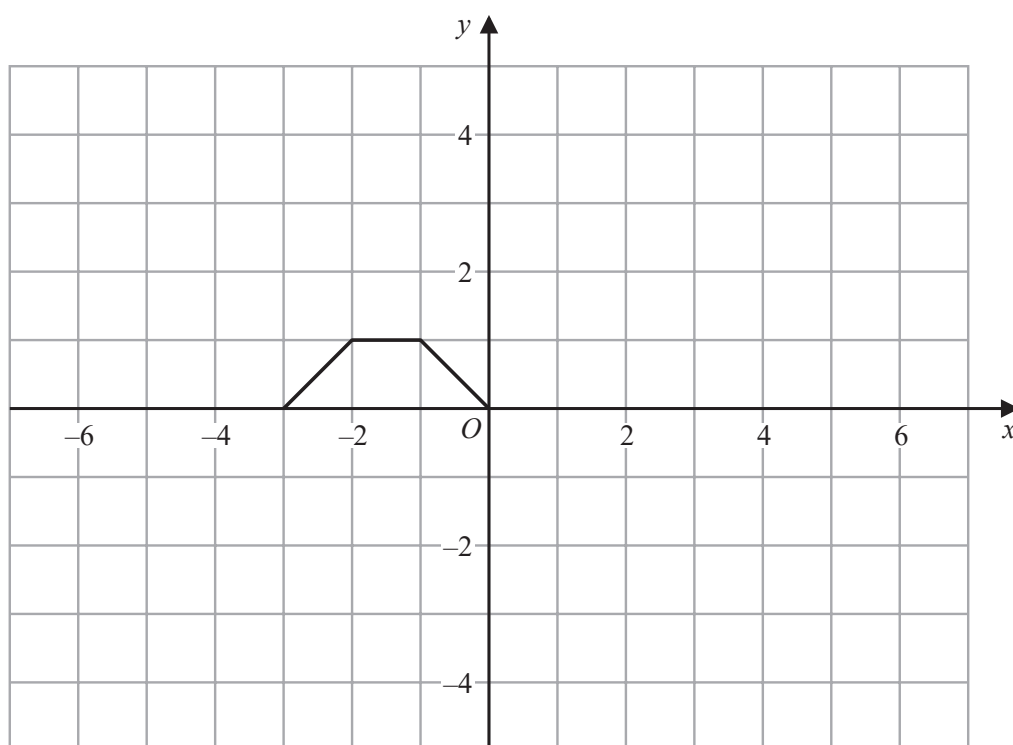
(b) Write down an equation of graph B.

(1)

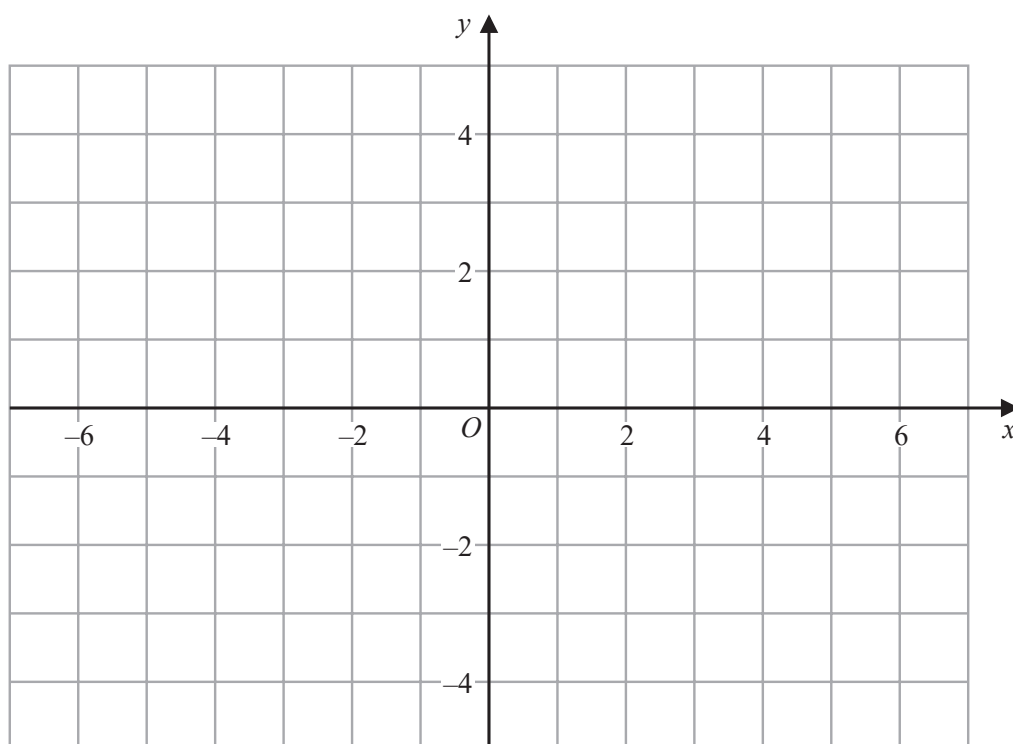
(Total for Question 23 is 2 marks)



21 Here is the graph of $y = f(x)$



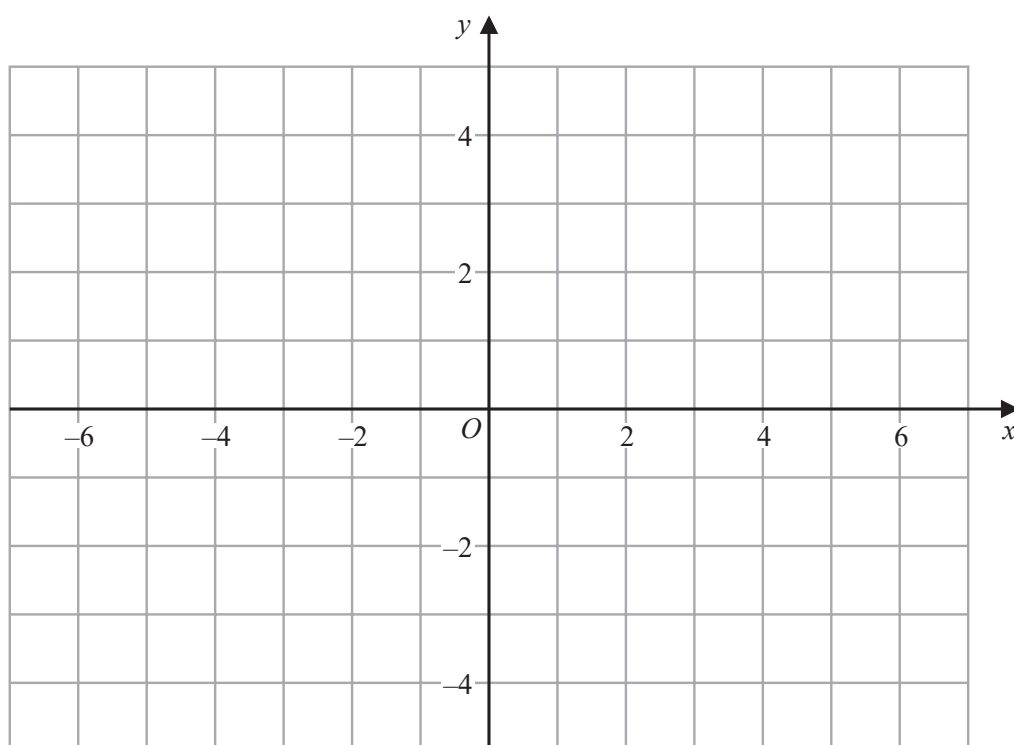
(a) On the grid below, draw the graph of $y = f(x) - 4$



(1)



(b) On the grid below, draw the graph of $y = f(-x)$

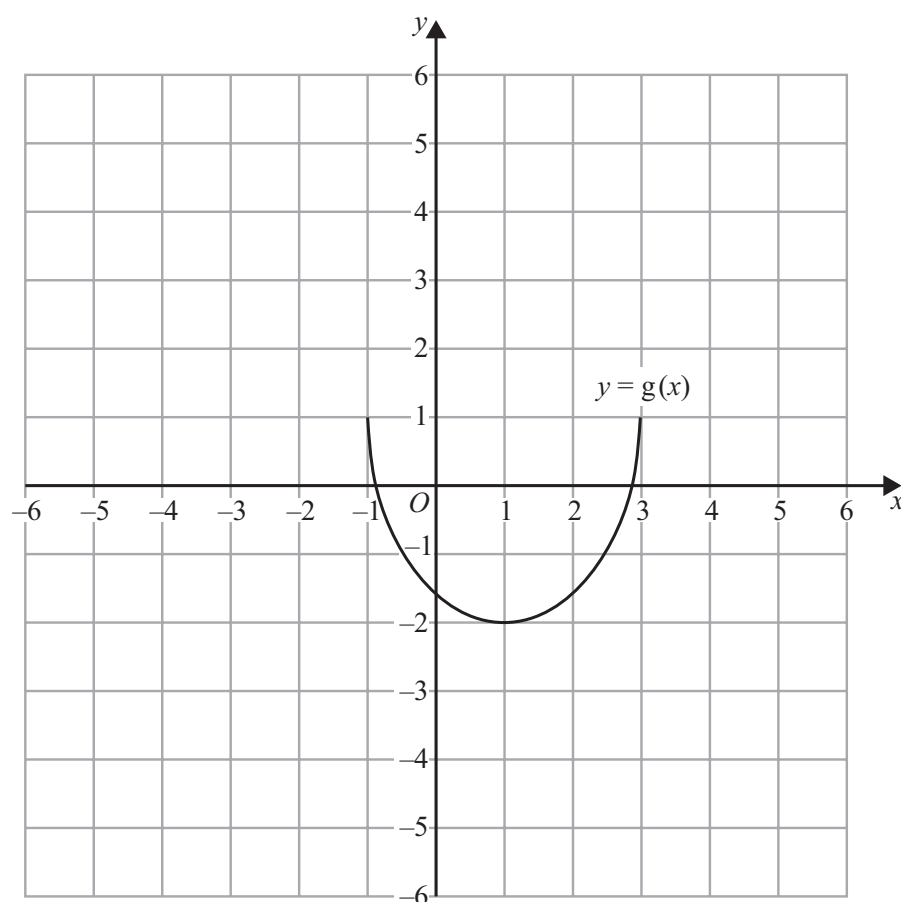


(1)

(Total for Question 21 is 2 marks)



21 The graph of $y = g(x)$ is shown on the grid.



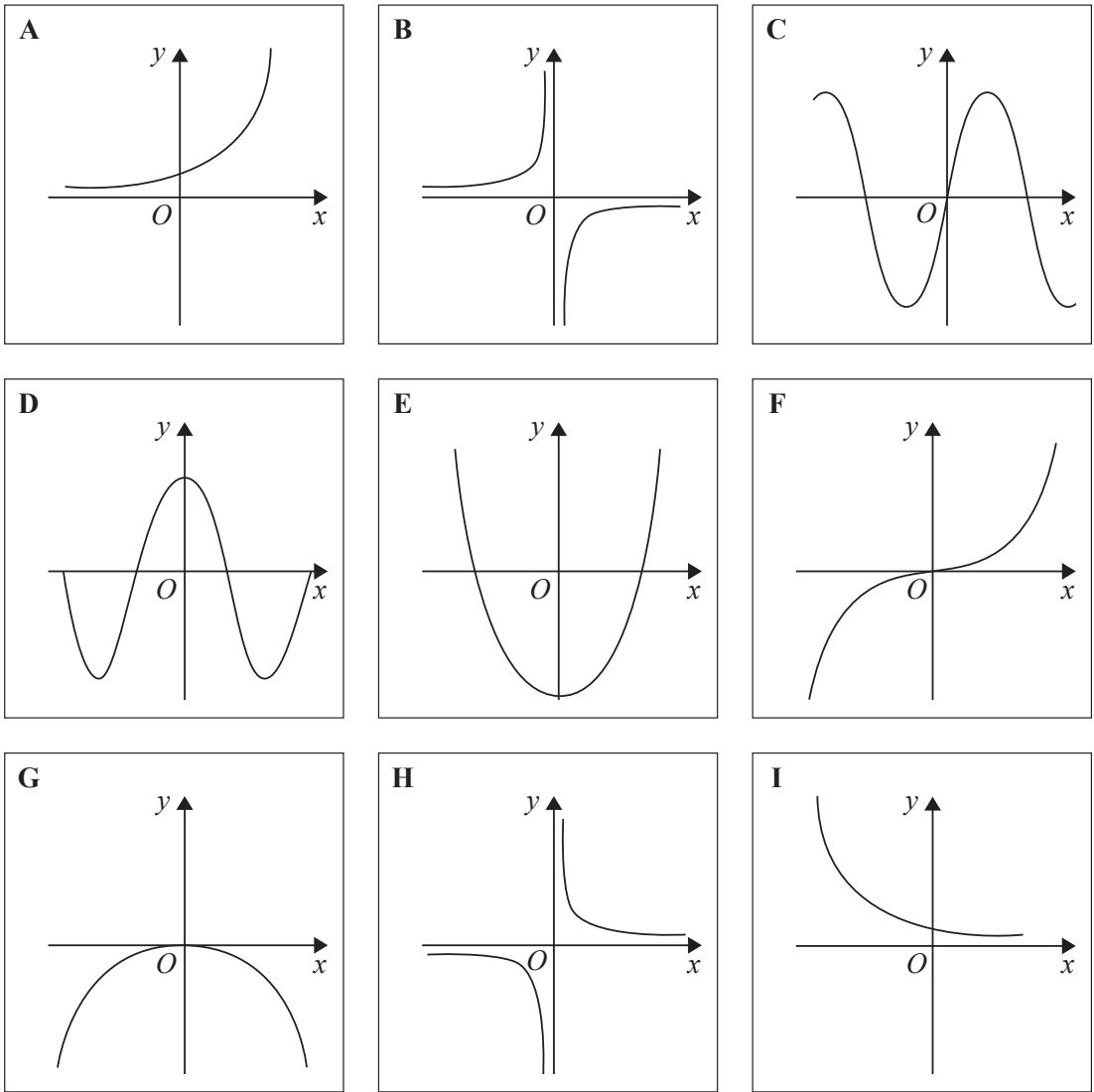
On the grid, draw the graph of $y = g(-x) + 2$

(Total for Question 21 is 2 marks)

Turn over for Question 22



14 Here are some graphs.



In the table below, match each equation with the letter of its graph.

Equation	Graph
$y = \sin x$	
$y = x^3 + 4x$	
$y = 2^x$	
$y = \frac{4}{x}$	

(Total for Question 14 is 3 marks)

23 **L** is the circle with equation $x^2 + y^2 = 4$

$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$ is a point on **L**.

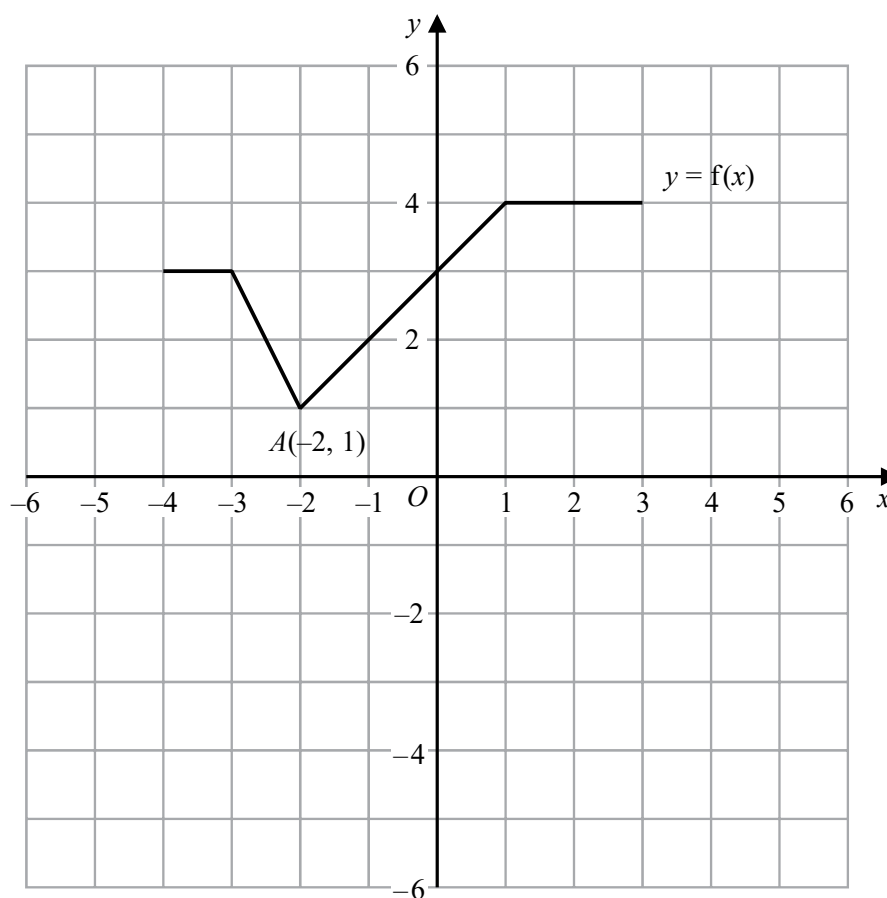
Find an equation of the tangent to **L** at the point *P*.

(Total for Question 23 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS



20 The graph of $y = f(x)$ is shown on the grid.



(a) On the grid, draw the graph with equation $y = f(x + 1) - 3$

(2)

Point $A(-2, 1)$ lies on the graph of $y = f(x)$.

When the graph of $y = f(x)$ is transformed to the graph with equation $y = f(-x)$, point A is mapped to point B .

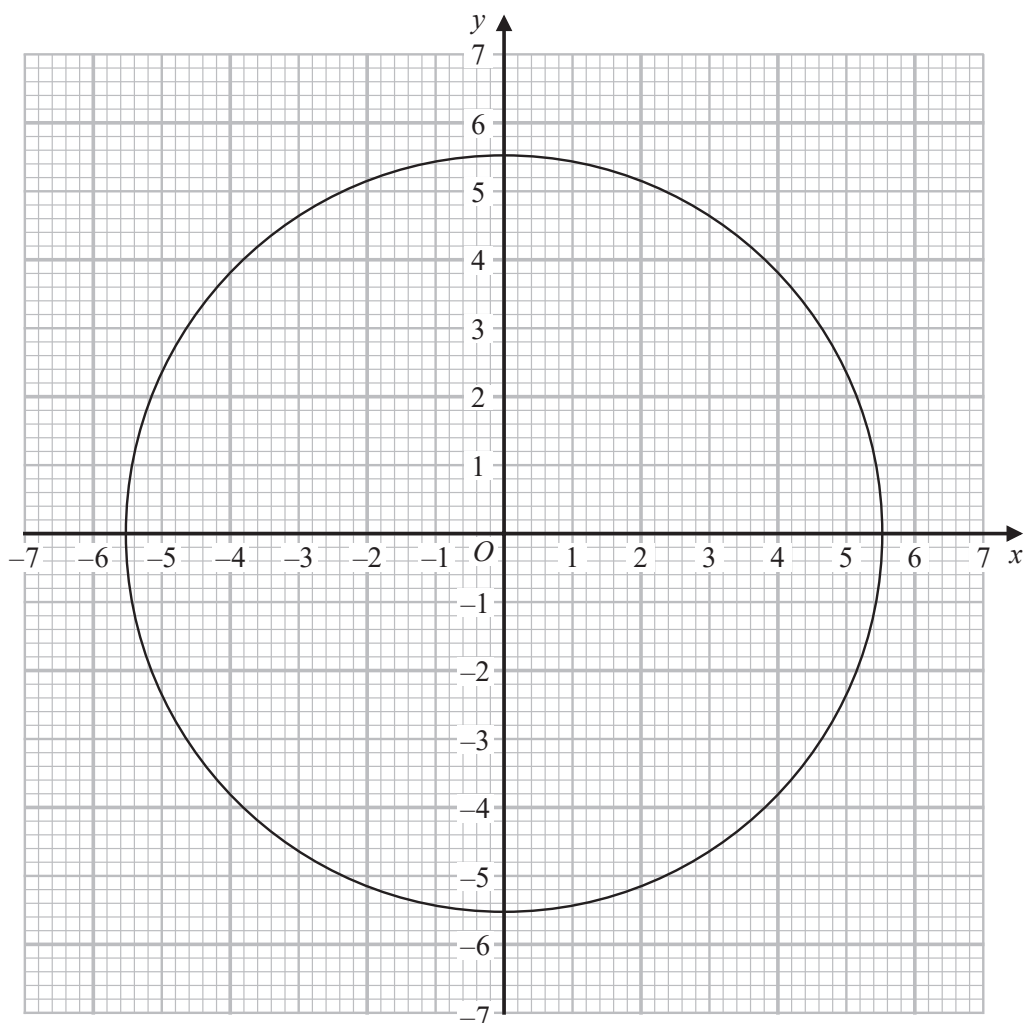
(b) Write down the coordinates of point B .

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

(Total for Question 20 is 3 marks)



20 The diagram shows the graph of $x^2 + y^2 = 30.25$



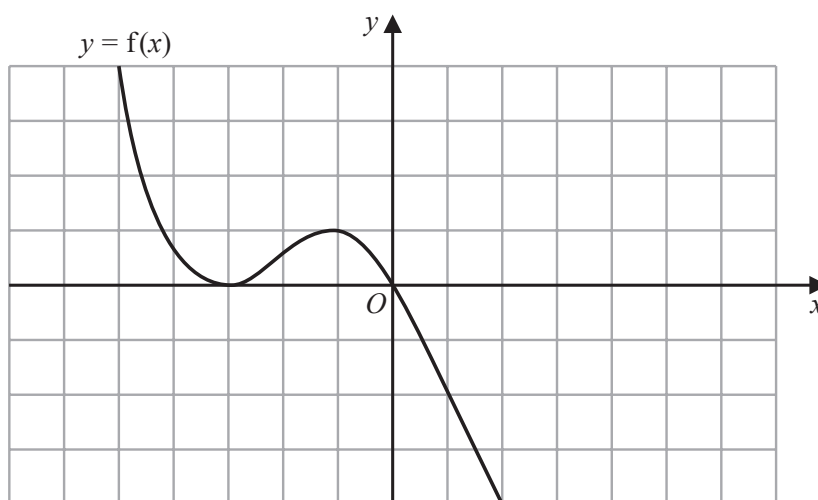
Use the graph to find estimates for the solutions of the simultaneous equations

$$\begin{aligned}x^2 + y^2 &= 30.25 \\ y - 2x &= 1\end{aligned}$$

(Total for Question 20 is 3 marks)



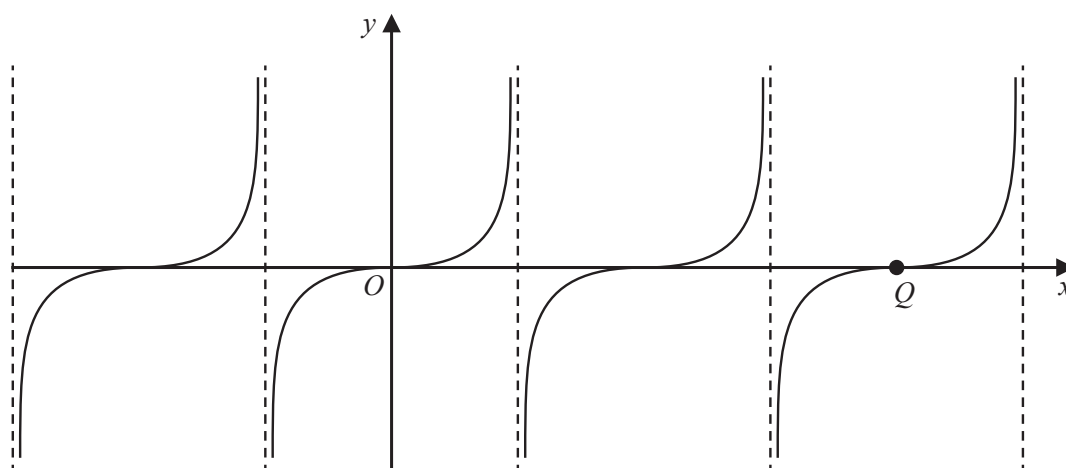
21 The graph of $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of $y = f(-x)$

(1)

Here is a sketch of the graph of $y = \tan x^\circ$



The graph of $y = \tan x^\circ$ is translated to give the graph of $y = g(x)$

Following the translation the point Q , shown on the graph above, moves to point R .
Point R has coordinates $(90, -5)$

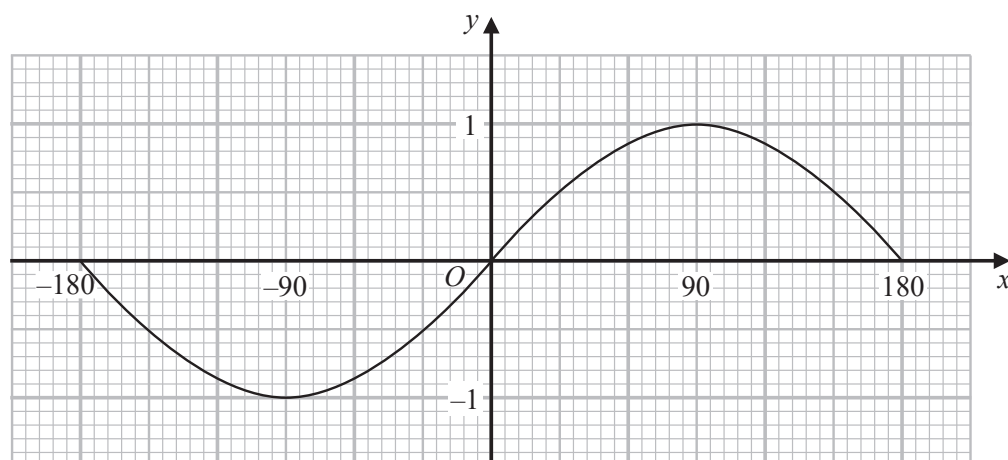
(b) Find an expression for $g(x)$ in terms of x .

(2)

(Total for Question 21 is 3 marks)



19 Here is the graph of $y = \sin x^\circ$ for $-180 \leq x \leq 180$



(a) Use the graph to find estimates for the solutions of

$$\sin x^\circ = 0.3 \quad \text{for } -180 \leq x \leq 180$$

.....
(2)

(b) Write down a value of x such that

$$\sin(x + 20)^\circ = 0 \quad \text{for } -180 \leq x \leq 180$$

$x =$
(1)

(Total for Question 19 is 3 marks)

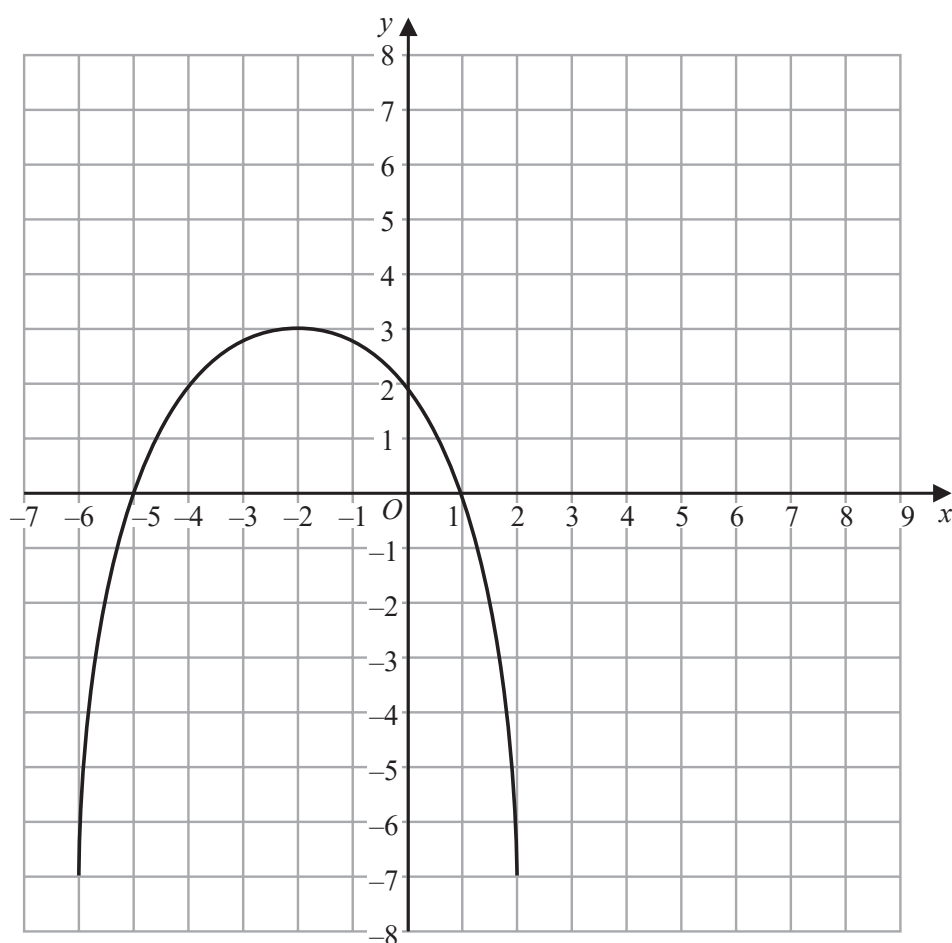


20 The turning point on the graph of $y = g(x)$ has coordinates $(-3, 6)$

(a) Write down the coordinates of the turning point on the graph of $y = g(x - 7)$

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

The graph of $y = f(x)$ is shown on the grid.



(b) On the grid, sketch the graph of $y = f(-x) + 3$

(2)

(Total for Question 20 is 3 marks)

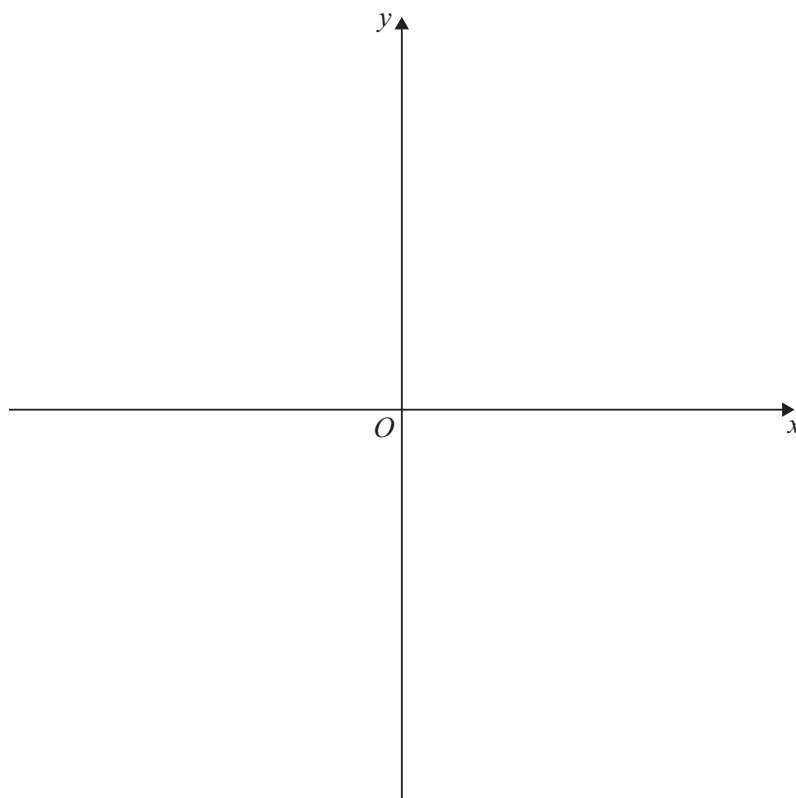
22 The equation of circle **A** is $x^2 + y^2 = 25$

Circle **A** is translated by the vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$ to give circle **B**.

Sketch circle **B**.

Show the coordinates of

the centre of circle **B**
and the points where circle **B** meets the y -axis.



(Total for Question 22 is 3 marks)

- 20 The equation of a curve is $y = a^x$
 A is the point where the curve intersects the y -axis.

(a) State the coordinates of A .

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

The equation of circle **C** is $x^2 + y^2 = 16$

The circle **C** is translated by the vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ to give circle **B**.

(b) Draw a sketch of circle **B**.

Label with coordinates
the centre of circle **B**
and any points of intersection with the x -axis.

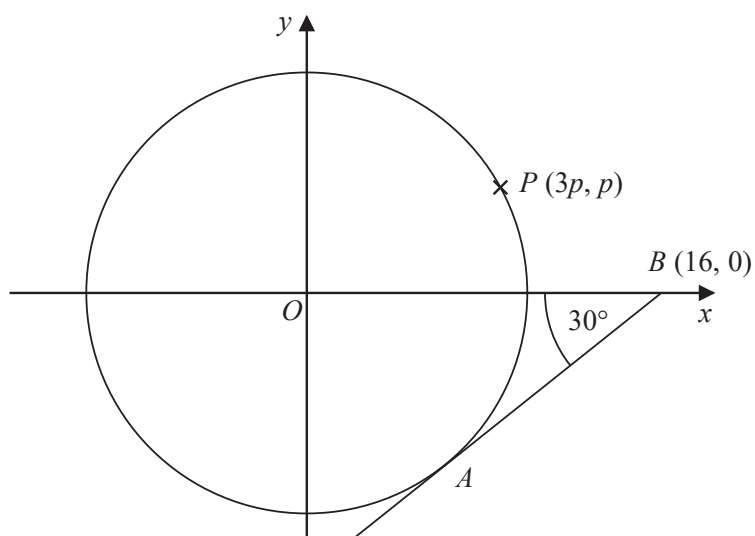
(3)

(Total for Question 20 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS



22 The diagram shows a circle, centre O .



AB is the tangent to the circle at the point A .
Angle $OBA = 30^\circ$

Point B has coordinates $(16, 0)$
Point P has coordinates $(3p, p)$

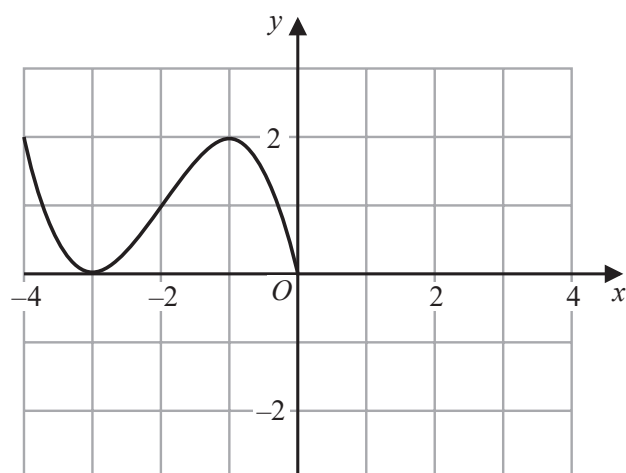
Find the value of p .
Give your answer correct to 1 decimal place.
You must show all your working.

$p = \dots\dots\dots$

(Total for Question 22 is 4 marks)

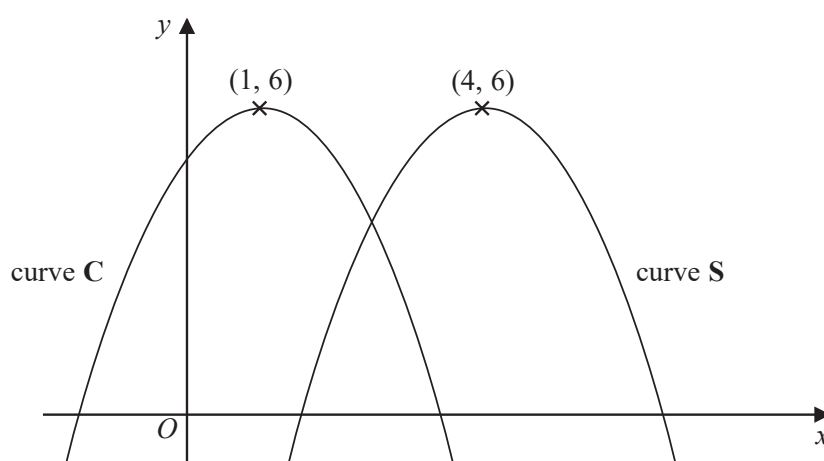


21 The graph of the curve with equation $y = f(x)$ is shown on the grid below.



(a) On the grid above, sketch the graph of the curve with equation $y = f(-x)$

(2)



The curve C with equation $y = 5 + 2x - x^2$ is transformed by a translation to give the curve S such that the point (1, 6) on C is mapped to the point (4, 6) on S.

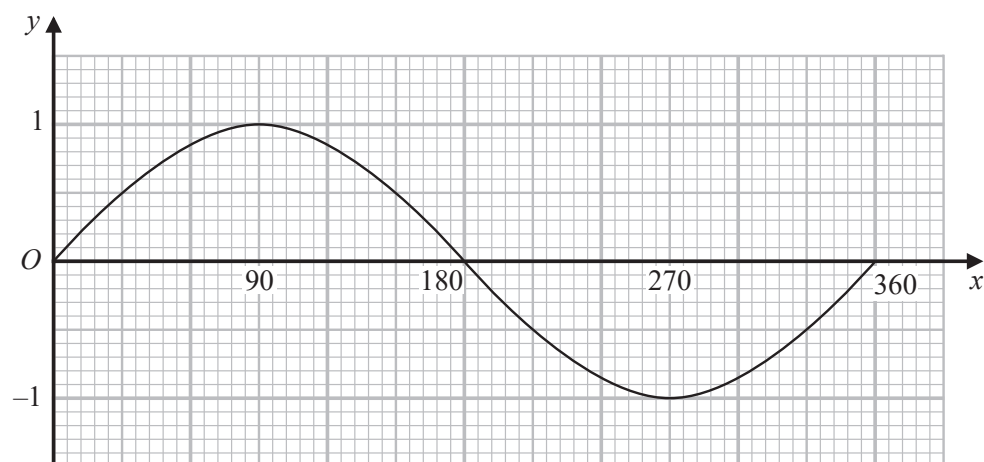
(b) Find an equation for S.

(2)

(Total for Question 21 is 4 marks)



18 Here is a graph of $y = \sin x^\circ$ for $0 \leq x \leq 360$



(a) Using this graph, find estimates of all **four** solutions of

$$\sin x^\circ = 0.6 \quad \text{for } 0 \leq x \leq 720$$

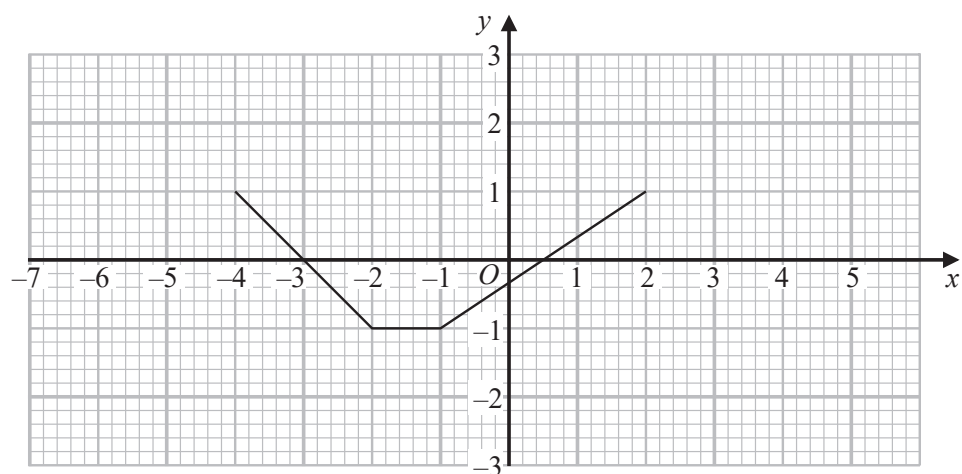
(2)

The graph of $y = \sin x^\circ$ is reflected in the x -axis.

(b) Write down an equation of the reflected graph.

(1)

Here is a graph of $y = f(x)$



(c) On the grid, draw the graph of $y = f(x - 2)$

(1)

(Total for Question 18 is 4 marks)

20 The centre of a circle is the point with coordinates $(-1, 3)$

The point A with coordinates $(6, 8)$ lies on the circle.

Find an equation of the tangent to the circle at A .

Give your answer in the form $ax + by + c = 0$ where a , b and c are integers.

(Total for Question 20 is 4 marks)



24 A circle has equation $x^2 + y^2 = 12.25$

The point P lies on the circle.

The coordinates of P are $(2.1, 2.8)$

The line L is the tangent to the circle at point P .

Find an equation of L .

Give your answer in the form $ax + by = c$, where a , b and c are integers.

(Total for Question 24 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS



23 A circle has equation $x^2 + y^2 = 25$

The point P with coordinates $(-3, 4)$ lies on the circle.

Alex says that the tangent to the circle at P crosses the x -axis at the point $(-8, 0)$

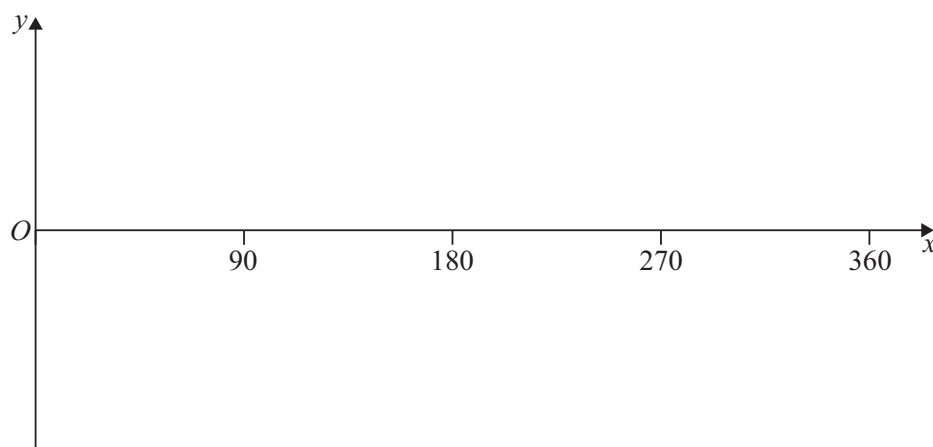
Is Alex correct?

You must show how you get your answer.

(Total for Question 23 is 4 marks)



22 (a) Sketch the graph of $y = \sin x^\circ$ for $0 \leq x \leq 360$



(2)

(b) Solve the equation $2 \sin x^\circ = -1$ for $0 \leq x \leq 360$

(2)

(Total for Question 22 is 4 marks)



20 C is the circle with equation $x^2 + y^2 = 4$

Find an equation of the tangent to C at the point $(p, 1)$ where $p > 0$

Give your answer in the form $y + \sqrt{a}x = b$ where a and b are integers.

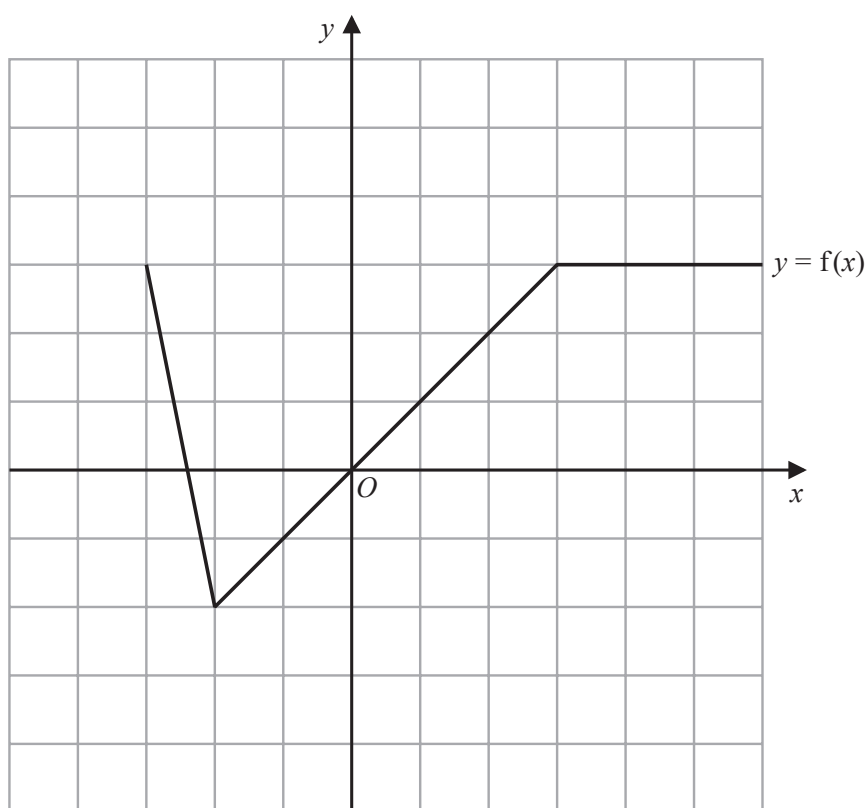
You must show all your working.

.....
(Total for Question 20 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS



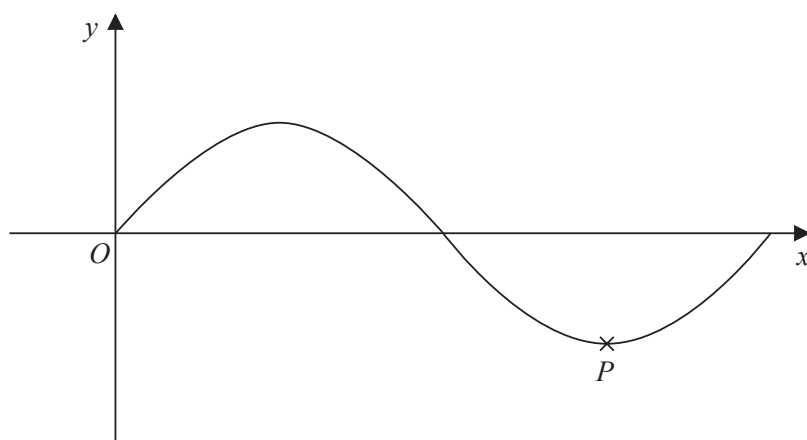
21 Here is the graph of $y = f(x)$



(a) On the grid, draw the graph of $y = -f(x)$

(1)

Here is a sketch of the graph of $y = \sin x^\circ$



The point marked P is a turning point on the graph.

The graph of $y = \sin x^\circ$ is translated to give the graph of $y = \sin(x + 180)^\circ + 4$

Following the translation the point P , shown on the graph above, moves to point R .

(b) Find the coordinates of R .

(..... , ...)
(3)

(Total for Question 21 is 4 marks)

22 C is a circle with centre $(0, 0)$

The straight line with equation $3x - 2y = 52$ is the tangent to C at the point P .

Find the coordinates of P .

(....., ...)

(Total for Question 22 is 4 marks)

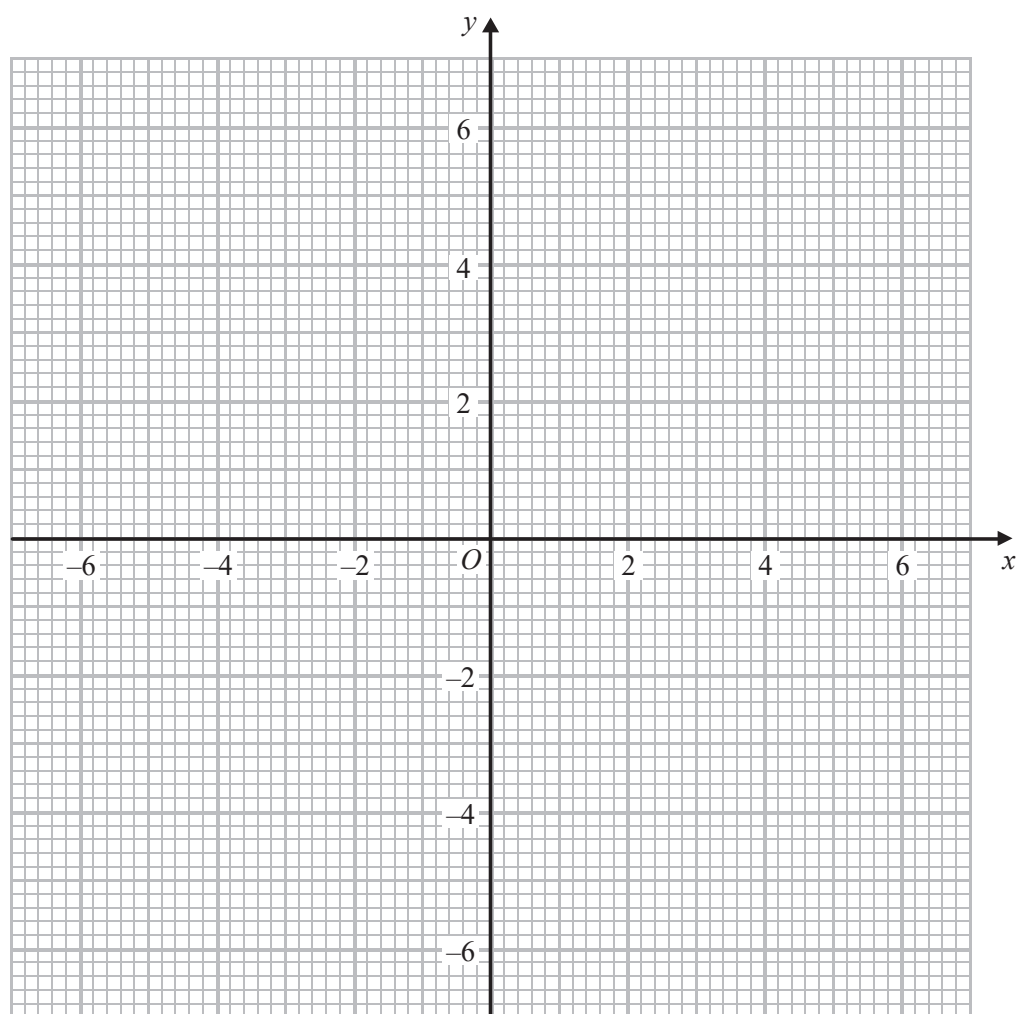


19 Prove algebraically that the straight line with equation $x - 2y = 10$ is a tangent to the circle with equation $x^2 + y^2 = 20$

(Total for Question 19 is 5 marks)



16 (a) On the grid, draw the graph of $x^2 + y^2 = 12.25$



(2)

(b) Hence find estimates for the solutions of the simultaneous equations

$$\begin{aligned}x^2 + y^2 &= 12.25 \\ 2x + y &= 1\end{aligned}$$

(3)

(Total for Question 16 is 5 marks)

22 C is a circle with centre the origin.

A tangent to C passes through the points $(-20, 0)$ and $(0, 10)$

Work out an equation of C .

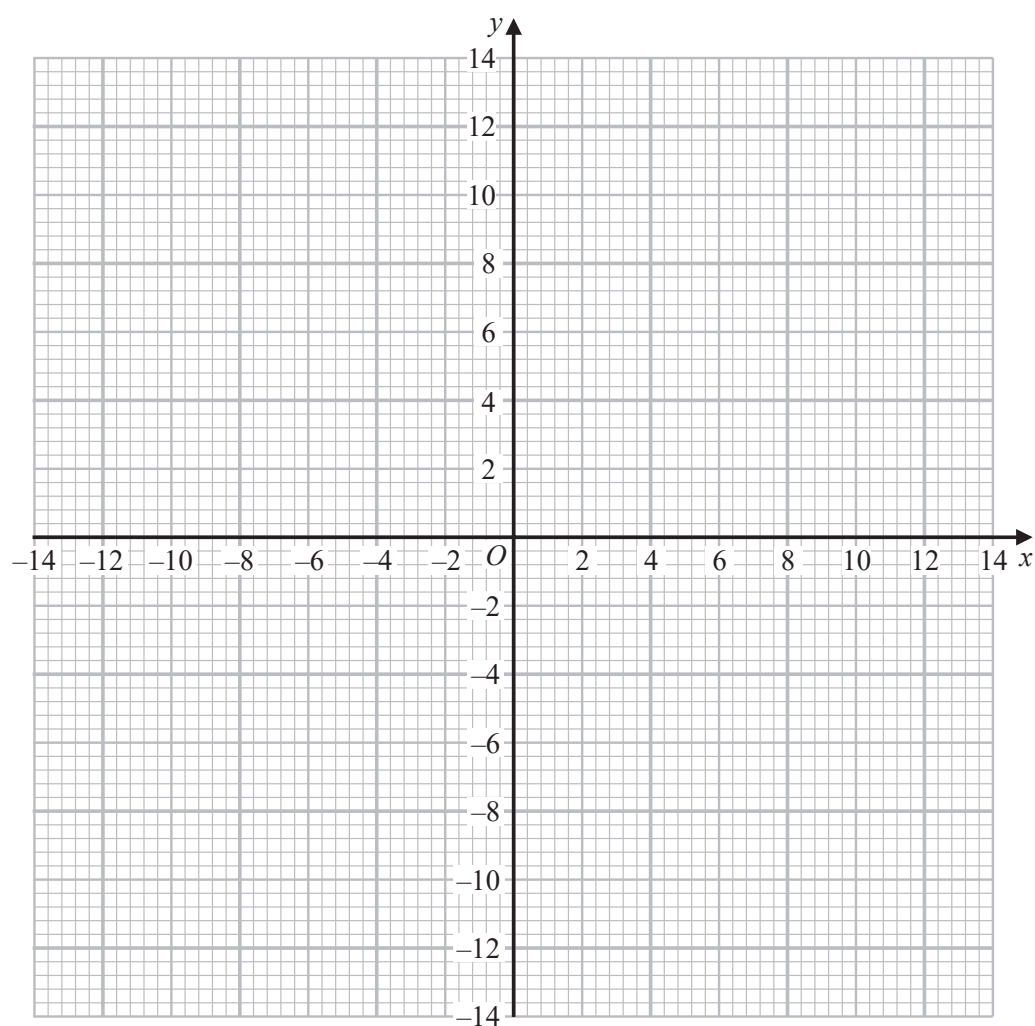
You must show all your working.

.....
(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



21 (a) On the grid, draw the graph of $x^2 + y^2 = 169$



(2)

(b) Use your graph to find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 169$$

$$2y = 3x$$

(3)

(Total for Question 21 is 5 marks)



23 **C** is a circle with centre $(0, 0)$

L is a straight line.

The circle **C** and the line **L** intersect at the points P and Q .

The coordinates of P are $(5, 10)$

The x coordinate of Q is -2

L has a positive gradient and crosses the y -axis at the point $(0, k)$

Find the value of k .

$k = \dots\dots\dots$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



MARK SCHEMES

official mark schemes, in the same order as the questions



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
5		70.5	P1 P1 P1 P1 A1	starts process of Pythagoras e.g. $5^2 + 12^2$ complete process for Pythagoras e.g. $\sqrt{5^2 + 12^2}$ or $\sqrt{25 + 144}$ or $\sqrt{169}$ (=13) (dep P1 for Pythagoras) process of adding all the lengths e.g. $5 + 5 + 12 + 12 + "13"$ (=47) (indep) process of multiplying at least 2 lengths by 1.5 cao SC: any evidence of working with Pythagoras award the P1 or P2
6		comparison	M1 A1	starts to manipulate expression e.g. $3y = 9x - 6$ or $3y = 9x - 5$ gives equation(s) which can be used to show that the gradients of the two lines are the same e.g. $y = 3x - 5/3$
7		72	P1 P1 A1	for showing the process of 30×60 (=1800) or 20×54 (=1080) (dep P1) for showing the complete process e.g. (" 1800 " – " 1080 ") $\div 10$ concluding the answer is 72 (and not 66)
8 (a) (b)		0.00000797 6.3×10^7	B1 M1 A1	cao for partial calculation involving powers of 10 e.g. $0.63 \times 10^{5-3}$ or 6.3×10^n where $n \neq 7$ or for $n \times 10^8$ or for 63000000 cao
9		500	M1 A1	recognition of 1.2 or 120% oe eg $600 \div 1.2$ oe $x \times 1.2 = 600$ oe or $120\% = 600$ cao
10		$x^3 + 6x^2 + 11x + 6$	M1 M1 A1	for method to find the product of any two linear expressions (3 correct terms) e.g. $x^2 + x + 2x + 2$ or $x^2 + 2x + 3x + 6$ or $x^2 + x + 3x + 3$ for method of multiplying out remaining products, half of which are correct (ft their first product) e.g. $x^3 + x^2 + 2x^2 + 3x^2 + 2x + 3x + 6x + 6$ cao

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	Shown	M1	for $6 \times 14.5 (= 87)$ or $13 \times 7 (= 91)$ or $13 \div 6 (= 2.16(666\dots))$	May work in hours or other units of time
		M1	for “87” $\div 7 (= 12.428\dots)$ or “87” $\div 13 (= 6.692\dots)$ or $6 \times 14.5 (= 87)$ and $13 \times 7 (= 91)$ or $14.5 \div “2.16” (= 6.692\dots)$	Accept figure rounded or truncated to 1dp
		C1	(dep M2) for 12.(428...) (workers) or 6.69(2...) (days) or 87 and 91	Figures must be correct and supported by working. Accept value in range 6.69 to 6.72 for number of days
12	comparison shown	M1	for starting to manipulate equation, eg $5y = 10x + 15$ or $5y = 10x - 4$ or $y - 2x + \frac{4}{5} = 0$ or $y - 2x = 3$	Ignore constant terms for both marks
		A1	for statement and equation(s) which can be used to show that the gradients of the two lines are the same, eg $5y = 10x + 15$ and $5y = 10x - 4$ and both have the same x coefficient OR $y = 2x - \frac{4}{5}$ and both have a gradient of 2	
13	enlargement	B2	for correct enlargement at (4, 8) (6, 4) (10, 4) (12, 8)	
		(B1	for correct size and orientation in the wrong position OR 3 of 4 vertices correct)	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
7 (a)	4	B1	for 4	Condone (0,4) or 0,4 Accept both solutions given as a coordinate for M1 eg (5.2, 0.8) or (0.8, 5.2) or (5.2, 0) and (0.8, 0)
	(3, -5)	B1	cao	
	5.1 to 5.3 and 0.7 to 0.9	M1	for a correct method, eg marking both intercepts with x-axis or one correct solution	
		A1	for answers in the range 5.1 to 5.3 and 0.7 to 0.9	
8	12.5	M1	for $135 - 120 (= 15)$ or $\frac{135}{120} (= 1.125)$ or $\frac{135}{120} \times 100 (= 112.5)$	
		M1	for “15” $\div 120 \times 100$ or “112.5” $- 100$ or (“1.125” $- 1$) $\times 100$	
		A1	cao	
9	Yes with comparisons shown	M1	for starting to manipulate equation eg $y = \frac{3}{6}x + \frac{7}{6}$ or $y = \frac{1}{2}x + \frac{7}{6}$ or $3y = \frac{3}{2}x - 6 \times 3$ or $6y = 3x - 36$	Ignore constant terms for both marks
		A1	for statement and equation(s) which can be used to show that the gradients of the two lines are the same eg $y = \frac{1}{2}x + \frac{7}{6}$ and both have a gradient of $\frac{1}{2}$ or Yes, $6y = 3x - 36$ and both have the same x coefficients	

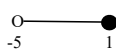


Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	(a) m^7	B1	cao	
	(b) $125n^3p^9$	B2	cao	Allow multiplication signs
		(B1)	for 2 of 3 terms correct in a single product)	$125n^3p^x$ or $125n^x p^9$ where $x \neq 0$ or an^3p^9 where a is a number
	(c) $8q^6r^3$	B2	cao	Allow multiplication signs
		(B1)	for 2 of 3 terms correct in a single product)	$8q^6r^x$ or $8q^x r^3$ where $x \neq 0$ or aq^6r^3 where a is a number
2	(a) 280	M1	for listing at least 3 multiples of both 40 and 56 OR finds the prime factors of both 40 and 56	40, 80, 120, ... 56, 112, 168, ... OR 2,2,2,5 and 2,2,2,7
		A1	cao	
	(b) 60	B1	60 or $2^2 \times 3 \times 5$ oe	$2^2, 3, 5$ not enough ie must be a product
3	$y = 3x - 6$	M1	for a correct method to find the gradient of the line, or $m = 3$ OR identifies -6 as the intercept in words or in a partial equation OR $y - b = m(x - a)$ where $m \neq 3$ and (a, b) is a correct coordinate	Just ringing -6 is insufficient
		M1	for $y = 3x + c$ or (L=) $3x - 6$ or $y = "3"x - 6$ OR $y - y_1 = 3(x - x_1)$ or $y - b = "3"(x - a)$ where (a, b) is a correct coordinate	Award of this mark implies the first M1 c must be seen either as a letter or a number
		A1	accept $y = 3x + -6$ oe	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	7	P1 P1 A1	process to use gradient eg $y=3x+c$ or $c = -6$ or $\frac{15-9}{d-5}$ or $(15-9) \div 3$ or $(6, 12)$ (dep) full process to rearrange equation formed to isolate d eg rearrangement of $15 = 3d - 6$ or $3 = \frac{15-9}{d-5}$ or for $5 + \frac{15-9}{3}$ cao	Condone use of a letter other than d , for d Must show processes to get as far as $d =$ Award P2 for an answer of $(7, 15)$
7	(a) 8.623×10^{-5} (b) 7.44×10^6	B1 M1 A1	cao for $\frac{3200+0.051}{0.00043}$ or $\frac{3200.051}{0.00043}$ or performs an operation eg shows 163.2, 7441860.5, 118.6(...) or an answer or $7.44(\dots) \times 10^n$ where $n \neq 6$ or 7441979(...) or an answer of 7.4×10^6 for $7.44(1979\dots) \times 10^6$	7441979.0689... If a correct answer is shown in working and then rounded incorrectly, award full marks. Answer need only be given correctly to 3 sig fig; if following digits are incorrect ignore them.
8	Rotation 90° anticlockwise centre $(-1, 1)$	M1 A1 A1	stating rotation or for showing R [(1,1), (1,-3), (3,-3)] for rotation of 90° anticlockwise for centre $(-1, 1)$ given as a coordinate.	Award for a triangle in the correct position without the label R as long as this is the only triangle in lower right quadrant. Accept rotation of 270° clockwise Can be given as a coordinate alone. Do not award A marks if there is evidence of other transformations in the description, or other ambiguity in the answer given.



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



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$m = \frac{f+4}{f-3}$	M1	for multiplying both sides by $m-1$, eg. $f(m-1) = 3m+4$	Condone missing brackets for this mark only
		M1	(dep) for a method to rearrange the formula to isolate terms in m in a correct equation, eg. $fm - 3m = f + 4$ or $-fm + 3m = -f - 4$	
		A1	for $m = \frac{f+4}{f-3}$ or eg $m = \frac{-f-4}{-f+3}$	
16	$y = -\frac{3}{4}x - \frac{11}{4}$	M1	for identifying gradient of $\frac{4}{3}$	Ignore constant term
		M1	for beginning a method to find the gradient of the perpendicular line eg $\frac{4}{3} \times m = -1$ or identifies gradient of perpendicular line as $-\frac{3}{4}$	Can fit providing gradient is clearly stated
		A1	for $y = -\frac{3}{4}x - \frac{11}{4}$ or any equivalent equation	$4y + 3x = -11$ $y + 5 = -\frac{3}{4}(x-3)$



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$y = -\frac{1}{3}x + 8$	M1 M1 A1	for a method for finding the gradient of L_2 eg use of $-\frac{1}{m}$ or $-\frac{1}{3}$ (dep) for substitution of (9, 5) into $y = -\frac{1}{3}x + c$ for $y = -\frac{1}{3}x + 8$ oe	$y - 5 = -\frac{1}{3}(x - 9)$ gets M2A1
16 (a)	540	P1 P1 A1	for $\frac{120}{20} (=6)$ or $\frac{20}{120} (=0.16..)$ or $\frac{90}{20} (=4.5)$ or $\frac{20}{90} (=0.22..)$ for $\frac{20}{120} = \frac{90}{n}$ or $\frac{20}{90} = \frac{120}{n}$ or $\frac{90 \times 120}{20}$ oe cao	Decimal values truncated or rounded to 2 dp or more
(b)	Explanation	C1	for explanation Acceptable examples If marks fall off Shirley will have over-estimated the number of bees There will be fewer bees Her amount will go down Not acceptable examples My answer will be wrong It will increase the answer	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
14 (a)	4^{-2}	B1	for 4^{-2}	Accept $n = -2$
(b)	5	M1	for $8^{\frac{5}{3}} = (\sqrt[3]{8})^5$ or 2^5 or $\sqrt[3]{8^5}$ or $\sqrt[3]{32768}$ or $9^{\frac{3}{2}} = (\sqrt{9})^3$ or 3^3 or $\sqrt{9^3}$ or $\sqrt{729}$	
		M1	for correctly evaluating $8^{\frac{5}{3}}$ or $9^{\frac{3}{2}}$, eg 32 or 27 seen	
		A1	cao	
15	3	P1	for process to make the y term the subject of $6y + kx - 12 = 0$ eg $6y = 12 - kx$ or $y = 2 - \frac{k}{6}x$	A correct answer with no supportive working gets 0 marks
		P1	for process to find gradient of line perpendicular to L_1 , eg $2 \times m = -1$ or $m = -\frac{1}{2}$ or for process to find k, eg $-\frac{k}{6} \times 2 = -1$	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11 (a)(i)	Box plot	B2	for fully correct box plot	Accept ends that are marked (eg line, cross, dot) or defined by the end of the whiskers if clear
		(B1	for median plotted at 900 or whiskers plotted finishing at 300 and 1300)	
(ii)	780 and 1200	B1	for 780 and 1200 correctly placed in the table	
(b)	60	M1	for a complete method eg $\frac{3}{4} \times 80$ oe	
		A1	cao	
12	$y = -\frac{2}{3}x - 1$	M1	for a method to find gradient of perpendicular line, eg $y = \frac{3}{2}x(-\frac{7}{2})$ and $\frac{3}{2} \times m = -1$ or gradient of perpendicular shown as $-\frac{2}{3}$	
		M1	for a method to find the value of c , eg $-5 = "-\frac{2}{3}" \times 6 + c$ or $y - -5 = "-\frac{2}{3}"(x - 6)$ oe	
		A1	for $y = -\frac{2}{3}x - 1$ oe eg $2x + 3y + 3 = 0$ or $y + 5 = -\frac{2}{3}(x - 6)$	
			SC B1 for $y = -\frac{1}{3}x - 3$ oe if M0 scored	



Paper: IMA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	0.13, 0.94, 0.06, 0.73, 0.27	B2	for all values correctly placed	Allow values that are truncated or rounded as long as the intention is clear.
		(B1	for at least 2 correct values placed)	
		M1	(fit their diagram) for one correct product, eg $0.87 \times 0.94 (= 0.8178)$ or $0.87 \times 0.06 (= 0.0522)$ or $0.13 \times 0.73 (= 0.0949)$ or $0.13 \times 0.27 (= 0.0351)$	
		M1	for a full method, eg “0.8178” + “0.0522” + “0.0949” or 1 – “0.0351”	
(b)	0.9649	A1	for 0.9649, 96.49% or $\frac{9649}{10000}$	
11	D A B C	B2	for all correct	
		(B1	for at least 2 correct)	
12	6.4	P1	for a suitable start to the process, eg, $M = \left(\frac{7-3}{2}, \frac{13+21}{2} \right) (= (2, 17))$ or $N = \left(\frac{15-3}{2}, \frac{23+21}{2} \right) (= (6, 22))$	Condone missing brackets on coordinates Ignore units throughout
		P1	(dep on P1) for a correct first step using of Pythagoras, eg $(x_N - x_M)^2 + (y_N - y_M)^2$ eg $(“6” - “2”)^2 + (“22” - “17”)^2 (= 41)$	
		A1	for answer in the range 6.4 to 6.41	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	$y = -2x + 3$	M1 M1 A1	for a correct method to find the gradient of the line, eg $\frac{-1-3}{2-0}$ ($= -2$) or uses 3 as the intercept in $y = mx + c$, eg $y = mx + 3$ oe, $y = 1.5x + 3$ for $y = [-2]x + c$, $c \neq 0$ or for (L $\Rightarrow$) $3 - 2x$ or uses their gradient and a point on the line, eg $y - -1 = [-2](x - 2)$ for $y = -2x + 3$ oe	 [−2] must be identifiable as their gradient Any correct equation gets 3 marks
10	$m = \frac{5(k-p)}{2}$	M1 M1 A1	for a correct first step, eg $k - p = \frac{2m}{5}$ or $5k = 5p + 2m$ or $\frac{k}{2} = \frac{p}{2} + \frac{m}{5}$ for a correct statement isolating $2m$, $-2m$, $\frac{m}{5}$ or $-\frac{m}{5}$ eg $5(k-p) = 2m$ or $5k - 5p = 2m$ or $\frac{m}{5} = \frac{k}{2} - \frac{p}{2}$ for $m = \frac{5(k-p)}{2}$ oe	Steps must be carried out not just intention seen Accept statements with m on the right hand side, eg $\frac{5(k-p)}{2} = m$

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	(11, 14.5)	P1	for process to work with coordinates, eg $8 - 2 (= 6)$ or $12 - 7 (= 5)$ or eg $(2 + 8) \div 2 (= 5)$ or $(7 + 12) \div 2 (= 9.5)$	Working may be seen on the diagram Allow alternative notation eg (6, 5) or (5, 6) or (5, 9.5) or (9.5, 5) Implied by $\frac{\dots}{8-2}$ or $\frac{12-7}{\dots}$ even if using $\frac{\text{diff in } x}{\text{diff in } y}$
		P1	for process to use proportion, eg " 6 " $\div 2 (= 3)$ oe or " 5 " $\div 2 (= 2.5)$ oe or $2 + \text{"6"} \times 1.5 (= 11)$ or $2 + 9 (= 11)$ oe or $7 + \text{"5"} \times 1.5 (= 14.5)$ or $7 + 7.5 (= 14.5)$ oe or " 5 " + " 6 " $(= 11)$ or $8 + \text{"5"} - 2 (= 11)$ oe or " 9.5 " + " 5 " $(= 14.5)$ or $12 + \text{"9.5"} - 7 (= 14.5)$ oe or $(11, a)$ where $a \neq 14.5$ or $(b, 14.5)$ where $b \neq 11$	Allow alternative notation eg (3, 2.5) or (2.5, 3) Implied by $8 + \text{"3"} (= 11)$ or $12 + \text{"2.5"} (= 14.5)$
		A1	for (11, 14.5) oe	Award P2 for (14.5, 11)



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
17		$\frac{28}{72}$	P1 for $\frac{6}{8}$ or $\frac{2}{8}$ or $\frac{7}{8}$ or $\frac{1}{8}$ oe seen on diagram or in a calculation P1 for $\frac{7}{9} \times \frac{2}{8}$ or $\frac{2}{9} \times \frac{7}{8}$ or $\frac{14}{72}$ oe P1 for $\frac{7}{9} \times \frac{2}{8} + \frac{2}{9} \times \frac{7}{8}$ or "$\frac{14}{72}$" + "$\frac{14}{72}$" oe A1 oe SC B1 for $\frac{14}{81}$ B2 for $\frac{28}{81}$	for $\frac{7}{9} \times \frac{6}{8}$ or $\frac{2}{9} \times \frac{1}{8}$ or $\frac{42}{72}$ or $\frac{2}{72}$ or $\frac{44}{72}$ oe for $1 - (\frac{7}{9} \times \frac{6}{8} + \frac{2}{9} \times \frac{1}{8})$ or $1 - (\frac{42}{72} + \frac{2}{72})$ or $1 - \frac{44}{72}$ oe
18		$y = -2x + 21$	P1 shows evidence of understanding that AC is perpendicular to DB, or states the gradient of DB as 0.5 oe P1 shows a process to find the gradient of a perp. line e.g. use of $-\frac{1}{m}$ or states $y = -2x + c$ or states the gradient of AC as -2 P1 (dep on P2) for sub. of $x = 5$, $y = 11$ into $y = mx + c$ where m is their found gradient for AC. A1 oe	

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



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
19		Proof (supported)	M1	for a method to find coordinates of $M(-1, -1)$ or $N(3, 1)$
			M1	for method to find gradient of MN or PR or for method to find column vector for MN or PR or for differences of x coordinates and differences of y coordinates for MN or PR
			A1	for gradients of MN and PR , ie $\frac{1}{2}$ or or for column vectors of MN and PR , $\overrightarrow{MN} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and $\overrightarrow{PR} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$ or for differences of x coordinates and of y coordinates for MN and PR
			C1	for conclusion from reasoning and correct working



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

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	14.5, 21	P1	for process to work with coordinates, eg $4 - (-3) (= 7)$ or $9 - 1 (= 8)$	Accept in reverse order eg $-3 - 4 (= -7)$ and negative distances throughout
		P1	for process to use ratio, eg $"7" \div 2 (= 3.5)$ or $"8" \div 2 (= 4)$ or $"7" \times 3 (= 21)$ or $"8" \times 3 (= 24)$	This mark is implied by 10.5 or 12 or 17.5 or 20
		P1	for complete process to find x or y coordinate of N, eg $"3.5" \times 3 + 4$ or $"4" \times 3 + 9$ or $"3.5" \times 5 - 3$ or $"4" \times 5 + 1$ OR to find both the required distances eg $"3.5" \times 3 (= 10.5)$ and $"4" \times 3 (= 12)$ or $"21" \div 2 (= 10.5)$ and $"24" \div 2 (= 12)$ or $"3.5" \times 5 (= 17.5)$ and $"4" \times 5 (= 20)$	
		A1	oe	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
6 (a)	$y = \frac{3}{2}x + 3$	M1	for a correct method to find the gradient of the line, eg $\frac{6-3}{2-0} (= \frac{3}{2})$ or identifies 3 as the intercept in words or in a partial equation or for $y = [\frac{3}{2}]x + c$ or for $y - b = [\frac{3}{2}](x - a)$ where (a, b) is a correct coordinate	Just circling 3 is insufficient $[\frac{3}{2}]$ must be identifiable as their gradient c must be seen either as a letter or a number
		M1	for $y = \frac{3}{2}x (+ c)$ oe or for $y = \frac{3}{2}x + 3, m \neq 0$ or $(L =) \frac{3}{2}x + 3$ or $y - y_1 = \frac{3}{2}(x - x_1)$ or $y - b = \frac{3}{2}(x - a)$ where (a, b) is a correct coordinate	Award of this mark implies the first M1
		A1	oe	Any correct equation gets 3 marks
	(b) Equation	B1	for $y = 5x + c, c \neq 0$ oe	May be in any equivalent form

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	(22, 20)	P1 P1 P1 P1 A1	for process to find width or height of diagram eg $38 - 6 (= 32)$ or $36 - 7 (= 29)$ for process to find length of side of square eg $"32" \div 4 (= 8)$ or process to find half width of diagram eg $"32" \div 2 (= 16)$ for process to find x coordinate eg $6 + 2 \times "8" (= 22)$ or $6 + "16" (= 22)$ or $(6 + 38) \div 2 (= 22)$ for process to find y coordinate eg $36 - 2 \times "8" (= 20)$ or $36 - "16" (= 20)$ or $7 + "8" + "29" - 3 \times "8" (= 20)$ cao SC: award 4 marks for (20, 22)	Figures may be shown on the diagram If $(6 + 38) \div 2$ leads to an answer other than 22, award P2 only Award for P3 for (22, y) or (x, 20) or $x = 22$ or $y = 20$
7	rotation 180° about $(-1, -2)$ or enlargement sf -1 centre $(-1, -2)$	B2 (B1)	rotation 180° about $(-1, -2)$ or enlargement sf -1 centre $(-1, -2)$ rotation 180° or rotation about $(-1, -2)$ OR enlargement sf -1 or enlargement centre $(-1, -2)$ Award no marks for the description if more than one transformation is given SC B1 for fully correct diagram if B0 scored	Condone missing brackets but do not accept centre written as a vector Do not accept 'half turn' for 'rotation 180°' Ignore references to clockwise and anticlockwise Triangles at $(-3, 1)$, $(-5, 1)$, $(-4, 3)$ and $(-3, -5)$, $(-5, -5)$, $(-4, -7)$

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	$b = \frac{2}{3}a + 2$	P1	for process to rearrange the equation to give y in terms of x eg $y = \frac{7-3x}{2}$ or $y = -\frac{3}{2}x + \left(\frac{7}{2}\right)$ or $m = -\frac{3}{2}$	
		P1	for using their gradient in $mn = -1$	
		P1	for showing a process to find the gradient of PQ eg $\frac{b-4}{a-3}$ OR for substituting $x = 3$ and $y = 4$ in $y = \frac{2}{3}x + c$	
		P1	(dep P3) for forming an equation in a and b eg $\frac{b-4}{a-3} = \frac{2}{3}$ or $b = \frac{2}{3}a + \text{“}2\text{”}$ OR correct equation in terms of x and y eg $y = \frac{2}{3}x + 2$	$y - 4 = \frac{2}{3}(x - 3)$ gets P4
		A1	for $b = \frac{2}{3}a + 2$ oe	Accept 0.66 or 0.67 oe for 2/3



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
24	Description	C2 (C1)	for (rotation) 90° clockwise about (−1, 0) or (rotation) 90° anticlockwise about (−1, 6) or (rotation) 180° about (−1, 2) or (rotation) 180° about (−1, 4) for (−1, 0) or (−1, 6) or (−1, 2) or (−1, 4))	Award 0 marks if there is reference to other transformations eg coordinates given as vectors (which is a translation)
25	9.75	P1 P1 B1 P1 A1	process to find the gradient of L $\left(= -\frac{3}{2} \right)$ process to find the gradient of the perpendicular line M eg use of $-\frac{1}{m}$ or states gradient as $\frac{2}{3}$ or $y = \frac{2}{3}x + c$ (indep) gives y coordinate of B = 8.5 oe (dep P2) process to find x coordinate of C (= 3) or y coordinate of C (= 4) eg the first stage of solving equations or using elimination by substitution, to find a coordinate of C . 9.75 oe	Could be indicated other ways, eg 8.5 on the y axis of a diagram fit their linear equation for M with L ; allow some error in manipulation of these linear equations as long as the overall process is correct. Award 0 marks for a correct answer with no supportive working.

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10	344 580.48	P1 P1 P1 A1	for a start to the process to find the initial investment eg $344\,605 \div 1.025$ oe (= 336 200) or for 1.025^3 (= 1.07689....) for complete process to find original investment, eg $344\,605 \div 1.025^3$ oe (= 319 078 to 320 265) for [initial investment] $\times 1.02^2 \times 1.035$ oe for answer in the range 343 587 to 344 581	[initial investment] must be clearly what they believe to be that and cannot be 344605
11 (a)	(9, 7.5)	M1 A1	for x coordinate = $PO(6) \times \frac{3}{2}$ (=9) or y coordinate = $OQ(3) \times \frac{5}{2}$ (= 7.5) or $PO(6) \times \frac{5}{2}$ (=15) or $OQ(3) \times \frac{3}{2}$ (= 4.5) cao	
(b)	$y = -2x + 3$	P1 P1 A1	for process to find the gradient of the line, eg $3 \div 6$ (=0.5) or $y = mx + 3$ for process to find gradient of perpendicular eg $-1 \div [\text{gradient of } PQ]$ (= -2) for $y = -2x + 3$ oe	Could use P and R or Q and R as fit from (a)

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	6.35, 6.45	B1	for 6.35 in the correct position	Accept 6.449 oe or 6.4499... oe
		B1	for 6.45 in the correct position	
12	49, 2	P1	for setting up $6 \div n = 3$ oe $7^n = a$ oe or one correct answer	Accept the figures written as a complete statement eg $(49x^6)^{\frac{1}{2}}$
		A1	cao	
13	(9, 8)	P1	for setting up an equation for one dimension (width) of the pattern eg $2b - a = 8$ oe or $2x + y = 8$ oe	a and b are the width and length x is the difference between the length and width, y is the width of the rectangle Both values correct implies this mark Award 0 marks for a correct answer with no supportive working.
		P1	for setting up an equation for the other dimension (height) of the pattern eg $2b + a = 16$ oe or $2x + 3y = 16$ oe	
		P1	(dep P2) for a full process to solve for both variables eg $4b = 24$, $b = 6$ and $12 - a = 8$, $a = 4$ or $8 = 2y$, $y = 4$ and $8 = 2x + y$, $x = 2$	
		P1	(dep P3) for a full process to find one of the coordinates of C eg $3 + 6 (= 9)$ or $4 + 4 (= 8)$ or $3 + 2 + 4 (= 9)$ or $4 + 4 (= 8)$	
		A1	cao	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	-6, 3.5	P1	for process to find gradient of PR or QR , eg $\frac{k+3-5}{k-4} \left(= \frac{k-2}{k+4} \right)$ or $\frac{k+3-6}{k-6} \left(= \frac{k+9}{k-6} \right)$ or $\frac{5-(k+3)}{-4-k} \left(= \frac{2-k}{-4-k} \right)$ or $\frac{-6-(k+3)}{6-k} \left(= \frac{-9-k}{6-k} \right)$ OR for start of process to use Pythagoras, eg $PR^2 = (k-4)^2 + (k+3-5)^2$ or $RP^2 = (-4-k)^2 + (-5-(k+3))^2$ or $QR^2 = (k-6)^2 + (k+3-6)^2$ or $RQ^2 = (6-k)^2 + (-6-(k+3))^2$	Condone missing bracket for first P1 only Stating eg Grad $PR = \frac{k-4}{k+3-5}$ Or grad $QR = \frac{k-6}{k+3-6}$ scores P0 but check SC
		P1	for forming a correct equation, eg $\frac{k+3-5}{k-4} \times \frac{k+3-6}{k-6} = -1$ or $\frac{k-2}{k+4} \times \frac{k+9}{k-6} = -1$ or $\frac{5-(k+3)}{-4-k} \times \frac{-6-(k+3)}{6-k} = -1$ or $\frac{2-k}{-4-k} \times \frac{-9-k}{6-k} = -1$ oe OR $(k-4)^2 + (k+3-5)^2 + (k-6)^2 + (k+3-6)^2 = (-6-5)^2 + (6-4)^2$ or $(k+4)^2 + (k-2)^2 + (k-6)^2 + (k+9)^2 = (-11)^2 + 10^2$	
		P1	for writing in the form $ak^2 + bk + c (= 0)$, eg $2k^2 + 5k - 42 (= 0)$ or $4k^2 + 10k - 84 (= 0)$	
		P1	(dep P3) for factorising, eg $(k+6)(2k-7) (= 0)$ or $(2k+12)(2k-7)$ or $(k+6)(4k-14)$ OR use of formula, eg $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -42}}{2 \times 2}$ or $\frac{-10 \pm \sqrt{10^2 - 4 \times 4 \times -84}}{2 \times 4}$	
		A1	cao SCB4 for correct answer coming from consistent use of reciprocals of gradients	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	(7, 3.5)	P1	process to find the gradient of OB , eg $\frac{-4-0}{2-0} (= -2)$	
		P1	process to find the equation of DE , eg substitutes $(12, -6.5)$ into $y = "-2"x + c$ or $y = [-2]x + c$ or $y - -6.5 = "-2"(x - 12)$ or $y - -6.5 = [-2](x - 12)$	Equation of DE is $y = -2x + 17.5$ Where $[-2]$ can be $\frac{-1}{2}$ or 2 or $\frac{1}{2}$ and must be labelled as the gradient of OB
		P1	process to find the equation of OD , eg substitutes $(0, 0)$ into $y = \frac{-1}{"-2"}x + c$ or $y = \frac{-1}{[-2]}x + c$ or $y - 0 = \frac{-1}{"-2"}(x - 0)$ or $y - 0 = \frac{-1}{[-2]}(x - 0)$	Equation of OD is $y = \frac{1}{2}x$ Where $[-2]$ can be $\frac{-1}{2}$ or 2 or $\frac{1}{2}$ and must be labelled as the gradient of OB
		P1	(dep P3) forms an equation that can be solved to find x coordinate of D , eg $"-2x + 17.5" = "\frac{1}{2}x"$	
		A1	cao	A correct answer with no supportive working gets 0 marks



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	Shown	M1	for the method to find a coordinate of the point D eg $\frac{1}{1+3} \times 16 (=4)$ or $\frac{3}{1+3} \times 8 (=6)$ or (4, 6) labelled	First two marks may be seen in either order Accept 4 or 6 stated or (6, 4)
		M1	for a correct form for L , eg $y = \sqrt{3}x + c$ OR a correct equation for the gradient of L , eg $\frac{[6]-f}{[4]-2} = \sqrt{3}$	Condone incorrect value for c when awarding this mark
		M1	for correct substitution to find c eg $[6] = \sqrt{3} \times [4] + c$ or $y - [6] = \sqrt{3}(x - [4])$ or $c = [6] - [4]\sqrt{3} (= -0.928...)$ OR starts to rearrange equation for gradient, eg $[6] - f = ([4] - 2)\sqrt{3}$	[4] must be clearly identified as the x -coordinate of D if incorrect Award of this mark implies the previous mark [6] must be clearly identified as the y -coordinate of D if incorrect
		M1	(dep on previous M1) for the method to substitute in -2 , eg $\sqrt{3} \times (-2) + [6] - \sqrt{3} \times [4]$ or $\sqrt{3} \times (-2) + [c]$ OR a correct unevaluated expression for f , eg $f = [6] - ([4] - 2)\sqrt{3}$	[c] must be clearly what they have found to be the y -intercept of L and must have come from correct processes to evaluate
		C1	accurate figure eg $f = -4.39...$ or $-4.39... < -4$	$-4.39...$ must come from correct working Accept -4.4 or better



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
7		Comment	B1	for correct mathematical comment eg line segments not a curve or should draw freehand or should not use a ruler, or should be a curve NB Do not accept statements about scale or plotting accuracy.
8		0.246, 0. $\dot{2}46$ 0. $\dot{2}4\dot{6}$, 0.24 $\dot{6}$	M1 A1	for correct use of recurring symbol eg $0.2\dot{4}6 = 0.24646\dots$ or 3 terms in the correct relative position cao
9		22.5	P1 P1 P1 P1 A1	for process to find James' speed eg $50 \div 2.5 (=20)$ or $50 \div 150 (= \frac{1}{3})$ for process to find James' time for 15 km eg $15 \div "20" (=0.75)$ or $15 \div \frac{1}{3} (=45)$ for process to find Peter's time for 15 km eg $"45" - 5 (=40)$ for process to find Peter's speed eg $15 \div "40"$ or $15 \div \frac{"40"}{60}$ oe
10 (a)		10	B1	accept ± 10
(b)		25	M1 A1	for $(\sqrt[3]{125})^2$ or $\sqrt[3]{125} = 5$ or $125^2 = 15625$ or $\sqrt[3]{125^2}$ cao



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	$3n^2 + 2n + 5$	M1	for a correct start to a method to find the n th term, eg equal 2nd differences imply a term in n^2	Need to see constant second difference found and n^2
		M1	for working with $3n^2$, eg $3n^2$ and sequence 7, 9, 11, ...	$3n^2 + 2n$ implies M2
		A1	for $3n^2 + 2n + 5$	
17	$-12, -7$	B1	cao	
18	160π	P1	for process to find curved surface area of cone, eg $\pi \times 10 \times 25 (= 250\pi) (= 785\dots)$	
		P1	for process to find the radius or diameter of the smaller cone eg $10 \times \frac{15}{25} (= 6)$ or $20 \times \frac{15}{25} (= 12)$ oe OR uses area scale factor, eg " 250π " $\times \left(\frac{15}{25}\right)^2 (= 90\pi)$	15 comes from $25 - 10$ $\frac{15}{25}$ may be seen as 0.6
		P1	for a complete process, eg " 250π " $- \pi \times "6" \times 15 (= 785\dots - 282\dots)$ or answer in range 502 to 503	
		A1	for 160π	Award 0 marks for an answer of 160π or an answer in range 502 to 503 with no supportive working. If 160π seen but answer in range 502 to 503 given on answer line isw and award full marks



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	98.8	P1	for process to find the radius of the top of the frustum eg $6 \div 10 \times 3 (= 1.8)$	Accept rounded or truncated values Accept multiples of π for process marks.
		P1	for process to find the curved surface area of the frustum eg $3 \times \pi \times 10 - "1.8" \times \pi \times 6 (= 60.3...)$	
		P1	for process to find the area of either circular face eg $\pi \times 3^2 (= 28.27...)$ or $\pi \times "1.8"{}^2 (= 10.1...)$	
		P1	for a process to find the curved surface area + the area of at least one circular face eg $3 \times \pi \times 10 - "1.8" \times \pi \times 6 + \pi \times 3^2 (= 88.5...)$ or $3 \times \pi \times 10 - "1.8" \times \pi \times 6 + \pi \times "1.8"{}^2 (= 70.49....)$	
		A1	for an answer in the range 98.7 to 98.8	If a correct answer within the range is shown in working but incorrectly rounded award full marks.
19	Statement	C1	for explanation Acceptable examples should go through (0, 1) should not go through (0, 0) it has touched the x-axis $3^0 = 1$ $3^0 \neq 0$ Not acceptable examples the graph has been drawn wrong axes are not labelled	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	84.9	P1 P1 A1	shows a process to find the radius or diameter eg $44 = 2 \times \pi \times r$ or $r = \frac{22}{\pi}$ or $d = \frac{44}{\pi}$ or $r = 7.0028$ or $d = 14.0056$. (dep on P1) complete method to find the area eg $\frac{1}{2} \times d^2 \times \sin 60$ oe, $\frac{1}{2} \times 14 \times \tan 60$ oe, $\frac{1}{2} \times 14 \times \sqrt{14^2 - 7^2}$ oe for answer in the range 84.8 to 85	Allow r in the range 7 to 7.1 and d in the range 14 to 14.1 Could be shown on the diagram. If the correct answer in the range is given in working and then rounded incorrectly award full marks.
14	curve (0,1) labelled	C1 C1	sketch of graph which starts above x-axis for negative x , and makes an increasing exponential rise into positive x for showing a label of (0,1) on the y axis	Condone graph “touching” the x axis. Do not award from a graph for positive x only. Do not award if a point is given for crossing the x -axis. Accept the coordinates shown as a label of “1” written on the y axis at the intersection.
15	6.5	B1	oe	Accept (eg) $6\frac{1}{2}$ and $\sqrt{42.25}$



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	$(-7, -1)$	M1 A1	for a method which shows understanding of the type of transformation eg reflection in the y axis or translation $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ or “(0 units right and) 3 units down” or for x coordinate as -7 or y coordinate as -1 for $(-7, -1)$	“Reflection” or “Translation” alone is insufficient. Note that the -7 or the -1 may appear in the working space, not necessarily in the final answer.
16	$2n^2 - 3$	M1 M1 A1	begins to work with 2 nd differences identifies $2n^2$ as part of the expression eg gives the sequence 2, 8, 18, 32, ... or gives a quadratic expression which includes the term $2n^2$ oe	$\begin{matrix} 6 & 10 & 14 & 18 & 22 \\ 4 & 4 & 4 & 4 \end{matrix}$ A quadratic expression of the form $2n^2 + bn + c$ can be awarded the first 2 marks
17	B, A, D, C	B2 (B1	for all correct for two or three correct)	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
4	(i) 238	P1 A1	for working with proportion eg $\frac{17}{50} \times 700$ oe cao	
	(ii) statement	C1	for statement Acceptable Sample is representative (otherwise answer wrong) Random sample (otherwise answer will be different) The 50 people are from the 700 (otherwise not accurate) 17 out of every 50 want a sports bag (otherwise answer will be different / wrong) There is no bias That the other 650 will want the same gifts as the 50 Not acceptable There would be more than 17 people who want the sports bag I rounded my answer 17 out of 50 want a sports bag A repeat of the calculation done in (i) Most of the people would want a sports bag References as what might change in the future (eg a change in membership) That all 700 people wanted a type of gift rather than no gift (otherwise would have changed my answer)	
5	(a) F	B1	cao	
	(b) D	B1	cao	
6	Shown (supported)	M1 M1 A1	for method to find at least two terms, eg $2 \times 4^2 - 1 (= 31)$ and $40 - 3^2 (= 31)$ for generating at least three correct terms of each sequence for generating at least the terms 1, 7, 17, 31, 49 of the first sequence and at least the terms 39, 36, 31, 24, 15, 4 of the second sequence	1 7 17 31 49 71 97 127 161 199 39 36 31 24 15 4 -9



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
1	$3n - 2$	B2 (B1)	for $3n - 2$ oe for $3n + k$ where $k \neq -2$ or is absent unambiguously shown)	Accept a different variable, eg. $3x - 2$ $n = 3n - 2$ gets B1 only $n + 3$ gets NO marks
2	Shown	M1 M1 C1	for conversion to improper fractions eg. $\frac{7}{3}$ or $\frac{15}{4}$ (dep) for method to multiply fractions, eg. $\frac{7 \times 15}{3 \times 4} (= \frac{105}{12})$ or $\frac{28 \times 45}{12 \times 12} (= \frac{1260}{144})$ oe for complete working showing each stage as far as $\frac{35}{4}$ or $8\frac{9}{12}$	Need not be shown with operators
3	B C D A	B2 (B1)	cao for two or three correct)	
4	A & D	B1	cao	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
5 (a)	63	B1	for 63, accept $3 \times 3 \times 7$ or $3^2 \times 7$	(A $\Rightarrow$) $2^2 \times 3^4 \times 7$ scores 0 marks
		M1	for at least two of $2^2, 3^4, 7^2$ or shows at least 3 multiples of 2268, eg 2268, 4536, 6804 and at least 3 multiples of 441, eg 441, 882, 1323	
		A1	for 15876 or $2^2 \times 3^4 \times 7^2$ oe	
6	65	P1	for a correct process to find the number of seconds, eg $67\,205\,600 \div 11.9 (= 5\,647\,529.4\dots)$ or for a correct process to convert between seconds and days, eg $24 \times 60 \times 60 (= 86\,400)$ oe, may be seen in stages or $11.9 \times 60 \times 60 \times 24 (= 1\,028\,160)$	Note that this mark may be awarded at any stage in the working. If a correct answer within the range is shown in working but incorrectly rounded award full marks.
		P1	for a complete process, eg “5 647 529.4...” $\div$ “86 400” or $67\,205\,600 \div$ “1 028 160”	
		A1	accept answers in the range 65 to 65.4 or 66	
7 (a)	(1, -3)	B1	cao	
		B1	for an answer in the range -0.8 to -0.6 or 2.6 to 2.8	
8	648	M1	for substitution into density formula eg 9×72 or $9 = \frac{m}{72}$	
		A1	cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	4.9	P1	for beginning to work with scale factors eg $\left(\frac{h}{12}\right)^3$ or $\left(\frac{12}{h}\right)^3$ or $\frac{90}{1350} \left(= \frac{1}{15}\right)$ or $\frac{1350}{90} (=15)$ or $90 : 1350$ oe	
		P1	for equating scale factors eg $\left(\frac{h}{12}\right)^3 = \frac{90}{1350}$ or $\left(\frac{12}{h}\right)^3 = "15"$ or for finding the linear scale factor, eg $\sqrt[3]{\frac{90}{1350}}$ or $\sqrt[3]{15}$ ($= 2.46(6\dots)$)	
		P1	for a complete method eg $\sqrt[3]{12^3 \times \frac{90}{1350}}$ or $12 \times \sqrt[3]{\frac{90}{1350}}$ or $\frac{12}{\left(\sqrt[3]{15}\right)^3}$	
(b)	$(15)^{\frac{2}{3}}$	A1	for answers in the range 4.8 to 4.9	
		B1	for $15^{\frac{2}{3}}$ or $\left(\sqrt[3]{15}\right)^2$ or $\sqrt[3]{15^2}$ or $225^{\frac{1}{3}}$	If given in an acceptable form, then given as a decimal, isw and award
17	$\frac{2}{3}$	M1	for correct substitution, eg $1.5 = k^{-1}$ oe or $\frac{1}{1.5}$	
		A1	oe but not $\frac{1}{1.5}$	Accept rounded or truncated to 2dp or better



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
11 (a)		1, -3	B1	cao
(b)		-0.75, 2.75	B1	accept -0.7 to -0.8, 2.7 to 2.8
(c)		-2.8	B1	cao
12 (a)		$\frac{1}{9}$	M1	for showing a method using either reciprocal or square root e.g. $\frac{1}{n}$ or 9 seen
			A1	cao Accept $\pm\frac{1}{9}$ or 0.1 recurring
(b)		$\frac{16}{25}$	M1	for showing cube root of 64 as 4 and the cube root of 125 as 5 or $\frac{16}{n}$ ($n \neq 25$) or $\frac{n}{25}$ ($n \neq 16$) or an intention to find the cube root and square.
			A1	cao Accept 0.64
13 (a)		$y = \frac{9}{x^2}$	M1	begins to work with $y = \frac{k}{x^2}$ oe e.g. subs of a pair of numbers into $y = \frac{k}{x^2}$ or states $k=9$
			A1	for $y = \frac{9}{x^2}$ Accept $y = 9x^{-2}$
(b)		$\frac{3}{4}$	M1	fit (dep on previous M1) subs $y = 16$ into proportional formula of the form $y = \frac{k}{x^2}$ oe
			A1	oe



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	Rotation 90° clockwise centre (−4, 1)	M1 A2 (A1)	for triangle B drawn at (4, 0), (4, −2), (3, −2) or for triangle C drawn at (−3, 0), (−3, −1), (−1, −1) or for rotating their B 90° clockwise about (1, 2) for rotation 90° clockwise centre (−4, 1) for any 2 of the 3 aspects)	Award for a triangle in the correct position without the label B or C as long as this is the only triangle in the quadrant. Accept just the vertices marked. Accept 270° (anticlockwise) Do not award A1 for ‘rotation 90° clockwise’ if triangle C is shown not in the correct orientation Do not award A marks if there is evidence of other transformations in the description or other ambiguity in the answer given
12 (i)	H	B1	cao	
(ii)	F	B1	cao	
(iii)	J	B1	cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	3, − 11	P1	for start of a process to complete the square, eg $2(x^2 - 6x) \dots$ or $2(x^2 - 6x \dots)$ or $(x - 3)^2 \dots$ or an x coordinate of 3	$\dots$ can be any constant term, but not a term in x
		P1	for completing the square ($y =$) $2(x - 3)^2 - 11$ or substitutes their value of x into the equation to find y	
		A1	cao	
21	Graph	C2	for a fully correct transformation	
		(C1	for a correct translation of $g(x)$ of 2 units in the positive y -direction or a correct reflection of $g(x)$ in the y -axis or for at least 2 of the points $(-1, 1)$, $(1, -2)$, $(3, 1)$ transformed to the correct final position, eg $(1, 3)$, $(-1, 0)$, $(-3, 3)$)	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
(b)	160	P1 P1 A1	for process to find the number sold in November, eg $180 \div 150 \times 100$ or $180 \div 1.5 (= 120)$ oe or for $0.75 \times 1.5 (= 1.125)$ oe or for $75 \times 1.5 (= 112.5)$ oe for a process to find the number sold in October, eg " $120 \div 75 \times 100$ " oe eg " $120 \div 0.75$ " or $180 \div "1.125"$ oe eg $180 \div "112.5" \times 100$ or [value] $\div 0.75$ oe cao	[value] can be any value they believe to be the number of bikes sold in November or 180
13	E C B H	B3 (B2) (B1)	for a fully correct table for 3 correct) for 2 correct)	
14	23.3	M1 A1	for a complete method eg $\frac{1}{2} \times 8.3 \times 9.8 \times \sin 35$ for answer in range 23.3 to 23.33	If an answer is shown in the range in working and then incorrectly rounded award full marks



Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	Proof with $\frac{127}{495}$	M1 M1 C1	0.25656... or $0.2 + 0.05656\ldots$ or $(10 \times 0.25\dot{6} =) 2.\dot{5}6$ or $2.5656\ldots$ or $(100 \times 0.25\dot{6} =) 25.\dot{6}5$ or $25.6565\ldots$ or $(1000 \times 0.25\dot{6} =) 256.\dot{5}6$ or $256.5656\ldots$ for finding two correct recurring decimals that when subtracted would result in a terminating decimal or integer, eg. $256.5656\ldots - 2.5656\ldots$ or $25.6565\ldots - 0.25656\ldots$ or $256.\dot{5}6 - 2.\dot{5}6$ or $25.\dot{6}5 - 0.25\dot{6}$ or for $\frac{254}{990}$ or $\frac{25.4}{99}$ full proof seen with $\frac{127}{495}$	
17	(2, -9)	P1 P1 P1 A1	substitutes $x = 0, y = -5$ into $y = x^2 + ax + b$ ($b = -5$) or substitutes $x = 5, y = 0$ into $y = x^2 + ax + b$ ($0 = 25 + 5a + b$) or starts process to find other intercept, eg writes $y = (x - 5)(x - k)$ for complete process to find two intercepts, eg. substitutes the second point into $y = x^2 + ax + b$ and solves to find a ($= -4$) and b ($= -5$) or substitutes $x = 0, y = -5$ into $y = (x - 5)(x - k)$ and solves to find k ($= -1$) (dep on P2) for factorising or completing the square of $x^2 + "-4"x + "-5"$ and identifying the x-coordinate of the turning point or for a complete process to find the x-coordinate of the turning point, eg $(5 + "-1")/2$ cao	x-coordinate of 2 with no or incorrect working gets NO marks

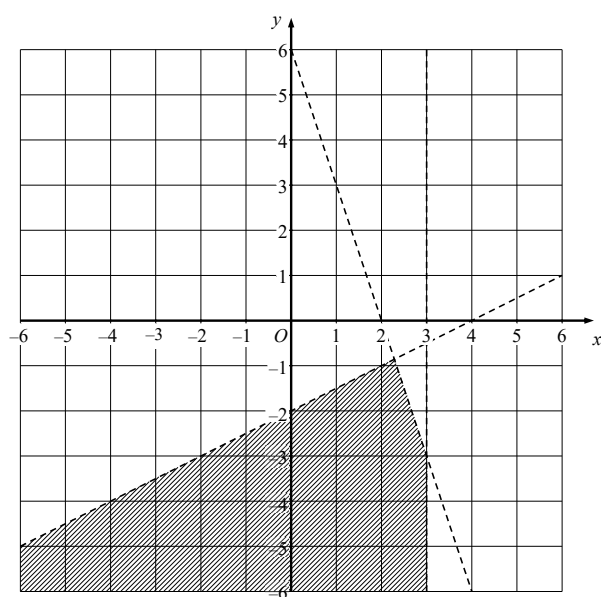
Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	2.7 and -0.7	M1	for $x^2-3 = 2x-1$ oe or $x^2-3 - 2x + 1 (=0)$ or completing the square eg $(y=)(x-1)^2-1-2$	
		M1	(dep M1) draws graph of $y = 2x-1$ or drawing the translated graph or describing the translation in words or $-1.7 + 1 (= -0.7)$ or $1.7 + 1 (= 2.7)$	Line segments required For 1.7 allow from 1.6 to 1.8 For -1.7 allow from -1.8 to -1.6
		M1	shows the points of intersection clearly for the given quadratic graph and linear graph or for one correct solution from appropriate supportive working	Points indicated or attempt to read off x-axis at the appropriate points – maybe indicated by dashes
		A1	for x in the range 2.6 to 2.8 and -0.6 to -0.8 SCB2 for plotting $y = 2x + 1$ and values for x in the range -1.1 to -1.3 and 3.1 to 3.3	No marks will be awarded for correct answers only
18	1.95	P1	for correct substitution into the cosine rule, eg $3.4^2 = 6.1^2 + 6.2^2 - 2 \times 6.1 \times 6.2 \times \cos BCA$	Can be any angle within triangle ABC
		P1	for a full process to find BCA eg $(\cos BCA =) \frac{6.1^2 + 6.2^2 - 3.4^2}{2 \times 6.1 \times 6.2}$ or $(BCA =) 32(.08046913...)$	P2 can be awarded for $BCA = 32(.08046913...)$
		P1	correct substitution into the sine rule, eg $\frac{DC}{\sin(32.08... \times \frac{2}{3})} = \frac{6.2}{\sin(180 - 32.08... - ("32.08..." \times \frac{2}{3}))}$	
		P1	for complete process to find DC eg $(DC =) \frac{6.2 \times \sin "12.832"}{\sin "135.088"}$	
		A1	Answer in the range 1.94 to 1.951	Must not come from incorrect processing



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
3	No (supported)	P1	for $3000 \div (2 + 3) (= 600)$	Full method to compare No working, answer only no marks No may be implied by a statement
		P1	for “600” $\times 2 (= 1200)$ or “600” $\times 3 (= 1800)$ or “600” $\div 6 (= 100)$ or “600” $\div 20 (= 30)$	
		P1	for “1200” $\div 6 (= 200)$ or “1800” $\div 20 (= 90)$ or “100” $\times 2 (= 200)$ or “30” $\times 3 (= 90)$	
		P1	for “90” $\div$ (“200” + “90”) $\times 100 (= 31.0\dots)$ or “90” $\div$ (“200” + “90”) $(= 0.31\dots)$ or $0.3 \times$ (“200” + “90”) $(= 87)$ or “90” $\div$ (“200” + “90”) $(= 0.31\dots)$	
		C1	correct conclusion and fully correct calculations with accurate figure eg No and 87 or No and 31% or No and 0.31	
4	(a)	B2	for all 4 values correct	Accept a freehand curve drawn that is not made of line segments Line sections outside the required range can be ignored.
		(B1)	for 2 or 3 correct values)	
	(b)	M1	ft (dep on B1) for plotting at least 4 of the points from their table correctly	
		A1	for a fully correct curve drawn	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	$\frac{1}{4}$	M1	for $f(1) = 3 \times 1^2 + 1 (= 4)$ and a clear intention to find $g(“4”)$	
			or for $\frac{4}{(3 \times 1^2 + 1)^2}$	
			or for stating $gf(x)$, eg $\frac{4}{(3x^2 + 1)^2}$ oe	
		A1	oe	
(b)	$\sqrt[4]{\frac{48}{x-1}}$	M1	for finding $fg(x)$, eg $3 \times \left(\frac{4}{x^2}\right)^2 + 1$ or $\frac{48}{x^4} + 1$	
		M1	for start of method to find the inverse of $fg(x)$, eg $y - 1 = 3 \times \left(\frac{4}{x^2}\right)^2$ or $y - 1 = \frac{48}{x^4}$	
			or $x - 1 = \frac{48}{y^4}$ or $x - 1 = 3 \times \left(\frac{4}{y^2}\right)^2$	
		M1	for $y^4 = \frac{48}{x-1}$ or $x^4 = \frac{48}{y-1}$ or for a final answer of $\sqrt[4]{\frac{48}{y-1}}$	
		A1	oe	
22	(3, 36)	P1	for factorising -3 from the expression, eg $-3(x^2 - 6x - 3)$ or $-3(x^2 - 6x) + 9$	ft from their factorising if only one error An answer only and no working is 0 marks
		P1	for starting the process to complete the square, eg $(x - 3)^2 - 9$	
		P1	for completing the process of completing the square, eg $-3[(x - 3)^2 - 12]$ or $-3(x - 3)^2 + 36$	
		A1	cao	

Question 17



Paper: 1MA1/1H					
Question	Answer	Mark	Mark scheme	Additional guidance	
7	1250	P1	for process to use area of base in the formula, eg $\frac{10000}{2 \times 4}$		
		A1	cao		
8	Pair of values	P1	for at least 5 multiples of 5 (with no more than 1 incorrect) or for at least 5 multiples of 7 (with no more than 1 incorrect) or for m = a multiple of 35 and n = a multiple of 14 or for $m = 35$ or $n = 14$	$m = 35, n = 14, 28, 42, 56, 84, \dots$ $m = 105, n = 14, 28, 56, 98, \dots$	
		A1	for a correct pair of values, eg $m = 35$ and $n = 14$ or $m = 35$ and $n = 28$ or $m = 105$ and $n = 14$		
9	(a)	(9), -4, -5, 0, 5, (4), (-9)	B2	for all 4 values correct	Accept a freehand curve drawn that is not made of line segments Ignore anything outside the required range
			(B1	for 2 or 3 correct values)	
	(b)	Graph drawn	B2	for a fully correct graph	
			(B1	ft (dep on B1 in (a)) for plotting at least 5 of the points from their table correctly)	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
20 (a)		-0.4 to -0.2 and 3.2 to 3.4	M1 A1	for $(y =) x + 4$ for answers in the range -0.4 to -0.2 and 3.2 to 3.4
(b)		1.6 to 2.5	M1 M1 A1	for drawing a tangent to the curve at $x = 2$ for method to find gradient of their tangent for answer in the range 1.6 to 2.5
21		8600	P1 P1 P1 A1	for process to find the length of the rectangle, e.g. $24 \times 4 (= 96)$ for process to find the perpendicular height of an equilateral triangle of side (24×2) cm, e.g. $48\sin 60 (= 41.5(69..))$ or $\sqrt{48^2 - 24^2} (= 24\sqrt{3}$ oe) for complete process to find the width of rectangle, e.g. " $41.5(69..)$ " + $24 + 24 (= 89.5(69..))$ for answer in the range 8592 to 8602
22		$2n^2 + n + 1$	M1 M1 A1	for a correct start to a method to find n th term, eg. equal 2nd differences imply a term in n^2 or sight of $an^2 + bn + c$ for a method leading to $2n^2$ and either n or 1 for $2n^2 + n + 1$ oe
23		$y = \frac{-3}{\sqrt{7}}x + \frac{8}{\sqrt{7}}$	M1 M1 A1	for method to find gradient of OP, eg. $\frac{\sqrt{7}}{2} \div \frac{3}{2} (= \frac{\sqrt{7}}{3}$ or 0.88 ...) oe (dep) for method to find gradient of tangent, m , eg. $\frac{\frac{\sqrt{7}}{2}}{\frac{3}{2}} \times m = -1$ ($m = \frac{-3}{\sqrt{7}}$ or -1.13..)) for $y - \frac{\sqrt{7}}{2} = \frac{-3}{\sqrt{7}}(x - \frac{3}{2})$ or $y = \frac{-3\sqrt{7}}{7}x + \frac{8\sqrt{7}}{7}$ oe or $y - 1.32.. = -1.13..(x - 1.5)$

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
3	(a)	2, -4, 2, 8	B2 (B1 for 2 or 3 correct values)	
	(b)	Graph	M1 A1 (dep B1) for at least 5 points plotted correctly ft from part a for a fully correct curve drawn	Accept freehand curves drawn that are not line segments; there must be some attempt to draw the minimum point below $y = -4$
	(c)	-2.6 or 1.6	B1 for 1 correct value, ft a non linear graph	Award for -2.6 or 1.6 or both values but do not award the mark if a correct value is given with an incorrect value. Accept 1.56 or -2.56 Note for ft to be applied if the graph may be joined by line segments

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
20 (a)	graph	C2	for a translation of the graph by the vector $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$	Condone graph of $y = f(-x)$ also being drawn on the grid
		(C1)	for a translation of the graph by the vector $\begin{pmatrix} -1 \\ b \end{pmatrix}$ where $b \neq -3$ or $\begin{pmatrix} a \\ -3 \end{pmatrix}$ where $a \neq -1$ or for a translation by the vector $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$ of 3 or 4 critical points)	Correct vector gets 1 mark
(b)	2, 1	B1	cao	
21	Sketch graph with TP at (2, -13) and intercepts at (0, -5), $(2 + \sqrt{\frac{13}{2}}, 0)$ and $(2 - \sqrt{\frac{13}{2}}, 0)$	B1	for a parabola drawn with intercept at the point (0, -5)	
		M1	for the start of a method to find the roots of $y = 0$, eg. $2(x - 2)^2 - 13 (= 0)$ oe or $(x =) \frac{- -8 \pm \sqrt{(-8)^2 - 4 \times 2 \times -5}}{2 \times 2}$	
		M1	(dep) for method to find the roots, eg. $2 \pm \sqrt{\frac{13}{2}}$ oe	
		B1	for turning point at (2, -13)	Turning point may be just seen and labelled on the sketch
		C1	for a fully correct parabola drawn with turning point at (2, -13) and intercepts at (0, -5), $(2 + \sqrt{\frac{13}{2}}, 0)$ oe and $(2 - \sqrt{\frac{13}{2}}, 0)$ oe clearly shown	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
23	Sketch graph with minimum point at $(3p, -9p^2 - 7)$ in 4 th quadrant and y intercept at $(0, -7)$	B1	for a curve drawn with intercept at the point $(0, -7)$	
		M1	for the start of a method to find the turning point, eg $(x - 3p)^2 \dots$ or an x coordinate of $3p$ at the vertex	where ... can be any constant term(s) but not term(s) in x
		M1	(dep) for a complete correct method to find the turning point, eg $(x - 3p)^2 - 9p^2 - 7$ or substitutes $x = 3p$ into the equation to find y	Allow $(3p)^2$ for $9p^2$ throughout
		B1	for turning point at $(3p, -9p^2 - 7)$	
		C1	for a sketch of a parabola drawn with intercept at $(0, -7)$ and minimum turning point clearly shown as being at $(3p, -9p^2 - 7)$ in the 4th quadrant.	A correct answer with no supportive working gets 0 marks



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
3	(a)	(2), -2, (-4), -4, -2, 2	B2 (B1 for 2 or 3 correct values)	Accept a freehand curve drawn that is not made of line segments Curve must not have a horizontal segment between (-1, -4) and (0, -4) Ignore anything drawn outside the required range
	(b)	Graph drawn	B2 (B1 fit (dep on B1 in (a)) for plotting at least 5 of the points from their table correctly)	
	(c)	- 0.5, - 4.25	B1 fit their graph with a single turning point or for x coordinate = - 0.5 and y coordinate = - 4.25 oe	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
4	3 : 5	P1 P1 P1 P1 A1	for process to find 20% or 120% of the cost, eg 8500×0.2 (= 1700) oe or 8500×1.2 (= 10 200) oe for process to find total cost of payments, eg 12×531.25 (= 6375) for complete process to find value of deposit, eg “10 200” – “6375” (= 3825) or $8500 - “6375”$ (= 2125) and “2125” + “1700” (= 3825) OR the deposit as a proportion of the total cost, eg $1 - \frac{“6375”}{“10200”}$ ($= \frac{3}{8}$) for finding a correct un-simplified ratio, eg “3825” : “6375” oe or 5:3 or $1.\dot{6} : 1$ or $\frac{5}{3} : 1$ Accept 1: $1.\dot{6}$, 1: $\frac{5}{3}$	When partitioning all figures quoted must be correct or a full method shown eg $10\% = 8500 \div 10$ (=850) and $20\% = “850” + “850”$ (=1700) May be seen as a fraction of the total eg $\frac{3825}{10200}$ ($= \frac{3}{8}$) Figures at this stage must be expressed as part of a ratio eg 51:85, $\frac{3}{8} : \frac{5}{8}$ Ignore consistent units
5	(a) 0, -4, -6, -4, 0 (b) Graph (c) 2.6 and -1.6	B2 (B1) M1 A1 M1 A1	fully correct figures at least 2 correct figures) (dep B1) for at least 5 points correctly plotted ft from (a) fully correct graph for $y = -2$ drawn or intersections with $y = -2$ or $y = x^2 - x - 4$ drawn or 1 correct value ft a quadratic graph or for answers in the range 2.5 to 2.7 and -1.5 to -1.7	 Must be a curve If answers stated as coordinates, award M1 for both coordinates and M0 for one coordinate

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
3 (a)	80	M1	for a complete method eg $\frac{20}{15} \times 60$ or 20×4 or $20 \div \frac{1}{4}$	
		A1	cao	
		M1	for method to find distance travelled in last 20 minutes, eg $75 \times \frac{20}{60}$ (= 25)	
		C2	for a fully correct travel graph	
(b)	Travel graph	(C1	for horizontal straight line from (10 15, 20) to (10 25, 20) or for a line of the correct length and gradient to indicate a speed of 75km/h eg a straight line from (10 25, 20) to (10 45, 45))	Can be implied by a distance of 25km drawn on the graph
4 (a)	(10), 5, (2), 1, 2, (5), 10	B2	for all 4 values correct	
		(B1	for 2 or 3 correct values)	
		M1	ft (dep on B1) for plotting at least 5 of their points correctly	
		A1	for a fully correct curve drawn	
(b)	Graph			Accept a freehand curve drawn that is not made of line segments
(c)	−0.65 to −0.8 and 2.65 to 2.8	M1	for $y = 4$ drawn or intersection with $y = 4$ or $y = x^2 - 2x - 2$ drawn or 1 correct value ft a quadratic graph	If answers stated as coordinates, award M1 for both coordinates and M0 for one coordinate
		A1	ft a quadratic graph or for answers in the range 2.65 to 2.8 and −0.65 to −0.8	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	132	M1 M1 A1	for finding an exterior angle eg $360 \div 6 (= 60)$ or $360 \div 5 (= 72)$ or an interior angle eg $180 \times 4 \div 6 (= 120)$ or $180 \times 3 \div 5 (= 108)$ for a complete method eg $360 - "120" - "108"$ or $"60" + "72"$ cao	Angles may be shown on the diagram. Only award this mark for an angle that is not contradicted Answer only award no marks
6	(a) 5,(1),(-1),-1,1,5 (b) Graph drawn (c) 0.3 to 0.5 and 2.5 to 2.7	B2 (B1) B2 (B1) M1 A1	for all 4 values correct (B1 for 2 or 3 correct values) for a fully correct graph (B1 fit (dep on B1 in (a)) for plotting at least 5 of the points from their table correctly) for a correct method, eg marking intercepts with x -axis or one correct solution or both solutions given as a coordinates, eg (0.4, 2.6) or (0.4, 0) and (2.6, 0) for answers in the range 0.3 to 0.5 and 2.5 to 2.7 or fit their graph with at least 2 solutions	 Accept a freehand curve drawn that is not made of line segments Ignore anything drawn outside the required range fit their graph for this mark Accept these coordinates reversed
7	3 : 2	P1 P1 A1	for a process to find either volume eg $3^3 (= 27)$ or $4^3 (= 64)$ for showing density A = $81 \div "27" (= 3)$ or density B = $128 \div "64" (= 2)$ for 3 : 2 oe	 Ignore units quoted

Paper: 1MA1/2H					
Question	Answer	Mark	Mark scheme	Additional guidance	
5	(a)	(6) 2 (0) 0 (2) 6	B2	for all 3 values correct	Accept a freehand curve drawn that is not made of line segments Ignore anything drawn outside the required range
			(B1)	for 1 or 2 correct values)	
	(b)	Graph drawn	B2	for a fully correct graph	
			(B1)	ft (dep on B1 in (a)) for plotting at least 5 of the points from their table correctly)	
	(c)	-1.7 to -1.5 and 2.5 to 2.7	M1	for drawing the line $y = 4$ or reading off intersections where $y = 4$ or one correct solution or both solutions given as coordinates, eg (-1.6, 2.6) or (-1.6, 4) and (2.6, 4)	ft their graph for this mark Accept these coordinates reversed
A1	for answers in the range -1.7 to -1.5 and 2.5 to 2.7 or ft their graph with at least 2 solutions		Algebraic methods score 0 marks		

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	55	P1	for process to find the sum of the interior angles of a pentagon, eg $180 \times (5 - 2)$ (= 540) oe	Can be implied by the shape correctly divided into triangle and quadrilateral or three triangles with correct angle sums marked
		P1	for the start to a process of giving each angle in a common form, eg $d = 3c$ or $e = 2c$ or $x, 3x, 2x$	Can be implied by division by 7 or 1, 1, 3, 2 given in a ratio eg 1 : 2 : 1 : 3
		P1	for process to find the value of c , eg $([540] - 155) \div 7$ oe or for a correct equation in one variable, eg $c + 155 + c + 3c + 2c = [540]$ oe	Where [540] is what they believe to be the angle sum of the pentagon
		A1	cao	
7	Rate of change of volume	C1	for a correct explanation Acceptable examples The rate of water poured Speed of pouring water out from the tank How fast the water is being used (in the tank over time) Amount of water decreasing in the tank each second Not acceptable examples Negative correlation / negative gradient Amount of water decreasing in the tank in seconds As time increases the volume of water in the tank decreases It is negative, the volume of litres is going down It represents the deceleration or changing speed	Allow amount of water increasing in the tank each second



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
9		65.60	P1 P1 A1	for start in using inverse proportionality, eg $5 \times 4.5 (= 22.5)$ or $4.5 = \frac{k}{5}$ or $5 \times 4.5 \times 60 (= 1350)$ or $\frac{5}{3}$ or $\frac{3}{5}$ for process to find number of hours for each cleaner today, eg $\frac{22.5}{3} (= 7.5)$ for 65.6(0) (SC B2 for 61.5(0))
10 (a)		0 to 20 seconds	B1	for between 0 seconds and 20 seconds
		with reason	C1	for reason given eg gradient is greatest oe
(b)		18	B1	ft from (a)
11		0.119	P1 P1 A1	for starting the process, eg finds area 25π or 16π oe, or finds angle for town A, $0 - 19 (70^\circ)$, may be on diagram for a complete process, eg $\frac{70}{360} \times \frac{25\pi}{41\pi}$ $0.118 - 0.119$ or $11.8\% - 11.9\%$



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13 (a)	Shown	M1	for finding one missing angle eg $BDE = y$ or $ODE = 90$ or $ODF = 90$ or $DBO = x$ or $BCD = 180 - y$ or (reflex) $BOD = 2y$	Could be shown on the diagram or in working
		A1	for a complete correct method leading to $y - x = 90$	
(b)	Explanation	C1	(dep on A1) for all correct circle theorems given appropriate for their working eg The <u>tangent</u> to a circle is perpendicular (90°) to the <u>radius</u> (<u>diameter</u>) <u>Alternate segment</u> theorem OR <u>Angle</u> at the <u>centre</u> is <u>twice</u> the <u>angle</u> at the <u>circumference</u> Opposite angles in a <u>cyclic quadrilateral</u> sum to 180°	
		C1	for explanation eg No as y must be less than 180 as it is an angle in a triangle	
14	11 – 19	P1	for drawing a tangent to the curve at time = 5	Using their drawn tangent, eg change in $y \div$ change in x Must come from gradient of a tangent.
		P1	for process to find the gradient, eg $70 \div 5$	
		A1	(dep on 1 st P1) for answer in the range 11 - 19 m/s	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	3.4	M1	for drawing a suitable tangent at $t = 6$	Use of change in y over change in x Answers of $\frac{10}{6}$ oe scores no marks
		M1	for a full method to find the gradient of the tangent at $t=6$, eg $20 \div 5.8$	
		A1	answer in the range 3.05 to 3.7	
20	$n^2 - 2n$	M1	for correct deduction from differences, eg 2nd difference of 2 implies $1n^2$ or gives a quadratic expression which includes the term $1n^2$ or states 1,4,9,16,25 and deduces 2,4,6,8,10	
		A1	oe	
21	$\frac{1}{81}$	M1	for finding the probability of heads eg $\sqrt[4]{\frac{16}{81}}$ ($=\frac{2}{3}$)	Seeing a probability of $\frac{2}{3}$ or $\frac{1}{3}$ is enough for this mark
		A1	or for finding the probability of tails $1 - \sqrt[4]{\frac{16}{81}}$ ($=\frac{1}{3}$) oe	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	1	B1	cao	
	(b) $\frac{8}{x-4}$	B1	cao	
	(c) $27n^{12}w^6$	B2 (B1)	cao for two of $27, n^{12}, w^6$ in a product	
11	Yes (supported)	P1	for process to find number of combinations, eg 5×8 oe (= 40) or for $240 \div 5$ (= 48) or $240 \div 8$ (= 30) or for $240 \div 5 \div 8$ (= 6) or $5 \times 8 \times x = 240$	
		C1	Yes and 6	
12 (a)	-0.09	M1	for suitable method to find gradient, eg $27 \div 300$	Any readings from the graph must be reasonable. Condone missing negative for M1 Can fit explanation linked to incorrect gradient in part (a)
		A1	for answer in the range -0.1 to -0.08 oe	
		C1	for explanation Acceptable examples volume of petrol used each km litres/km Rate of fuel consumption For every 9 litres you can travel 100km Not acceptable examples volume $\div$ distance volume of petrol used per distance km/litre as distance increases volume decreases	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
14	8 : 12 : 9 : 1	P1 P1 P1 A1	for $2 + 3 (= 5)$ and $9 + 1 (= 10)$ OR for assigning a total number of sweets for F + G and O + J eg $F + G = 100$, $O + J = 50$ for finding correct multiplier for relationship between totals for F + G and O + J eg $\times 4$ to get from 5, 10 to 20, 10 OR for working out the number of sweets from their totals for F, G eg 40, 60 or for O, J, eg 45, 5 for $2 \times 4 (= 8)$ and $3 \times 4 (= 12)$ OR for ratio in unsimplified form, eg 40 : 60 : 45 : 5 cao	May be in algebraic form, eg $2a + 3a (= 5a)$ and $9a + 1a (= 10a)$ May be in algebraic form, eg $F + G = 5a$, $O + J = 2.5a$
15	0.7 to 1.1	M1 M1 A1	for tangent to the curve drawn at $t = 12$ for method to find the gradient of their tangent, eg $28 \div 30$ for answer in the range 0.7 to 1.1 dependent upon tangent drawn	Working may be seen on the diagram Ignore negative signs

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
8 (a)	0.14	M1	for a method to find the gradient, eg. $14 \div 100$ using readings from the graph, at least one correct or for an answer of $0.14x$	Must use the scales on the graph
		A1	for answer in the range 0.135 to 0.145 or ft correct readings from the graph	May be expressed as a fraction
(b)	Cost per unit of electricity	C1	for a correct explanation Acceptable examples eg cost of each unit (of electricity) rate of change of cost with units of electricity used cost per unit of electricity each unit costs 14p average cost charged for each unit of electricity used Not acceptable examples cost of how many units used costs in pounds per number of units used how much the cost of electricity goes up the relationship of cost and number of units used how steep it is	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	187.5	M1	for $\left(\frac{5}{2}\right)^3$ or $\left(\frac{2}{5}\right)^3$ or 2.5^3 or $\left(\frac{1}{2.5}\right)^3$ or $2^3 : 5^3$	Accept $\frac{375}{2}$
		M1	for a complete method, eg $12 \div 8 \times 125$ or 12×2.5^3	
		A1	oe	
14	17	M1	for $27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2$ or 3^2 or $\sqrt[3]{27^2}$ or $\sqrt[3]{729}$ or $\left(\frac{1}{2}\right)^{-3} = \frac{1}{\left(\frac{1}{2}\right)^3}$ or 2^3	
		M1	for a full method eg “3” ² + “2” ³ or for correctly evaluating $27^{\frac{2}{3}}$ or $\left(\frac{1}{2}\right)^{-3}$ eg 9 or 8 seen	
		A1	cao	
15	25	M1	for a tangent drawn at $t = 3$	A tangent must be seen to award any marks
		M1	for a complete method to find the gradient from tangent eg $50 \div (4 - 2)$	This mark can be awarded if the tangent is drawn at $t \neq 3$
		A1	for answer in the range 22 to 28 or ft acceptable tangent	Award 0 marks for a correct answer (in the range) with no (or incorrect) supportive working

Paper: 1MA1/3H					
Question	Answer	Mark	Mark scheme	Additional guidance	
21 (a)	Sketch	B1	for an appropriate sketch, ie reflection in x axis	Allow some tolerance on the points and in drawing the function if the intention is clear	
		M1	for coordinates of $p = (270, -1)$	May see 270 and -1 marked in the correct positions on the axes	
		M1	for describing part of the translation, eg “270” – 180, or “ -1 ” + 4 or $[x_p] - 180$, or $[y_p] + 4$ or for an answer of $(90, b)$ or an answer of $(a, 3)$	$[x_p]$, $[y_p]$ must be a numerical value and clearly identified as point P by labelling or on the diagram with no contradiction	
		A1	cao		
22	1760	M1	for starting to find the area under the curve, eg $0.5 \times 10 \times 54 (= 270)$ oe or $0.5 \times 10 \times (54 + 76) (= 650)$ oe or $0.5 \times 10 \times (76 + 92) (= 840)$ or for a method to find an estimate for the area of at least 1 strip with heights at intersection of midpoint and curve eg $10 \times [39]$ oe or $10 \times [67]$ oe or $10 \times [86]$ oe	Must have one correct expression for the award of this mark May be seen as a rectangle added to a triangle Where $38 \leq [39] \leq 40$ Where $66 \leq [67] \leq 68$ Where $85 \leq [86] \leq 87$	
		M1	for a complete method to find the area under the curve, eg $0.5 \times 10 \times 54 + 0.5 \times 10 \times (54 + 76) + 0.5 \times 10 \times (76 + 92)$ oe eg $0.5 \times 10 (92 + 2(54 + 76))$ or $10 \times [39] + 10 \times [67] + 10 \times [86]$ oe	Allow 1 error in y values used	
		A1	for 1760 or 1890 to 1950 SCB2 for an answer in the range 1815 – 1855	Allow 1890 to 1950 only if it comes from midpoint method	

Paper: 1MA1/3H				
Question	Working	Answer	Mark	Notes
18 (a)	values 0, 2, 5, 10, 18	130	M1	for starting to find area under the curve, eg $0.5 \times 5 \times 2 (= 5)$
			M1	for a complete method to find the area under the curve using 4 strips of equal width, eg $"5" + 0.5 \times 5 \times (2+5) (= 17.5) + 0.5 \times 5 \times (5+10) (= 37.5) + 0.5 \times 5 \times (10+18) (= 70)$
			A1	for 130 or answer in range 130.1 to 132 supported by accurate working
(b)		overestimate with reason	C1	for "overestimate" and appropriate reason linked to method eg area between trapeziums and curve also included
19		Proof (supported)	M1	starts process to find point of intersection by substituting, eg $(10 + 2y)^2 + y^2 (= 20)$
			M1	for expanding, eg $4y^2 + 20y + 20y + 100$ (3 out of 4 terms correct)
			M1	(dep M2) for 3-term quadratic equation ready for solving, eg $5y^2 + 40y + 80 = 0$
			M1	(dep on previous M1) for method to solve an equation of the form $ay^2 + by + c = 0$, eg by factorising or correct substitution into quadratic formula
			C1	fully correct method leading to $y = -4$ or $x = 2$ or $(y + 4)^2 = 0$ or $(x - 2)^2 = 0$ and statement, eg only one point of intersection so the line is a tangent to the circle
20		Proof	C1	draws OC and considers angles in an isosceles triangle (algebraic notation may be used, eg two angles labelled x)
			C1	finds sum of angles in triangle ABC , eg $x + x + y + y = 180$, or sum of angles at O , eg $180 - 2x + 180 - 2y$
			C1	complete method leading to $ACB = 90$
			C1	complete proof with all reasons given, eg base angles of an isosceles triangle are equal, angles in a triangle add up to 180° , angles on a straight line add up to 180°



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	150 000	P1 P1 A1	for process to find cost in 2007, eg $162\,000 \div 0.9 (= 180\,000)$ oe for process to find cost in 2003, eg $[\text{cost in 2007}] \div 1.2 (= 150\,000)$ oe cao	Award 2 marks for $162\,000 \div 1.08$ oe
12 (a)	1.5	M1 A1	for method to find the gradient of the line, eg $\frac{12}{8}$ for 1.5 oe	Must see use of scales.
(b)	Explanation	C1	Explanation relating to rate of change of volume with time, eg rate at which the container fills or change in number of litres per second or number of litres added per second	Ignore any quantities given. Award the mark for an explanation involving rate.
(c)	Explanation	C1	Explanation relating to volume (amount) of liquid in the container at the start eg number of litres in the container when $t = 0$, amount of liquid in the container to start with	
13	6.50	M1 M1 A1	for method to find ratio or scale factor of lengths or volumes eg $\sqrt{3} : 2$ or $1 : 1.15(47\dots)$ or $0.86(60\dots) : 1$ or $\sqrt{27} : 8$ oe for complete method to find ratio of volumes and use to find required volume eg $10 \div ("1.15\dots")^3$ or $10 \times ("0.86\dots")^3$ for answer in the range 6.49 to 6.53	Scale factors may just be seen as 1.15..., 0.86...etc If an answer is given within the range then incorrectly rounded to 3 sig figs, award full marks. Accept 6.5

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
14	240	M1 A1	for start to method to find total number of matches, eg 16×15 or $16^2 - 16$ or $16 \times 15 \times 2 (= 480)$ or $\frac{16 \times 15}{2} (= 120)$ cao	Credit complete listing strategies
15 (a)	488 to 507	M1 M1 A1	for method to find area of one strip using trapezia, eg $\frac{1}{2} \times 5 \times 22 (= 55)$ or $\frac{1}{2} \times 5 \times (22 + 28) (= 125)$ or $\frac{1}{2} \times 5 \times (28 + 32) (= 150)$ or $\frac{1}{2} \times 5 \times (32 + 35) (= 167.5)$ OR for a method to find an estimate for the area using rectangles eg 5×22 or 5×28 or 5×32 or 5×35 for complete and correct method to find the area using four strips, eg $\frac{1}{2} \times 5 \times 22 + \frac{1}{2} \times 5 \times (22 + 28) + \frac{1}{2} \times 5 \times (28 + 32)$ $+ \frac{1}{2} \times 5 \times (32 + 35)$ or $5 \times 22 + 5 \times 28 + 5 \times 32 + 5 \times 35$	May use area of triangle + area of rectangle for the second, third and fourth strips – lengths must be correct. May use triangle for first strip, $\frac{1}{2} \times 5 \times 22$
(b)	Underestimate (supported)	C1	for answer in the range 488 to 507 (SC B1 for using area under the curve) (dep M1) for underestimate since parts not included below the graph OR ft their method	May use triangle for first strip, $\frac{1}{2} \times 5 \times 22$

Paper: IMA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	129 to 160	M1	for a method to find an estimate for the area under the curve eg $0.5 \times 30 \times 9$	Do not accept 30×9
		A1	for value in the range 129 to 160 (If M0, SC B1 for 126 or 127.5)	Award full marks for any correct method leading to a better estimate.
	(b) underestimate with reason	C1	(dep M1) for “underestimate” and appropriate reason linked to their method, eg area between triangle and curve not included	
	(c) Explanation	C1	for explanation, Acceptable examples method gives average acceleration (in first 60 seconds) he has not used/drawn a tangent (at time 60 seconds) he has not worked out the gradient (at time 60 seconds) Not acceptable examples he has not used strips he has calculated it accurately rather than using an estimate the estimate of 13 should be about 4.4 the answer should be approximately 0.073	
17	7.645	P1	for process to use area to find at least one frequency, eg for first frequency $(7.2 - 6.4) \times 10 (= 8)$ or $(7.2 - 6.4) \times 5 (= 4)$ or $4 \times 5 (= 100)$	Frequencies could be written on the graph
		P1	for process to find all frequencies, eg 8, 20, 40, 12 or multiples eg 4, 10, 20, 6 or 100, 250, 500, 150	Marks are for correct processes, one or more frequencies may be incorrect
		P1	(dep P2) for process to estimate mean, eg $((6.8 \times [8]) + (7.4 \times [20]) + (7.8 \times [40]) + (8.1 \times [12])) \div ([8] + [20] + [40] + [12])$	
		A1	for 7.645 (accept 7.65)	Award full marks if a correct answer is seen in working and is then incorrectly rounded.

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$1 - \left(\frac{1}{2}\right)^n - \left(\frac{1}{2}\right)^n$	M1 A1	for $\left(\frac{1}{2}\right)^n$ oe oe eg $1 - \left(\frac{1}{2}\right)^{n-1}$	
21 (a)	19.1	M1 M1 A1	for a method to find an estimate for the area of at least 1 trapezium under the curve eg $0.5 \times 1 \times (4 + 6)$ or $0.5 \times 1 \times (6 + 7.2)$ or $0.5 \times 1 \times (7.2 + 7.8)$ for a complete method eg $0.5 \times 1 \times (4 + 6) + 0.5 \times 1 \times (6 + 7.2) + 0.5 \times 1 \times (7.2 + 7.8)$ or $0.5 \{(4 + 7.8) + 2(6 + 7.2)\}$ cao	Allow a maximum of 2 errors in y values used Ignore any reference to units
(b)	Statement	C1	eg distance (travelled)	If units are given they must be correct
22	$\frac{1}{x(x+4)}$	M1 M1 A1	inverting the fraction and multiplying eg $\frac{6x^3}{(9x^2-144)} \times \frac{3(x-4)}{2x^4}$ for factorising $9x^2 - 144$, eg $(3x - 12)(3x + 12)$ cao	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	Relationship shown	M1	for use of Pythagoras' theorem, eg $d_A^2 = d_B^2 + d_C^2$ or $a^2 = b^2 + c^2$ or $(2x)^2 = (2y)^2 + (2z)^2$ or $a = \sqrt{b^2 + c^2}$ or uses a 3, 4, 5 triangle	May be seen at any stage Where d_A , a , $2x$, etc are their diameters Could be any Pythagorean triple
		M1	for forming correct expressions for the areas of at least 2 of the 3 semicircles, eg at least two of $\frac{1}{2}\pi\left(\frac{a}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{b}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{c}{2}\right)^2$ or at least two of $\frac{1}{2}\pi x^2$, $\frac{1}{2}\pi y^2$, $\frac{1}{2}\pi z^2$ or at least two of $\frac{1}{2}\pi\left(\frac{5}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{3}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{4}{2}\right)^2$	Where a , b , c are their diameters Where $2x$, $2y$, $2z$ are their diameters Where 3, 4, 5 are their diameters
		C1	for a fully correct and convincing chain of reasoning, eg showing that eg $\frac{1}{2}\pi\left(\frac{a}{2}\right)^2 = \frac{1}{2}\pi\left(\frac{b}{2}\right)^2 + \frac{1}{2}\pi\left(\frac{c}{2}\right)^2$ can be reduced to $a^2 = b^2 + c^2$ or that $(2x)^2 = (2y)^2 + (2z)^2$ is the same as $\frac{1}{2}\pi x^2 = \frac{1}{2}\pi y^2 + \frac{1}{2}\pi z^2$	
14 (a)	0.9	M1	for drawing a tangent at $t = 2$	
		M1	for a complete method to find the gradient eg tangent at $t = 2$ and " $2.7 \div 3$ "	Use of change in y over change in x Working may be seen on the diagram
		A1	for answer in the range 0.7 to 1.1	Accept answers in the form $\frac{a}{b}$ where a and b are integers
(b)	Statement	C1	eg distance (travelled)	If units are given they must be correct



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	56	P1	for a correct process to find AF , eg $\sqrt{13^2 - 9^2}$ ($= 9.38\dots$) or $2\sqrt{22}$ or $\sqrt{88}$	Decimal values truncated or rounded to 3 sf or more If a correct answer within the range is shown in working but incorrectly rounded award full marks
		P1	for a correct process to find FH , eg $\frac{9}{\cos(49)}$ ($= 13.7\dots$)	
		P1	for a correct trig statement involving FAH , eg $\tan(FAH) = \frac{13.7\dots}{9.38\dots}$	
		A1	answer in the range 55.6 to 56	
21 (a)	1.06	M1	for tangent drawn at $t=17.5$	No tangent drawn at $t=17.5$ scores zero marks Use of change in y over change in x Working may be seen on the diagram Answer of $\frac{10.5}{17.5}$ oe scores no marks Accept answers in the form a/b where a and b are integers
		M1	for a complete method to find the gradient, eg tangent drawn at $t = 17.5$, and $18.5 \div 17.5$	
		A1	answer in the range 0.9 to 1.2	
		C1	suitable explanation, eg the rate of change of volume	
(b)	Explanation			If units are given they must be correct.
22	$\frac{x^3 - 3}{2}$	M1	for $(h(x)) = \sqrt[3]{2x + 3}$	$[h(x)]$ must be their composite function and cannot be either $\sqrt[3]{x}$ or $2x + 3$
		M1	for a correct first step to find the inverse of $[h(x)]$	
		A1	oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	$(a - b)(a + b)$	B1	for $(a - b)(a + b)$ oe	
(b)	Relationship shown	M1 C1	for factorising the expression, eg $(2^{20} - 1)(2^{20} + 1)$ or for $(2^{40} \div (2^{20})^2)$ for explanation, eg 2^{20} is even so $2^{20} - 1$ and $2^{20} + 1$ are odd (leading to conclusion)	Note that 1048575 and 1048577 earns 2 marks as an alternative approach
16	Triangle at (6, -2) (4, 4) (8, 4)	M1 A1	for the correct shape in the correct orientation in the wrong position or for two correct points cao	
17 (a)	16.5 to 19.5	M1 M1 A1	for tangent drawn at $t = 2.5$ dep (M1) for a complete method to find the gradient from tangent eg $(48 - 0) \div (4 - 1.4) (= 18.4...)$ for answer in the range 16.5 to 19.5 or ft acceptable tangent	The tangent must be seen to award any marks Award 0 marks for a correct answer (in the range) with no (or incorrect) supportive working
(b)	Description	C1	eg speed or velocity	“speed” may be expressed in a different way, eg distance per unit time (at that point) Award if extra information is given provided not contradictory.

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	52.5	P1	starts to find area under graph, eg $\frac{30 \times 12}{2}$ (=180) or 50×12 (=600) or $\frac{20 \times 12}{2}$ (=120)	
		P1	complete process to find area under graph, eg $\frac{30 \times 12}{2} + 50 \times 12 + \frac{20 \times 12}{2}$ (= 900)	
		P1	starts process to find half way time, eg $((\text{"900"} \div 2) - 180) \div 12$ (=22.5)	
		A1	52.5 oe	
	(b) Comparison	C1	acceptable comparison Acceptable (acceleration) during first part is positive but (acceleration) during last part is negative / deceleration (acceleration is) greater during the last part than during the first part gradient is steeper in the last part / longer to speed up than slow down speed / (acceleration) is increasing at start and decreasing at end (acceleration) is slower in the first part (acceleration) is ascending in the first part and descending in the last part 0.4 is the first part and -0.6 in the last part Not acceptable goes down in the last part speed is greater in last part than first part	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
14 (a)	-2.5	M1	for drawing a tangent at $t = 5$	No tangent drawn score 0 marks
		M1	(dep on M1) for a complete method to find the gradient eg tangent at $t = 5$ and “10” ÷ “4” or an answer in the range 2.0 to 2.8	Working may be seen on the diagram
		A1	for answer in the range -2.0 to -2.8 dependent on tangent drawn	Accept answers in the form $\frac{a}{b}$ where a and b are integers
	79	M1	for a method to find an estimate for the area of at least 1 trapezium under the curve, eg $\frac{1}{2} \times 2 \times (25 + 16)$ (= 41) oe or $\frac{1}{2} \times 2 \times (16 + 9)$ (= 25) oe or $\frac{1}{2} \times 2 \times (9 + 4)$ (= 13) oe	May be seen as a rectangle added to a triangle Allow consistent use of incorrect width for both M marks
			or for a method to find an estimate for the area of at least 1 rectangle with heights at intersection of midpoint and curve, eg 2×20.5 (= 41) oe or 2×12.5 (= 25) oe or 2×6 (= 12) oe	
		M1	for a complete method, eg $\frac{1}{2} \times 2 \times (25 + 16) + \frac{1}{2} \times 2 \times (16 + 9) + \frac{1}{2} \times 2 \times (9 + 4)$ oe or $\frac{1}{2} \times 2 \times (25 + 4 + 2(16 + 9))$ or $(2 \times 20.5) + (2 \times 12.5) + (2 \times 6)$	Allow 1 error in y values used
(b)		A1	For 79 or 78	Allow 78 only if it comes from rectangle/midpoint method



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
14 (a)(i)	0.83	B1	for a tangent drawn at $t = 15$	Working: $7.5 \div 9 = 0.83....$ No tangent scores 0 marks
		M1	full method to use the tangent to find the gradient (eg $7.5 \div 9$)	This mark can be awarded if the tangent is drawn at $t \neq 15$ Working may be seen on the diagram
		A1	for answer in the range 0.6 to 1.0	
	Statement	C1	statement Acceptable examples acceleration rate of change of speed increase in speed over time Not acceptable examples rate of change m/s/s increase in speed	
		P1	for splitting the area into strips and correct process to find the area of one strip, eg $\frac{5 \times 4}{2} (=10)$ or $\frac{(4+12)}{2} \times 5 (=40)$ or $\frac{(12+18)}{2} \times 5 (=75)$ or $\frac{(18+20)}{2} \times 5 (=95)$	Working 4, 12, 18, 20
		P1	for a complete process using at least 4 strips to find the area under the curve eg, "10" + "40" + "75" + "95"	Allow one error in the reading of speeds
(b)	220	A1	for answer in the range 215 to 225 from correct working using at least 4 strips	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
12 (a)(i)	10	M1	for a tangent drawn at $t = 3$	A tangent must be seen to award any marks
		M1	for a complete method to find the gradient from tangent, eg $\frac{30}{3}$	This mark can be awarded if the tangent is drawn at $t \neq 3$
		A1	for answer in the range 8.5 to 11.5 or ft acceptable tangent at $t = 3$	Accept answers in the form $\frac{a}{b}$ where a and b are integers
(ii)	Acceleration or rate of change of velocity	C1	for a correct explanation Acceptable examples acceleration rate of change of velocity increase in velocity each second how quickly the velocity increases increase in velocity over time the rate at which the particle is accelerating Not acceptable examples rate of change increase in velocity the velocity per second velocity $\div$ time as time increases so does the velocity how steep the line is the acceleration of the particle and how far it got	Award 0 marks for a correct answer (in the range) with no (or incorrect) supportive working Award if extra information is given provided not contradictory or incorrect Accept 'speed' for 'velocity'

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
12 (b)	220	M1	for a method to find an appropriate area, eg $\frac{1}{2} \times 30 \times 2 (= 30)$ oe or $\frac{1}{2}(30 + 50) \times (4 - 2) (= 80)$ oe or $\frac{1}{2} \times (50 + 60) \times (6 - 4) (= 110)$ oe or for a method to find an estimate for the area of at least one rectangle with height at intersection of midpoint and curve, eg $2 \times 16 (= 32)$ oe or $2 \times 42 (= 84)$ oe or $2 \times 56 (= 112)$ oe	Must have one correct expression for the award of this mark May be seen as a rectangle added to a triangle
		M1	for a complete method, eg $\frac{1}{2} \times 30 \times 2 + \frac{1}{2}(30 + 50) \times 2 + \frac{1}{2}(50 + 60) \times 2$ or $\frac{1}{2} \times 2 \times (0 + 60 + 2(30 + 50))$ or $2 \times 16 + 2 \times 42 + 2 \times 56$	Allow 1 error in v values used
		A1	for 220 or 228	Allow 228 only if it comes from rectangle/midpoint method

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	0.12	P1 P1 A1	for process to start eg $(1 - 0.2) \div (3 + 17)$ (= 0.04) or $(3 + 17) \div (1 - 0.2)$ oe (= 25) or $(100 - 20) \div (3 + 17)$ (= 4) or 3×4 (= 12) and 17×4 (= 68) full process to find the required probability eg $3 \times "0.04"$ or $\frac{3}{20} \times (1 - 0.2)$ oe or $3 \div "25"$ or $3 \times "4" \div 100$ oe	Just $1 - 0.2 = 0.8$ is not sufficient for P1 May be seen in a ratio 0.12 using incorrect probability notation gets P2
17	$\frac{3x+1}{2x}$	M1 A1 A1	for $(3x+1)(x-3)$ or $2x(x-3)$ for $(3x+1)(x-3)$ and $2x(x-3)$ $\frac{3x+1}{2x}$ oe	Accept $(2x+0)$ for the first two marks but not for the final answer
18	Graph drawn	C2 (C1)	for graph translated by -2 in the y direction for a graph translated in the y direction OR for a correct graph through four of the five key points)	Key points: $(-180, -2)$, $(-90, -3)$, $(0, -2)$, $(90, -1)$, $(180, -2)$

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	(a) sketch	B1	for appropriate sketch which crosses the x axis at (2,0) and (4,0), minimum point at (3,-1) and end points at (1,3) and (5,3)	Allow some tolerance on the points if the intention is clear.
	(b) $y = g(-x)$	B1	cao	
19	(a) shown	C1	for first step, eg $2((x+1)^2 - 1)$ or $2(x^2 + 2x + 1 - 1)$ oe	It is insufficient to state $gf(x) = 2x(x+2)$ without showing the first step, and the following sequence of algebraic steps leading to it. Could be shown in the form of a flowchart, which must show inverse operations.
		C1	for fully correct chain of reasoning	
	(b) 4.5	M1	process to find inverse of g , eg $g^{-1}(x) = \frac{1}{2}x + 1$ or for $2(x-1) = 7$	
		A1	for 4.5 oe	

Paper: 1MA1/3H					
Question	Answer	Mark	Mark scheme	Additional guidance	
10	(a)	1.56	B1	1.56 to 1.563	If an answer in the range is seen in working and then incorrectly rounded award full marks.
	(b)	3.63	M1	for a complete method to find fg(34) eg 4 sin 65(=3.625..) or fg(x) eg 4 sin (2x–3)	
			A1	for answer in the range 3.6 to 3.63	
	(c)	Statement	C1	for statement eg positive and negative square root required. Acceptable examples The other answer is –9 The quadratic should have 2 solutions. Not acceptable examples He has not expanded the brackets. He needed to (x+4) twice as there is a squared sign. (x+4) ² is 16 not 25. Didn't expand the bracket.	
11	Graph drawn	C2 (C1	for fully correct sketch between 0° and 360° for a graph with clear asymptotes at 90° and 270° only or the correct graph translated along the x-axis must have a period of 180)		

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	(180, -1)	B1	for 180 ^(o)	
		B1	for -1	
			SC B1 if B0 scored for answer of (-1, 180)	
22	$\frac{65}{214}$	B1	for $\sin 30 = 0.5$	Answer of $\frac{3.25}{10.7}$ or $\frac{6.5}{21.4}$ gets 3 marks Where [0.5] is their value of $\sin 30$ Answer must be in the form $\frac{m}{n}$ where m and n are integers
		P1	for use of the sine rule with values substituted, eg $\frac{6.5}{\sin ABC} = \frac{10.7}{\sin 30}$ oe	
		P1	for $(\sin ABC \Rightarrow) \frac{6.5 \times \sin 30}{10.7}$ oe or for a complete process to find $\sin ABC$, eg $(\sin ABC \Rightarrow) \frac{6.5 \times [0.5]}{10.7}$ oe	
		A1	for $\frac{65}{214}$ oe eg $\frac{325}{1070}$	



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

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$	P1 P1 P1 A1	for process to find $\vec{OR} = \mathbf{a} - \mathbf{b}$ or $\vec{RO} = \mathbf{b} - \mathbf{a}$ for process to find $\vec{MR} = \frac{3}{5}(\mathbf{a} - \mathbf{b})$ or $\vec{MO} = \frac{2}{5}(\mathbf{b} - \mathbf{a})$ or $\vec{RM} = \frac{3}{5}(\mathbf{b} - \mathbf{a})$ or $\vec{OM} = \frac{2}{5}(\mathbf{a} - \mathbf{b})$ for complete process to find $\vec{MT}$ in terms of $\mathbf{a}$ and $\mathbf{b}$, eg $\frac{3}{5}(\mathbf{a} - \mathbf{b}) + \mathbf{b}$ oe or $\frac{2}{5}(\mathbf{b} - \mathbf{a}) + \mathbf{a}$ oe for $\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ or $\frac{1}{5}(3\mathbf{a} + 2\mathbf{b})$ or $\frac{3\mathbf{a} + 2\mathbf{b}}{5}$	Accept decimals instead of fractions
21 (a)	Sketch graph	B1	cao	Allow freehand sketch provided intention is clear. (-3, -4), (-2, -3), (-1, -3), (0, -4)
(b)	Sketch graph	B1	cao	Allow freehand sketch provided intention is clear. (0, 0), (1, 1), (2, 1), (3, 0)

Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
12 (a)		comment	C1	for comment e.g. incorrect denominator for the 2nd student or probabilities for 2 nd student do not add up to 1
(b)		No (supported)	C1	for "no" with supporting evidence, e.g. probabilities should be multiplied together or 0.4×0.25
13		7	P1 P1 A1	for correct process to find any frequency, eg. $"1.1" \times 10 (= 11)$ or $"2.8" \times 10 (= 28)$ or $"2.3" \times 20 (= 46)$ or $"1.4" \times 20 (= 28)$ or $"1.4" \times 10 (= 14)$ or $"0.7" \times 30 (= 21)$ or for a correct process to find the total area and an area of any block, eg. using $1 \text{ cm}^2 = 1$ unit of area to get 53.6 and one of 4.4, 11.2, 18.4, 11.2, 5.6, 8.4 (dep P1) for complete process to find 20% of $(\text{"1.4"} \times 10 + \text{"0.7"} \times 30)$, eg. $\frac{20}{100} \times "35"$ or $\frac{"5.6" + "8.4"}{"53.6"} \times 134 \times \frac{20}{100}$ cao
14		C, F, A, H	B3 [B2 [B1	for a fully correct table for 2 or 3 correct] for 1 correct]

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	Result shown	M1	(indep) for writing $\sqrt{12}$ as $2\sqrt{3}$	This mark can be awarded whenever this is seen, which might be later in the process.
		M1	for method to rationalise the denominator eg $\frac{8+\sqrt{12}}{5+\sqrt{3}} \times \frac{5-\sqrt{3}}{5-\sqrt{3}}$ or $\frac{8+2\sqrt{3}}{5+\sqrt{3}} \times \frac{5-\sqrt{3}}{5-\sqrt{3}}$ oe	
		M1	(dep on previous M1) for expanding terms, condone one error in numerator or denominator eg $\frac{40-8\sqrt{3}+5\sqrt{12}-\sqrt{12}\sqrt{3}}{25-5\sqrt{3}+5\sqrt{3}-\sqrt{3}\sqrt{3}}$ or $\frac{40-8\sqrt{3}+10\sqrt{3}-2\sqrt{3}\sqrt{3}}{25-5\sqrt{3}+5\sqrt{3}-\sqrt{3}\sqrt{3}}$ or $\frac{34+2\sqrt{3}}{22}$ oe	
		A1	for a complete chain of reasoning leading to $\frac{17+\sqrt{3}}{11}$	
20	$x = 2.1, y = 5.1$ $x = -2.9, y = -4.7$	M1	for drawing the graph of $y - 2x = 1$	For both A marks accept answers in the ranges $x = 2.0$ to $2.2, y = 5.0$ to 5.2 $x = -2.8$ to $-3.0, y = -4.6$ to -4.8 Accept values given as coordinates
		A1	for one correct pair of values or for both correct x values, or for both correct y values	
		A1	for both correct pairs, correctly matched	

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

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	$\frac{1}{3}$	P1	for start of process to find the probability of spinner B landing on red eg $\frac{1}{4}x = \frac{1}{24}$ oe or $\frac{1}{24} \div \frac{1}{4}$ or $x = \frac{1}{6}$	
		P1	for process to find probability of one red and one not red eg $\frac{1}{4} \times (1 - \frac{1}{6}) (= \frac{5}{24})$ or $(1 - \frac{1}{4}) \times \frac{1}{6} (= \frac{3}{24})$ or process to find probability of both not red, eg $(1 - \frac{1}{4}) \times (1 - \frac{1}{6}) (= \frac{15}{24})$	
		P1	for a complete process to find the required probability eg " $\frac{5}{24}$ " + " $\frac{3}{24}$ " or $1 - \frac{1}{24} - \frac{15}{24}$	
		A1	oe	
19 (a)	18 and 162	M1	for a correct method, eg line drawn at 0.3 to sine curve or point(s) marked on sine curve or for one correct value	
(b)	-20 or 160	A1	for answers in the range 15 to 18 and 162 to 165 and no incorrect values	
		B1	cao	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
20 (a)	(4, 6)	B1	cao	see end of mark scheme
	(b) Sketch	B2 (B1)	for a fully correct sketch including points (2, 6), (−2, −4), (6, −4) for a correct sketch of $f(-x)$ or $f(x) + 3$ including the maximum point and the endpoints	
21	27	M1 M1 A1 C1	for start by finding one missing angle, eg angle $CBD = 35$ or angle $ADC = 90$ or angle $ACE = 117$ for making progress by finding a second angle, eg angle $BDE = 117$ or angle $DCE = 62$ or angle $BCA = 63$ for angle $BDC = 27$ (dep on M1) for stating one correct circle theorem used eg <u>Angles</u> in a <u>semicircle</u> are 90 or <u>Angles</u> in the <u>same segment</u> are equal or <u>Angles</u> at the circumference <u>subtended</u> from the same <u>arc</u> of a circle are equal or The <u>angle</u> at the <u>centre</u> of a circle is <u>twice</u> the <u>angle</u> at the <u>circumference</u>	Angles clearly identified on the diagram or in the working space may be awarded marks provided there is no ambiguity or contradiction. Underlined words need to be shown; circle theorems stated need to be linked to their method, which can be implied from correctly identified angles (stated or written on the diagram).

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

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

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	2.5	P1	use of $\sin 30 = \frac{1}{2}$ to find $OA (= 8)$ or $OAB = 90^\circ$ eg $OA = 16\sin 30^\circ$ or right angle marked on diagram	
		P1	recognition that equation of circle is $x^2 + y^2 = r^2$	Accept $3p^2 + p^2 = r^2$ for the award of this mark
		P1	Correct substitution of p , $3p$ and r in $x^2 + y^2 = r^2$ eg $9p^2 + p^2 = OA^2$ or $(3p)^2 + p^2 = "8^2"$	Do not accept $3p^2 + p^2 = 8^2$ for the award of this mark
		A1	for answer in the range 2.5 to 2.53	Accept $\sqrt{6.4}$ or $\frac{4\sqrt{10}}{5}$ If an answer within the given range is seen in working and rounded incorrectly award full marks. Award 0 marks for the answer without supportive working.

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	Graph drawn	C2	for graph reflected in the y-axis	Key points: (0, 0), (1, 2), (2, 1), (3, 0), (4, 2) Award C1 if line segments but goes through all key points
		(C1	for a graph reflected in the x-axis or for a correct graph through four of the five key points)	
	$y = 5 + 2(x - 3) - (x - 3)^2$	C2	for $y = 5 + 2(x - 3) - (x - 3)^2$ oe eg $y = -x^2 + 8x - 10$, $y = -[(x - 4)^2 - 6]$	For either C mark accept equivalent expressions If a correct answer for C2 is given and is then incorrectly simplified, award C1 a need not be positive
		(C1	for $y = 5 + 2(x + 3) - (x + 3)^2$ or $y = 5 + 2(x - a) - (x - a)^2$, $a \neq 3$, $a \neq 0$ or $y = f(x - 3)$ or $y = (x - 4)^2 + 6$ or correct expression missing “y=”	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	30	P1	for process to find one correct frequency, eg. $0.8 \times 5 (=4)$ or $1.6 \times 10 (=16)$ or $2.2 \times 10 (=22)$ or $1.2 \times 15 (=18)$ or to find one correct area eg $5 \times 8 (=40)$ or $10 \times 16 (=160)$ or $10 \times 22 (=220)$ or $15 \times 12 (=180)$	Accept equivalent methods proportional to those shown.
		P1	for process to find total number of people, eg. "4" + "16" + "22" + "18" (= 60) or for process to find total area eg "40" + "160" + "220" + "180" (= 600)	Condone 1 error in reading from the graph for 2 nd and 3 rd P marks
		P1	for process to find 20% of the total number of people, eg. "60" $\times$ 0.2 oe (= 12) or for process to find 20% of the total area "600" $\times$ 0.2 oe (=120)	
		A1	cao	NB: correct answer without supportive working gets 0 marks
18 (a)	37, 143, 397, 503	M1	for any two correct angles within the ranges below or for a correct method to find a solution beyond 360, eg. "angle read from 0 to 360" + 360	Accept given as coordinates for M1 only
		A1	for all 4 angles in the range, 35 to 40, 140 to 145, 395 to 400 and 500 to 505	
(b)	$y = -\sin x^\circ$	B1	for any acceptable equations, eg. $y = -\sin x^\circ$ or $y = \sin(-x^\circ)$ or $-y = \sin x^\circ$ or $y = \cos(x^\circ + 360n + 90)$ or for any positive integer n , $y = \sin(x^\circ - (2n - 1)180)$ or $y = \cos(x^\circ + 360n)$	Quoted are just the more likely solutions but check all attempts Condone missing degrees sign
(c)	graph	C1	for correct graph shown translated 2 in the positive x-direction	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$7x + 5y - 82 = 0$	P1	for process to work out the gradient of the line from the centre of the circle to the point (6,8) eg $\frac{8-3}{6--1}$ ($= \frac{5}{7}$)	
		P1	(dep P1) for using $mn = -1$ eg $-1 \div \frac{5}{7}$ ($= -\frac{7}{5}$)	
		P1	for substituting (6, 8) into $y = -\frac{7}{5}x + c$ or for $(y - 8) = -\frac{7}{5}(x - 6)$ or for $y = -\frac{7}{5}x + \frac{82}{5}$ oe	
		A1	$7x + 5y - 82 = 0$ oe SC B2 for answer of $5x + 7y - 86 = 0$ oe in any form	Must be in form $ax + by + c = 0$ with integer coefficients, eg $82 - 7x - 5y = 0$

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
24	$6x + 8y = 35$	M1	for a process to find the gradient of the radius, eg $\frac{2.8-0}{2.1-0}$ ($= \frac{4}{3}$)	
		M1	for process to find the gradient of the tangent, eg uses $\frac{-1}{m}$	
		M1	for substitution of (2.1, 2.8) into $y = \frac{-3}{4}x + c$ or into $(y - y_1) = \frac{-3}{4}(x - x_1)$	
		A1	oe as long as in the form $ax + by = c$, where a , b and c are integers	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
23	No (supported)	P1	for a first step, eg to find the gradient of the line (normal) joining (0, 0) to (-3, 4), eg $\frac{4-0}{-3-0} (= -\frac{4}{3})$ OR finds the length ² for one side of triangle, eg $(-3 - -8)^2 + (4 - 0)^2 (= 41)$ or $(-3 - 0)^2 + (4 - 0)^2 (= 25)$ or 64	Alternative processes may be seen and should be duly credited.
		P1	for a second step, eg to find the gradient of the tangent, eg $-1 \div \frac{-4}{3} (= \frac{3}{4})$ OR finds the length ² for two sides of triangle, two of 25, 41 and 64	
		P1	for a third step, eg to find the gradient of the line joining (-8, 0) to (-3, 4), $\frac{4-0}{-3--8} (= \frac{4}{5})$ or finds the equation of the tangent, eg $y = \frac{3}{4}x + \frac{25}{4}$ or $y - 4 = \frac{3}{4}(x - -3)$ OR for process to use Pythagoras' rule, eg $41 + 25 (= 66)$ or $64 - 25 (= 39)$ or $64 - 41 (= 23)$	
		C1	for No from correct figures and a complete process from comparison of gradients, eg $\frac{3}{4}$ and $\frac{4}{5}$ or showing the equation of the tangent does not pass through (-8, 0), eg when $x = -8$, $y = \frac{1}{4}$ (not 0) or when $y = 0$, $x = -\frac{25}{3}$ (not -8) OR correct figures from Pythagoras' rule, eg $41 + 25 (= 66) \neq 64$ or $64 - 41 \neq 25$ or $64 - 25 \neq 41$ oe	
				Award 0 marks for No without complete and correct supportive working

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
22 (a)	Sketch	M1	for correct shape for $0 \leq x \leq 360$	Can be implied by $x = -30$
		A1	for fully correct sketch with labels at 1 and -1	
	210, 330	M1	for one correct solution	
		A1	or for $\sin 30 = \frac{1}{2}$ cao	
23	-5	P1	for $x^2 + y^2 = 125$ or $5^2 + 10^2 (= 125)$	Where [y] is their y coordinate of Q
		P1	for process to find y coordinate of Q, eg $(\pm)\sqrt{125 - (-2)^2}$	
		P1	for selecting $-\sqrt{125 - (-2)^2}$ eg $y = -11$	
		P1	(dep P2) for process to find y intercept, eg $\frac{10 - [y]}{5 - -2} (= 3)$ and substitutes $x = 5, y = 10$ in $y = "3"x + k$	
			or $\frac{10 - [y]}{5 - -2} (= 3)$ and $[y] + 2 \times "3"$	
			or $\frac{10 - k}{5} = \frac{k - [y]}{2}$	
			or $[y] + \frac{2}{7} \times (10 - [y])$	
		A1	cao	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	$y + \sqrt{3}x = 4$	P1	for process to find the value of p , eg $\sqrt{4-1^2} (= \sqrt{3})$	May occur later in the process
		P1	for a start of a process to find gradient of tangent, eg gradient of normal/radius = $\frac{1}{p}$ or $\frac{1}{\sqrt{3}}$ or $\frac{1}{[p]}$ or for gradient of tangent = $-p$ or $-\sqrt{3}$ or $-[p]$	Where $[p]$ is their stated value of p
		P1	(dep P1) for substituting (" $\sqrt{3}$ ", 1) into $y = -\sqrt{3}x + c$ or for $y - 1 = -\sqrt{3}(x - \sqrt{3})$ oe or for $1 = -p \times p + c$ or for substituting ($[p]$, 1) into $y = -[p]x + c$ or for substituting (" $\sqrt{3}$ ", 1) into $y = -\frac{1}{[m]}x + c$	Where $[m]$ is clearly their gradient of the normal/radius
		A1	for $y + \sqrt{3}x = 4$	A correct answer with no supportive working gets 0 marks

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	(12, -8)	P1	for process to rearrange the equation to give y in terms of x , eg $y = \frac{3x-52}{2}$ or $y = \frac{3}{2}x - 26$ or $m = \frac{3}{2}$	Condone an incorrect value for the y intercept ($= c$)
		P1	for process to find gradient of OP , eg $-1 \div \frac{3}{2}$ ($= -\frac{2}{3}$) or $-1 \div [m]$	Where $[m]$ is clearly identified as the gradient of the straight line $3x - 2y = 52$ Allow 0.66(6...) or 0.67 for $\frac{2}{3}$ throughout
		P1	(dep on equation of the form $y = \frac{-1}{[m]}x$ for the radius may be implied in subsequent working) for starting to solve $3x - 2y = 52$ with $y = \frac{-1}{[m]}x$ simultaneously to find the value of x or y eg substituting $y = \frac{-2}{3}x$ or $y = \frac{-1}{[m]}x$ into $y = \frac{3}{2}x - 26$ or $3x - 2y = 52$ or an equation of the form $y = \frac{3}{2}x + c$ eg $-\frac{2}{3}x = \frac{3}{2}x - 26$ or $3x - 2\left(-\frac{2}{3}x\right) = 52$ or $-\frac{2}{3}x = \frac{3}{2}x + c$ or $-\frac{1}{[m]}x = \frac{3}{2}x - 26$ or $3x - 2\left(-\frac{1}{[m]}x\right) = 52$ or $-\frac{1}{[m]}x = \frac{3}{2}x + c$	Where $[m]$ is clearly identified as the gradient of the straight line $3x - 2y = 52$ Can be done by elimination Award P1 for a correct method to eliminate x or y : coefficient of x or y the same and correct operator to eliminate selected variable eg $\begin{array}{r} 9x - 6y = 156 \\ + 4x + 6y = 0 \\ \hline (13x = 156) \end{array} \qquad \begin{array}{r} 6x - 4y = 104 \\ - 6x + 9y = 0 \\ \hline (-13y = 104) \end{array}$
		A1	cao	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	0.55, 0.67, 0.33, 0.35, 0.65	B1	for 0.55 in correct position	Can be seen as fractions or percentages
		B1	for the branches for the second game correct	
		M1	for one correct product, eg $0.45 \times "0.33"$ ($=0.1485$) or $"0.55" \times "0.35"$ ($=0.1925$) or $0.45 \times "0.67"$ ($=0.3015$) or $"0.55" \times "0.65"$ ($=0.3575$)	
		M1	for correct method eg $(0.45 \times "0.33") + ("0.55" \times "0.35")$ or $1 - (0.45 \times "0.67") - ("0.55" \times "0.65")$	
		A1	answer in range 0.34 – 0.341 oe	
16 (a)	Correct graph	B2	for a circle radius 3.5, centre (0, 0)	Circle could be drawn freehand as long as it approximates to a circle
		(B1	for a circle centre (0, 0) of a different radius, or for a circle drawn of radius 3.5 centre not (0, 0) or incomplete correct circle)	
		M1	for $2x + y = 1$ drawn, or for correctly eliminating one variable, eg $x^2 + 1 - 4x + 4x^2 = 12.25$ or $x^2 + (1 - 2x)^2 = 12.25$	
		A1	for the pair of x values, or the correct pair of y values, or one correct pair of x/y values fit from (a) (dep on B1)	
		A1	for both correct pair of x/y values, unambiguously matched fit from (a) (dep on B1)	
16 (b)	$x = 2.0, y = -2.9$ $x = -1.2, y = 3.3$			$2x + y = 1$ does not have to be shown Use professional judgment
				Accept values given as coordinates. Check graph for answers

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	$x^2 + y^2 = 80$	P1	for process to find gradient of tangent eg $\frac{10-0}{0-20} (= \frac{1}{2})$ or for $20^2 + 10^2 (= 500)$ or start to method to find angle between tangent and x axis, eg $\tan \theta = \frac{10}{20}$	
		P1	for process to find gradient of normal/radius eg $\frac{-1}{0.5} (= -2)$ or for $\sqrt{20^2 + 10^2}$ or $\sqrt{500}$ or 22.36... or 22.4 or completes process to find angle between tangent and x axis. eg $\theta = \tan^{-1}\left(\frac{10}{20}\right) (= 26.565\dots)$	
		P1	for equation of tangent eg $y = "0.5"x + 10$ oe or for equation of radius eg $y = "-2"x$ oe or for using similar triangles eg $\frac{r}{10} = \frac{20}{\sqrt{500}}$ or for $\sin("26.565\dots") = \frac{r}{20}$	
		P1	for process to find the x coordinate eg $"0.5"x + 10 = "-2"x$ ($x = -4$) or for $r = \frac{20}{\sqrt{500}} \times 10$ or $r = 20 \times \sin("26.565\dots")$	
		A1	oe	Accept $(4\sqrt{5})^2$ for 80



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	120	P1	for using the cosine rule for any angle, eg $(5\sqrt{7})^2 = 10^2 + 5^2 - 2 \times 10 \times 5 \times \cos B$	May be any angle; check diagram for working.
		P1	for a complete process to find $\cos B$ eg $(\cos B =) \frac{10^2 + 5^2 - (5\sqrt{7})^2}{2 \times 10 \times 5}$ oe	
		P1	for $\cos^{-1}(\frac{1}{2}) = 60$ or $\cos B = -0.5$	
		A1	cao	A correct answer with no supportive working gets 0 marks
21 (a)	Circle drawn	B2	for drawing a circle centre (0,0) and radius 13	Circle could be drawn freehand as long as it closely approximates to a circle
		(B1	for drawing a circle centre (0,0) with radius $\neq 13$ or a circle of radius 13 with a centre not (0,0) or an incomplete correct circle drawn)	
(b)	$x = 7.2$, $y = 10.8$ and $x = -7.2$, $y = -10.8$	M1	for drawing the line $2y = 3x$	
		A1	for both x values correct or both y values correct or one pair of x and y values correct ft from (a) dep on B1	For both A marks accept answers in the ranges $x = 7.0$ to 7.4 , $y = 10.6$ to 11.0 $x = -7.0$ to -7.4 , $y = -10.6$ to -11.0
		A1	for both correct pairs of values correctly matched ft from (a) dep on B1	Accept values given as coordinates Check graph for answers