Pearson

WEEK 6 TASKS
(Higher 4-6)

Top Examiner Tips for GCSE Maths

① Revise all the course content use our revision checklist to help.

② Memorise the formulae. Use our poster to help.

③ Fuel your concentration. Eat properly before the exam and have some water on your desk.

④ Make sure you have the correct equipment listed on the front of the paper.

⑤ Read the question carefully.

⑥ Roughly allow one minute for each mark available.

⑦ Don't forget to show ALL the stages of your working.

⑧ Communicate your responses fully. Use the correct terminology.

⑨ Present and organise your work clearly.

⑩ Check your answers. Does it make sense?

Pearson

.

Remember: The exam is your opportunity to "show what you know"!

WEEK 6 TASK 1
Estimated completion time = 90 minutes.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   Calculate $\sqrt{6\sin 72° - 4\cos 39°}$

Give your answer correct to 3 significant figures.

....

(Total for Question 1 is 2 marks)

2 *ABC* and *PQR* are similar triangles.
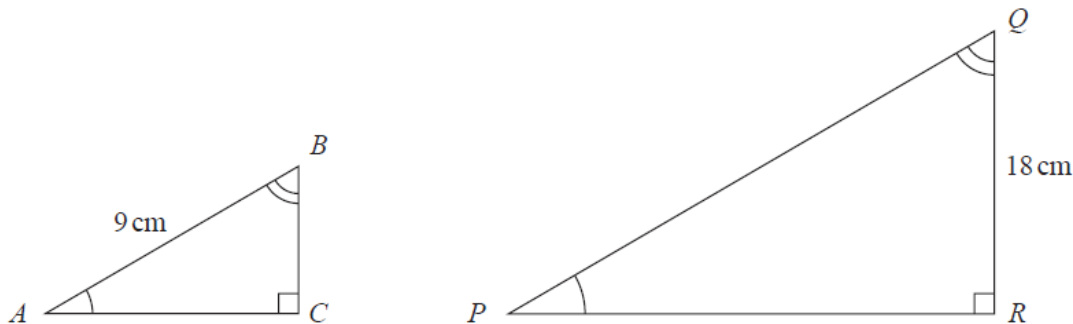
AB : *PQ* = 2 : 5

(i) Work out the length of *PQ*.

.... cm

(2)

(ii) Work out the length of *BC*.

.... cm

(2)

(Total for Question 2 is 4 marks)

3   The table shows information about the distances travelled by 50 new cars before a tyre was changed.

Distance (d km)	Number of cars
$5000 \leqslant d < 25\,000$	9
$25\,000 \leqslant d < 45\,000$	25
$45\,000 \leqslant d < 65\,000$	16

Calculate an estimate for the mean distance.

.......................km

(Total for Question 3 is 3 marks)

4   The diagram shows a cylinder with diameter 10 cm and height 12 cm.
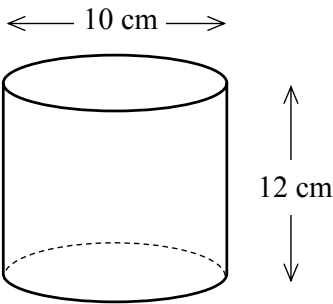
Calculate the volume of this cylinder.
Give your answer correct to 3 significant figures.

.....................cm³

(Total for Question 4 is 2 marks)

5   Luke invested £4000 in a savings account for 3 years.
Compound interest was paid at a rate of 1.8% each year.

Alexa also invested £4000 in a savings account for 3 years.
Simple interest was paid at a rate of 1.8% each year.

Luke got more interest than Alexa in total over the 3 years.

How much more?
You must show all your working.

£.........................

6 The height, h metres, of a tall building is 184 metres correct to the nearest metre.

Complete the following statement to show the range of possible values of h.

.... $\leqslant h <$ ....

(Total for Question 6 is 2 marks)

---

7 Here is a rectangle $ABCD$.
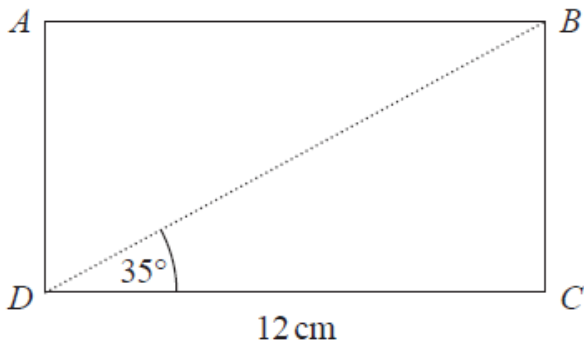
Work out the perimeter of the rectangle.
Give your answer correct to 3 significant figures.

.... cm

(Total for Question 7 is 4 marks)

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

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

(2)

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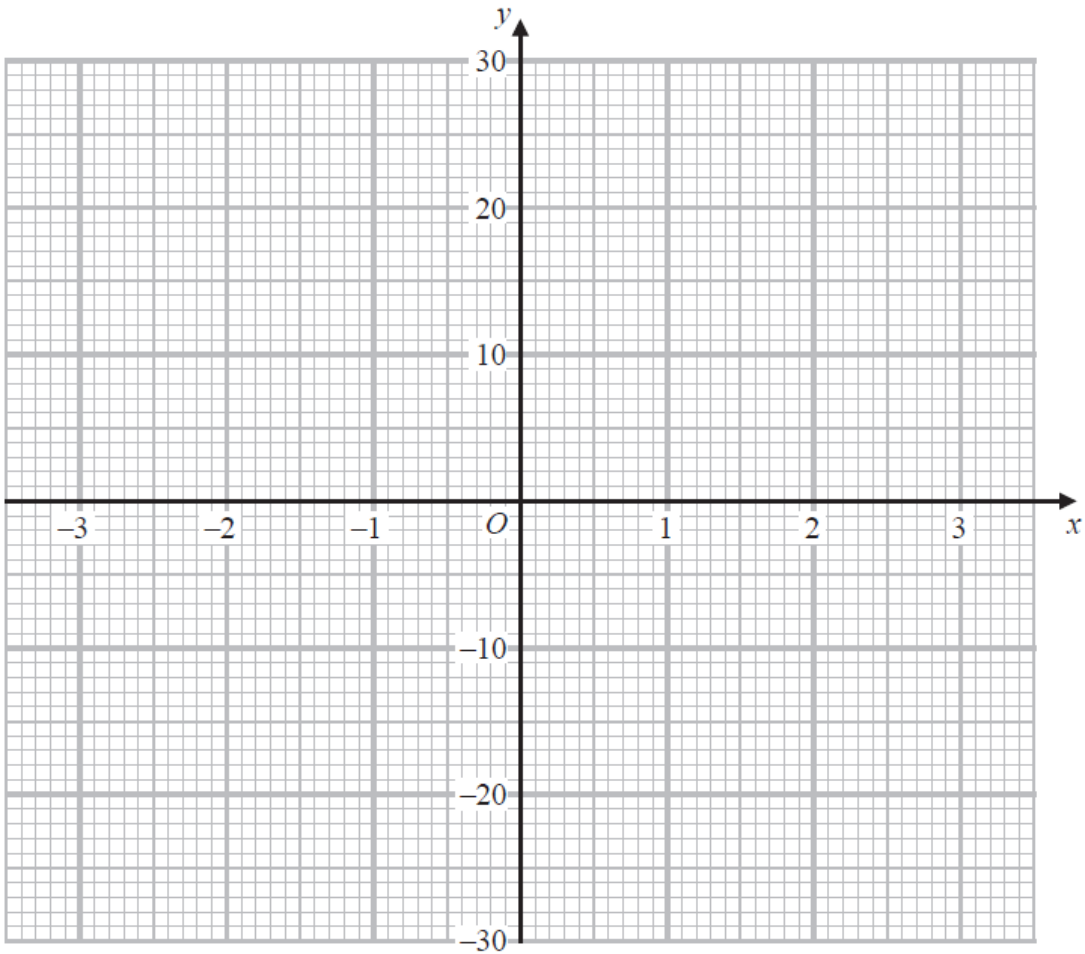
(2)

(c) Use your graph to find the value of x when $y = 6$

....

(1)

(Total for Question 8 is 5 marks)

9 Here is some information about the population and the land area of England, Scotland and Wales in 2016

	Population	**Land area (km^2)**
England	5.5×10^7	1.3×10^5
Scotland	5.4×10^6	8.0×10^4
Wales	1.9×10^6	2.1×10^4

(a)   Calculate the total population of England, Scotland and Wales in 2016

....

(1)

(b)   Calculate the average number of people per km^2 in England, Scotland and Wales in 2016
Give your answer correct to the nearest whole number.

....

(3)

(Total for Question 9 is 4 marks)

10   There are n adults in a club.
54 of the adults are over 30 years of age.

20 of the adults in the club are chosen at random.
8 of these 20 adults are over 30 years of age.

Work out an estimate for the value of n.

……………………………………

(Total for Question 10 is 2 marks)

11   Solve $\dfrac{8 - 3x}{4} = 8 - 2x$

$x =$……………………..

(Total for Question 11 is 3 marks)

12 Mrs Atkins is going to choose two students from her class to take part in a competition.
She can choose from 16 girls and 14 boys.

(a) Work out the number of different ways of choosing one girl and one boy.

....
(1)

(b) Work out the number of different ways of choosing two boys.

....
(2)

(Total for Question 12 is 3 marks)

13 (a) Show that the equation $x^4 - 3x - 1 = 0$ has a solution between $x = 1$ and $x = 2$

(2)

(b) Show that for $x > 0$ the equation $x^4 - 3x - 1 = 0$ can be arranged to give $x = \sqrt[4]{3x + 1}$

(1)

(c) Starting with $x_0 = 1$, use the iteration formula $x_{n+1} = \sqrt[4]{3x_n + 1}$ once to find an estimate for a solution of $x^4 - 3x - 1 = 0$

....

(1)

(Total for Question 13 is 4 marks)

14
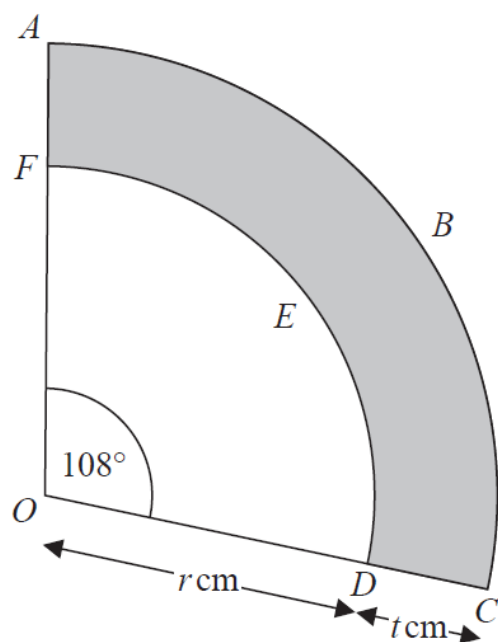
ABC and *DEF* are two arcs of circles, centre *O*.
OFA and *ODC* are straight lines.

(a)   Show that the perimeter of the shaded region is given by $\dfrac{6\pi r + 3\pi t + 10t}{5}$ cm

(5)

(b)(i) Find the exact value of $\dfrac{6\pi r + 3\pi t + 10t}{5}$ when $r = 0$ and $t = 10$

Give your answer in its simplest form.

....

(1)

(ii) Explain what your value in part (b)(i) represents.

....

....

....

(1)

(Total for Question 14 is 7 marks)

15 *c* is inversely proportional to *d*.

  c = 0.5 when *d* = 6

  Find a formula for *c* in terms of *d.*

…………………..……………………..

(Total for Question 15 is 3 marks)

16 There are some counters in a box.
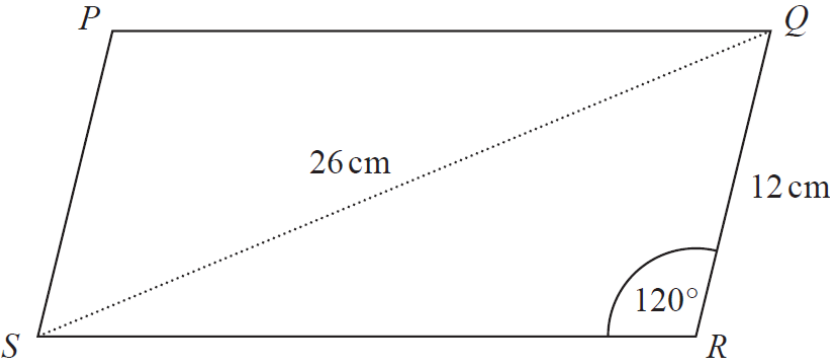 Each counter is blue or green or red or yellow.

  The total number of blue and green counters is twice the total number of red and yellow counters.
  The number of green counters is $\frac{1}{6}$ of the number of blue counters.

  Show that, to the nearest percent, the percentage of blue counters in the box is 57 %

(Total for Question 16 is 4 marks)

17

Calculate the area of the parallelogram *PQRS*.
Give your answer correct to 3 significant figures.
You must show all your working.

.... cm²

(Total for Question 17 is 5 marks)

18 Frank invested an amount of money for 12 years.

The graph shows the value of Frank's investment over the 12 year period.
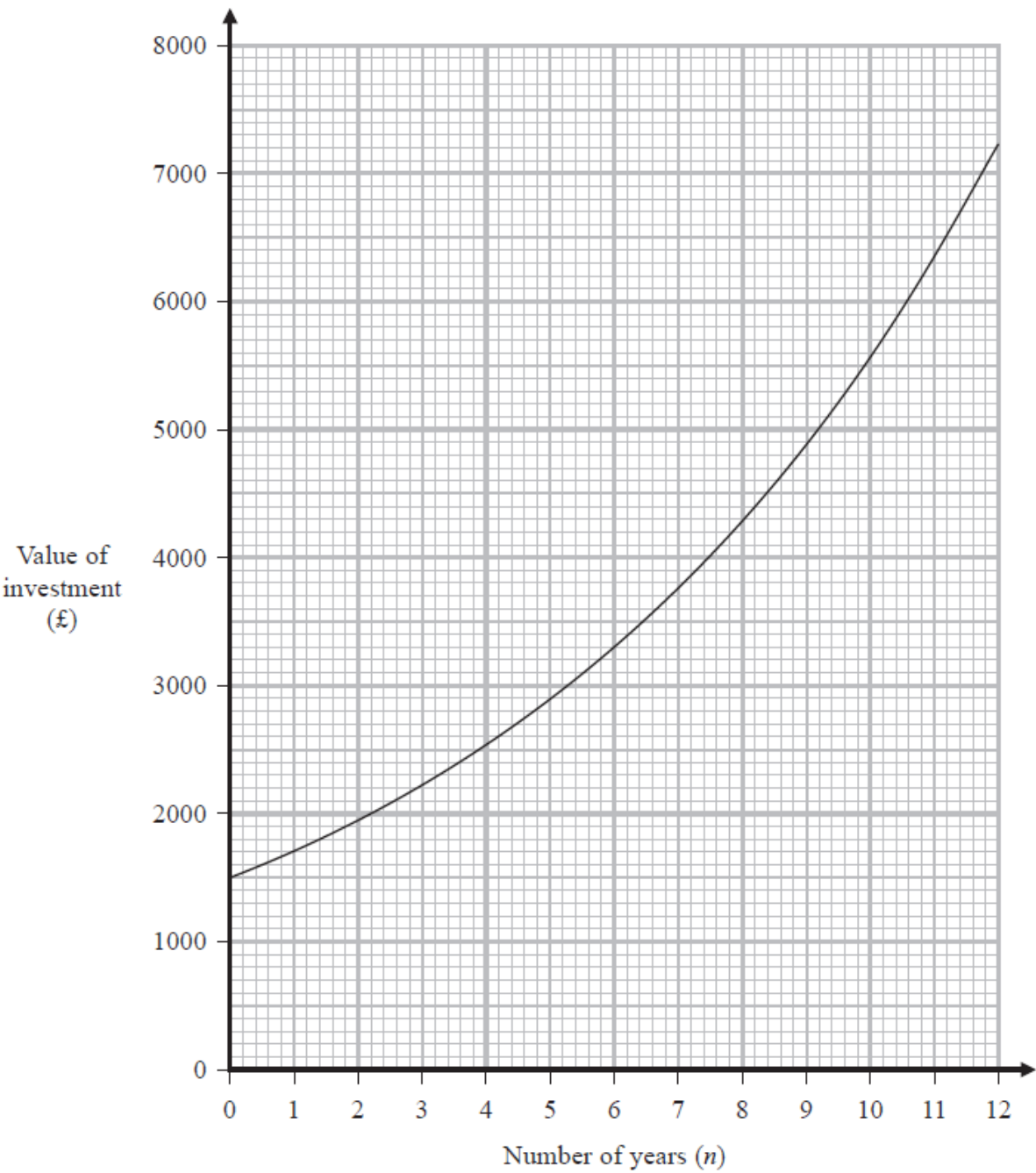
(a) (i) Write down the amount of money that Frank invested.

£.........................

(1)

Frank said that 12 years after he had made his investment, it was worth more than five times its original value.

   (ii) Was Frank correct?
         Give a reason for your answer.

   ....

   ....

   ....

                                                                                                                      (1)

(b) (i) Find an estimate for the gradient of the curve at $n = 7$

                                                                                        ....
                                                                                                                      (3)

   (ii) Explain what this gradient represents.

   ....

   ....

   ....

                                                                                                                      (1)
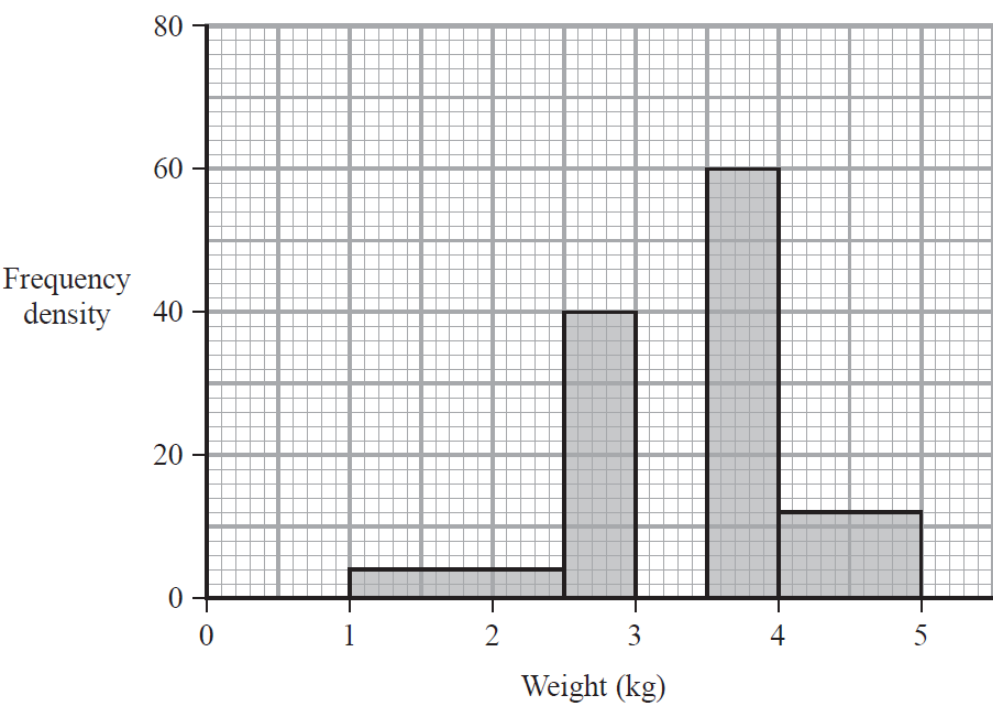
                                                               (Total for Question 18 is 6 marks)

The incomplete histogram shows information about the weights of 100 babies.
All 100 babies have a weight between 1 kg and 5 kg.

6 of the babies have a weight between 1 kg and 2.5 kg.

Complete the histogram.
You must show all your working.

(Total for Question 19 is 4 marks)

20   Two bags, **A** and **B**, each contain only green marbles and red marbles.

There are 6 green marbles and 4 red marbles in bag **A**.
There are 8 green marbles and 2 red marbles in bag **B**.

One marble is going to be taken at random from bag **A** and placed in bag **B**.
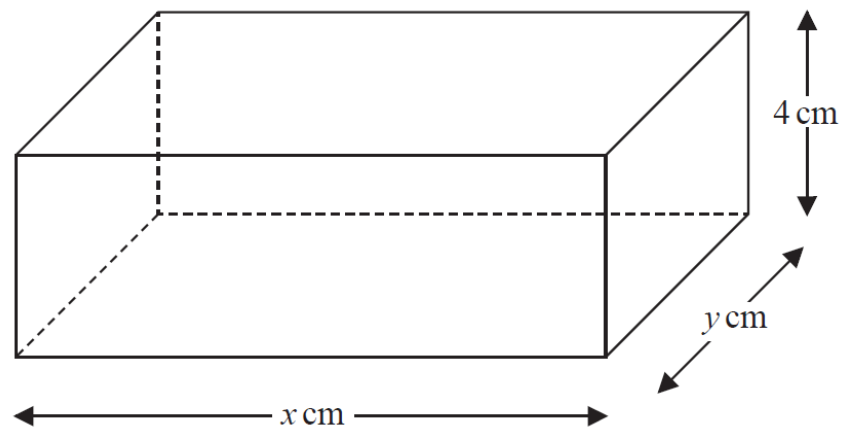
A marble is then going to be taken at random from bag **B**.

Work out the probability that this marble will be a green marble.

....

(Total for Question 20 is 4 marks)

21 Here is a solid cuboid.

The volume of the cuboid is 119 cm³
The total surface area of the cuboid is 155.5 cm²

Given that $x > y$, work out the value of x and the value of y.
You must show all your working.

$x =$ ....

$y =$ ....

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

WEEK 6 TASK 2

Estimated completion time = 90 minutes.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   Work out an estimate for the value of $\dfrac{297 \times 9.44}{0.503}$

....

(Total for Question 1 is 3 marks)

2 The diagram shows a square *ABCD*.
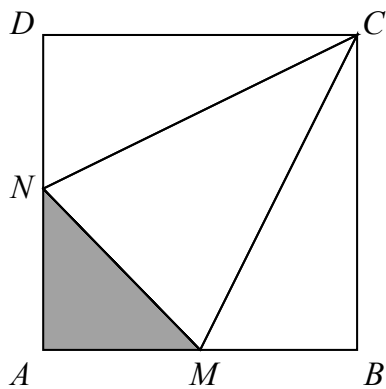
M is the midpoint of *AB*.
N is the midpoint of *AD*.

The area of the shaded triangle *AMN* is 18 cm^2

Work out the area of triangle *MCN*.

.... cm^2

(Total for Question 2 is 4 marks)

3 (*a*) On the number line below, show the set of values of *x* for which $-1 < x \leqslant 4$
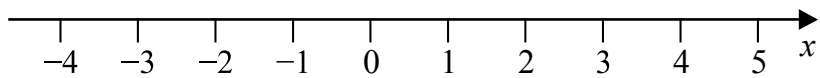
(2)

(*b*) Solve the inequality $4y - 7 < 15$

....

(2)

(Total for Question 3 is 4 marks)

4 There are 140 balloons in a packet.
The balloons are red or yellow or blue or green.

20% of the balloons are red.

$\frac{2}{7}$ of the balloons are yellow.

The ratio of the number of blue balloons to the number of green balloons is 5 : 4

Work out the number of green balloons in the packet.

....

(Total for Question 4 is 5 marks)

5 (*a*) Write down the value of 10^{-2}

....
(1)

(*b*) Write the number $375\,000\,000$ in standard form.

....
(1)

(*c*) Write the following numbers in order of size.
Start with the smallest number.

$$582 \times 10^3 \qquad 5.82 \times 10^{-2} \qquad 0.005\,82 \qquad 0.582 \times 10^5$$
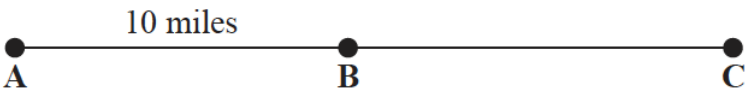
....
(2)

(Total for Question 5 is 4 marks)

6 The diagram shows some information about junctions **A**, **B** and **C** on a motorway.

10 miles

A ———————————— B ———————————— C

Raja drove from **A** to **B** at an average speed of 50 mph.
The distance from **A** to **B** is 10 miles.

Raja took 30 minutes to drive from **A** to **C**.
He drove from **A** to **C** at an average speed of 62 mph.

Work out Raja's average speed as he drove from **B** to **C**.

.... mph

(Total for Question 6 is 4 marks)

7 Kirsty bought a new TV.
The total cost of the TV was £360, including VAT at 20%

Work out the cost of the TV before the VAT was added.

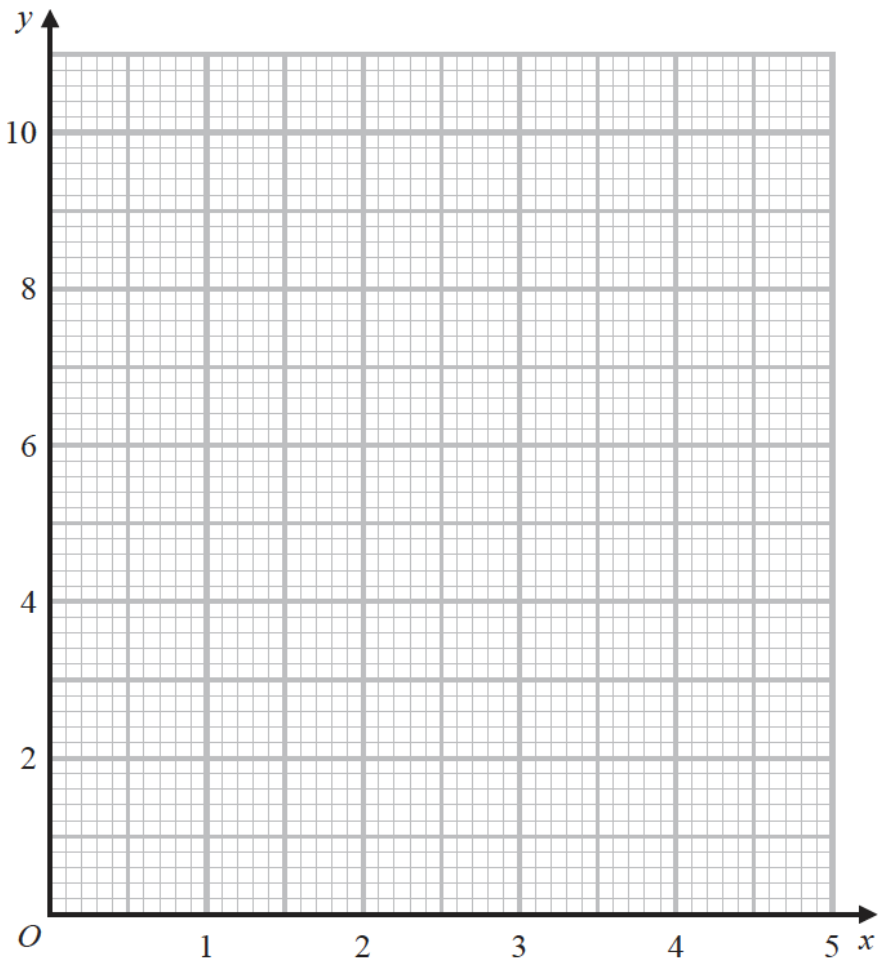£..

(Total for Question 7 is 2 marks)

8 (*a*) Complete the table of values for $y = \dfrac{2}{x}$

x	0.2	0.5	1	2	4	5
y		4				0.4

(2)

(*b*) On the grid below, draw the graph of $y = \dfrac{2}{x}$ for values of x from 0.2 to 5

(2)

(Total for Question 8 is 4 marks)

9 *A, B* and *C* are three points.

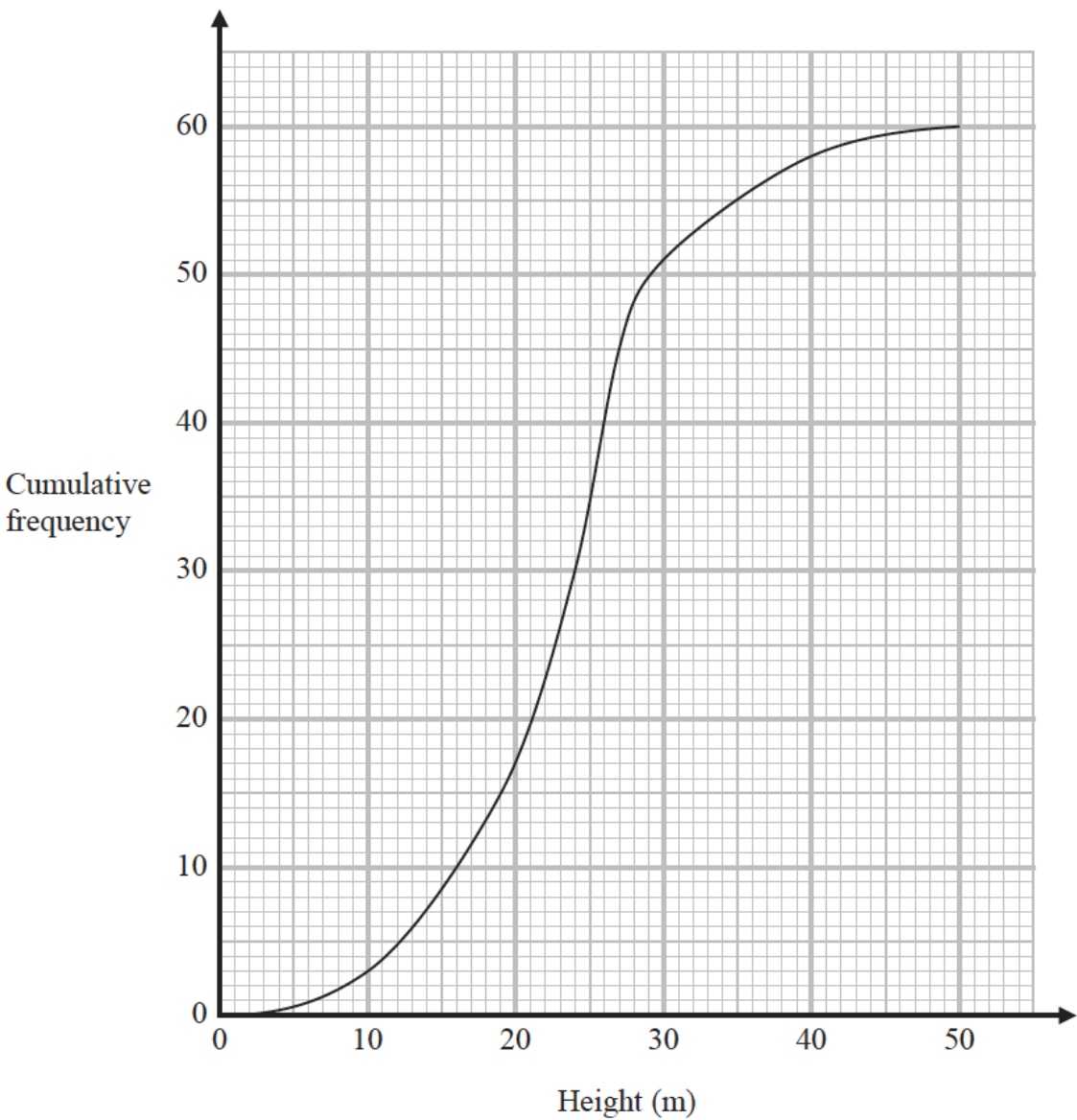The coordinates of *A* are $(-2, 5)$
The coordinates of *B* are $(1, 1)$
The coordinates of *C* are $(19, -23)$

Does point *C* lie on the straight line that passes through *A* and *B*?
You must show how you get your answer.

(Total for Question 9 is 3 marks)

10 The cumulative frequency graph shows information about the heights of 60 fir trees.

(*a*) Use the graph to find an estimate for the median height.

.... m

(1)

(*b*) Use the graph to find an estimate for the interquartile range of the heights.

.... m

(2)

(*c*) Use the graph to find an estimate for the percentage of these fir trees that have a height greater than 30 metres.

....%

(3)

(Total for Question 10 is 6 marks)

---

11 Jo has to make *h* the subject of the formula $d = \dfrac{\sqrt{3h}}{2}$

Here is her working.

$2d = \sqrt{3h}$

$2d^2 = 3h$

$h = \dfrac{2d^2}{3}$

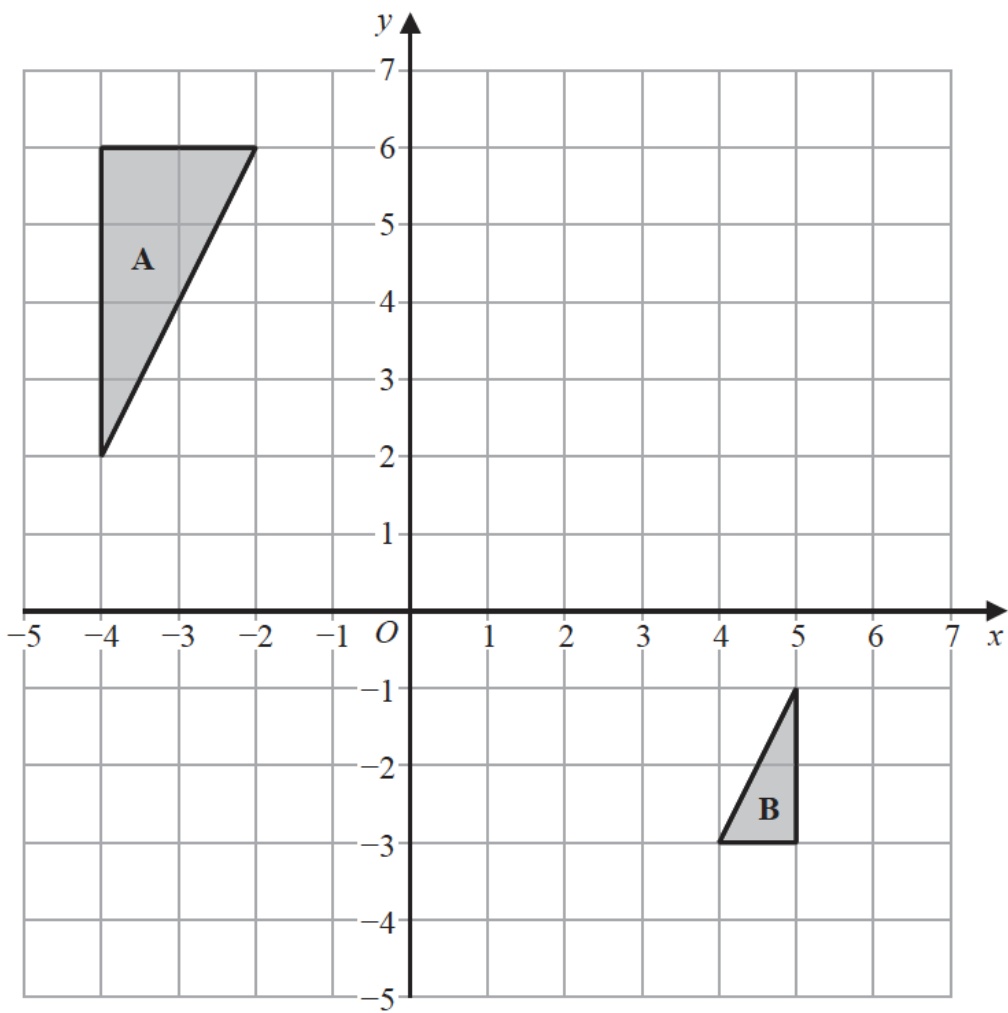What mistake has Jo made in the second line of her working?

....

....

....

(Total for Question 11 is 1 mark)

12 Write $1.1\dot{3}\dot{6}$ as a fraction in its simplest form.

....

(Total for Question 12 is 3 marks)

13

Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

....

....

....

(Total for Question 13 is 2 marks)

14 Here is a table of values for m and for r

m	2	6	10	14
r	20	16	12	8

Harry says,

"r is inversely proportional to m because the values of r decrease by 4 and the values of m increase by 4"

(*a*) Is Harry correct?
You must give a reason for your answer.

....

....

....

(1)

y is inversely proportional to x^2

(*b*) Complete this table of values.

x	1	2	5	
y		50		2

(4)

(Total for Question 14 is 5 marks)

15
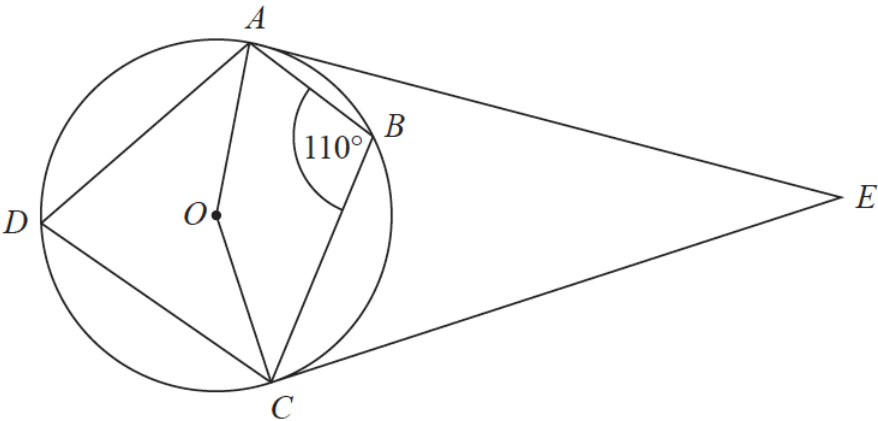
A, *B*, *C* and *D* are points on the circumference of a circle, centre *O*.
AE and *CE* are tangents to the circle.

Angle *ABC* = 110°

Work out the size of angle *AEC*.
You must show all your working.

....°

(Total for Question 15 is 4 marks)

16   Express $\sqrt{45} + \dfrac{45}{\sqrt{5}}$ in the form $a\sqrt{5}$ where a is an integer.

....

(Total for Question 16 is 3 marks)

_____

17   Here are the first five terms of an arithmetic sequence.

$$2 \qquad 5 \qquad 8 \qquad 11 \qquad 14$$

Prove algebraically that the sum of the squares of any two consecutive terms of this sequence is always 1 less than a multiple of 6

(Total for Question 17 is 4 marks)

_____

18   Here is a speed-time graph for part of a car journey.
This part of the journey took 60 seconds.
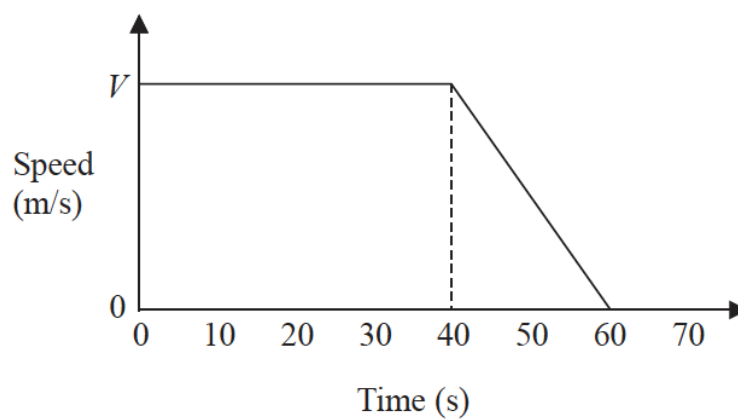
The car travelled at a constant speed of V m/s for the first 40 seconds.
It travelled 1 km in the 60 seconds.

Work out the value of V.

....

(Total for Question 18 is 3 marks)

19 Here is a logo, *OABCDEF*.
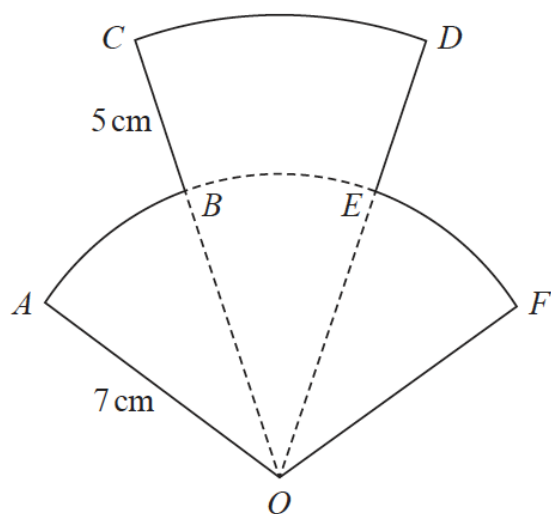
OABEF is a sector of a circle, centre *O* and radius 7 cm.
OBCDE is a sector of a circle, centre *O* and radius 12 cm.

Angle *AOF* = 100°
Angle *COD* = 40°

The perimeter of the logo is *P* cm.

Find the exact value of *P*.
Give your answer in the form $a + b\pi$ where *a* and *b* are integers.

....

(Total for Question 19 is 4 marks)

20   Dan has a grid of nine circles.
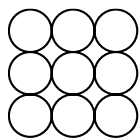
Dan chooses at random two of the circles in the grid.

(*a*) Show that the probability that Dan chooses the two circles shown shaded below is $\dfrac{1}{36}$
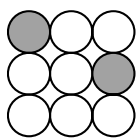
(2)

Joan also has a grid of nine circles.
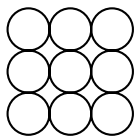
Joan chooses at random three of the circles in the grid.

(*b*) Find the probability that these three circles are in a straight line.

....

(3)

(Total for Question 20 is 5 marks)

21 $f(x) = \dfrac{4}{x+3}$

$g(x) = 3x + 1$

(a) Find $f^{-1}(x)$

....

(2)

Given that $a > 0$

(b) find the set of values of a for which $gf(2a) < a$

....

(5)

(Total for Question 21 is 7 marks)

TOTAL FOR PAPER IS 80 MARKS

WEEK 6 TASK 3
Estimated completion time = 90 minutes.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   (*a*) Work out the reciprocal of 0.8

....
(1)

(*b*) Work out $\dfrac{\sqrt{7.4 - 2.5^2}}{5.6 + 7.2}$

Write down all the figures on your calculator display.

....
(2)

(Total for Question 1 is 3 marks)

2 In a box there are only red beads, green beads, yellow beads and pink beads.

The table shows each of the probabilities that, when a bead is taken at random from the box, the colour of the bead is red or is green.

Colour	red	green	yellow	pink
Probability	0.16	0.2		

The number of yellow beads is the same as the number of pink beads.

Vera is going to take at random one bead from the box and put the bead back in the box.

(*a*) Work out the probability that Vera will take a pink bead.

....
(2)

Cathy is going to take a bead from the box.
She will record the colour of the bead and put the bead back in the box.
Cathy will do this 50 times.

(*b*) Work out an estimate for the number of times she will take a red bead from the box.

....
(2)

(Total for Question 2 is 4 marks)

3   The scatter graph shows information about the number of cups of tea sold by a cafe each day and the temperature at noon that day.
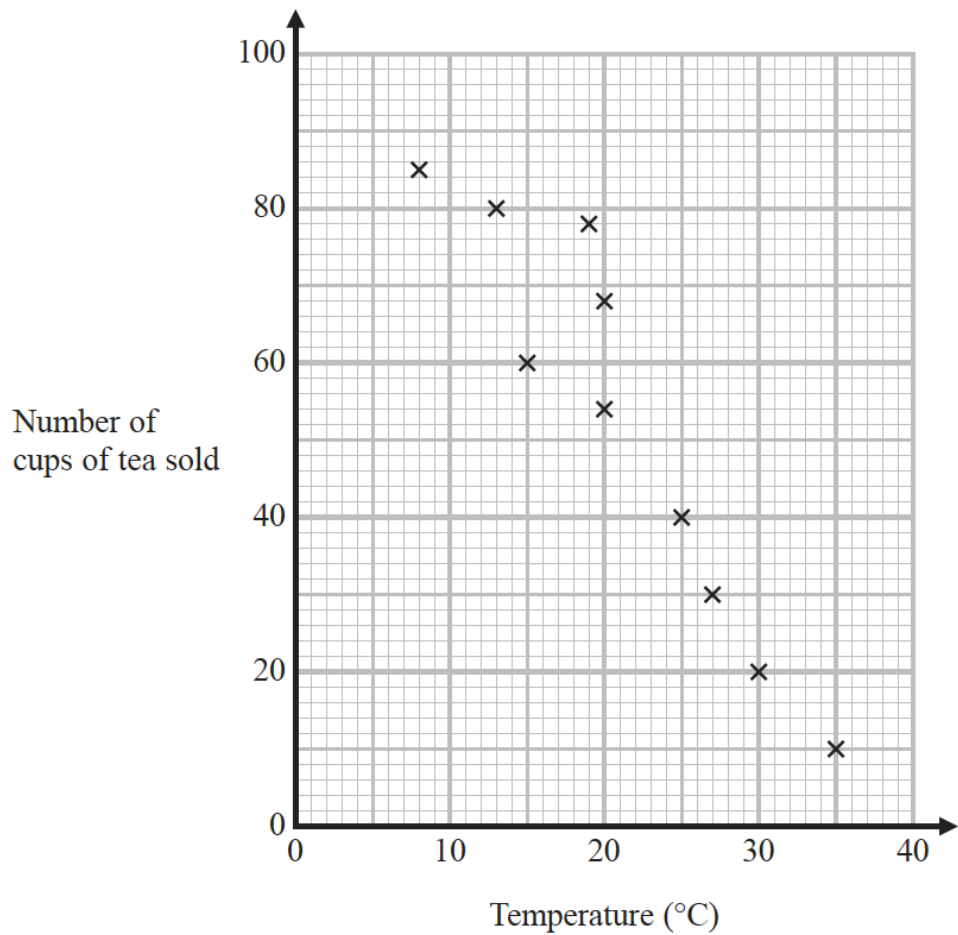
On a different day 46 cups of tea were sold and the temperature at noon was 22°C

(*a*) Show this information on the scatter graph.

(1)

(*b*) What type of correlation does the scatter graph show?

....

(1)

On a Tuesday the temperature at noon is expected to be 10°C

(*c*) Using the scatter graph, find an estimate for the number of cups of tea the cafe can expect to sell on this Tuesday.

....

(2)

(Total for Question 3 is 4 marks)

4 *ABCD* is a rectangle.
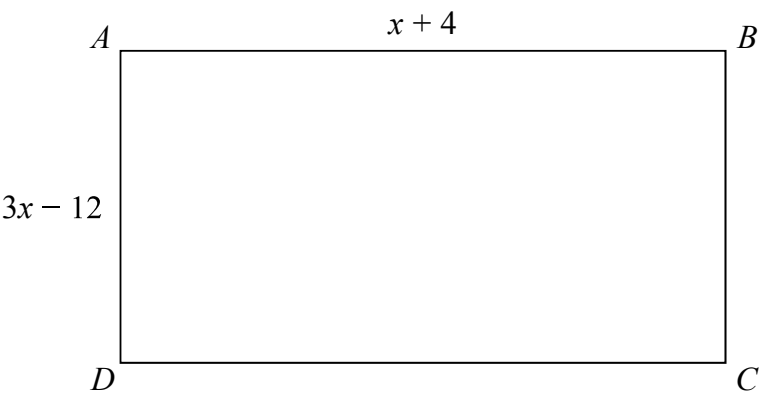
All measurements are in centimetres.

The perimeter of the rectangle is 38 cm.

(*a*) Work out the length of *AD*.

.... cm

(4)

Jamal says,

"If I double the value of *x* then the perimeter of the rectangle will double."

(*b*) Is Jamal correct?
You must give a reason for your answer.

....

....

....

(1)

(Total for Question 4 is 5 marks)

5   Here are the equations of five straight lines.

$$y = 3 \qquad y = 3x + 2 \qquad 3y = x + 2 \qquad x = 3 \qquad x + 3y = 2$$

Each of these straight lines is parallel to the x-axis or is parallel to the y-axis or has a positive gradient or has a negative gradient.

Complete the following table by placing a tick ($\checkmark$) in the correct column for each equation.

Equation	Line parallel to the x-axis	Line parallel to the y-axis	Line with positive gradient	Line with negative gradient
$y = 3$				
$y = 3x + 2$				
$3y = x + 2$				
$x = 3$				
$x + 3y = 2$				

(Total for Question 5 is 3 marks)

6 *ABCD* is a rectangle.
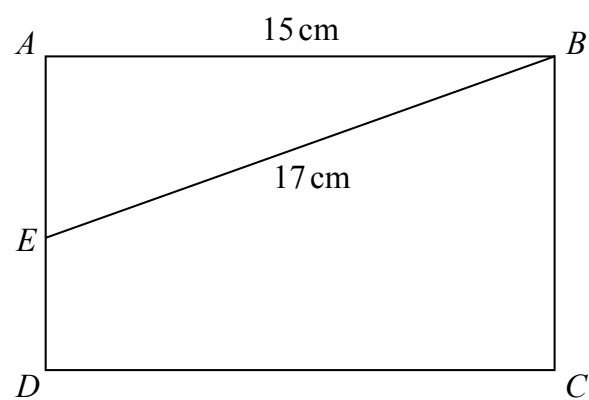
E is the point on *AD* such that *AE* : *ED* = 4 : 3

Work out the area of the rectangle.

.... cm²

(Total for Question 6 is 5 marks)

7 The mass of $\frac{1}{2}$ pint of milk is 303 g.

1 pint is 0.568 litres
1000 cm^3 = 1 litre

Work out the density of the milk.
Give your answer in g/cm^3

.... g/cm^3

(Total for Question 7 is 3 marks)

8   Selina invests £2000 in a savings account for 3 years.
The account pays compound interest at a rate of 2.5% per annum.

Calculate the total amount of interest Selina will get by the end of the 3 years.

£..

(Total for Question 8 is 3 marks)

9 The diagram shows the right-angled triangle *ABC*.
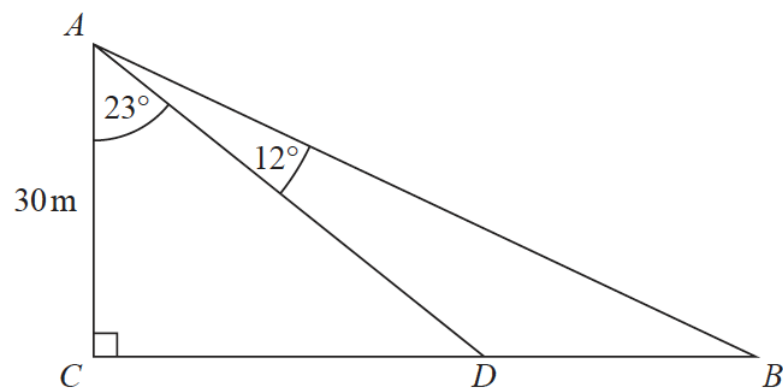
CDB is a straight line.

Calculate the length of *DB*.
Give your answer correct to 2 decimal places.

.... m

(Total for Question 9 is 4 marks)

10 A shop sells

17 different types of sandwich
15 different types of drink
26 different types of snack
14 different types of dessert.

A meal deal consists of either

a sandwich, a drink and a snack
or a sandwich, a drink and a dessert.

(*a*) Show that there are over 10 000 different ways to choose a meal deal.

(3)

The owner of the shop says,

"If I halve the number of snacks available, this will halve the number
of ways to choose a meal deal."

The owner of the shop is incorrect.

(*b*) Explain why.

....

....

....

(1)

(Total for Question 10 is 4 marks)

11 (*a*) Expand and simplify $(x + 2)(3x - 1)(x + 4)$

....
(3)

(*b*) Solve $\dfrac{23 - 2y}{4} = y - 7$

$y =$ ....
(3)

(*c*) Solve $3p^2 - 3p - 7 = 0$

Give your solutions correct to 3 significant figures.

....

(3)

(Total for Question 11 is 9 marks)

12
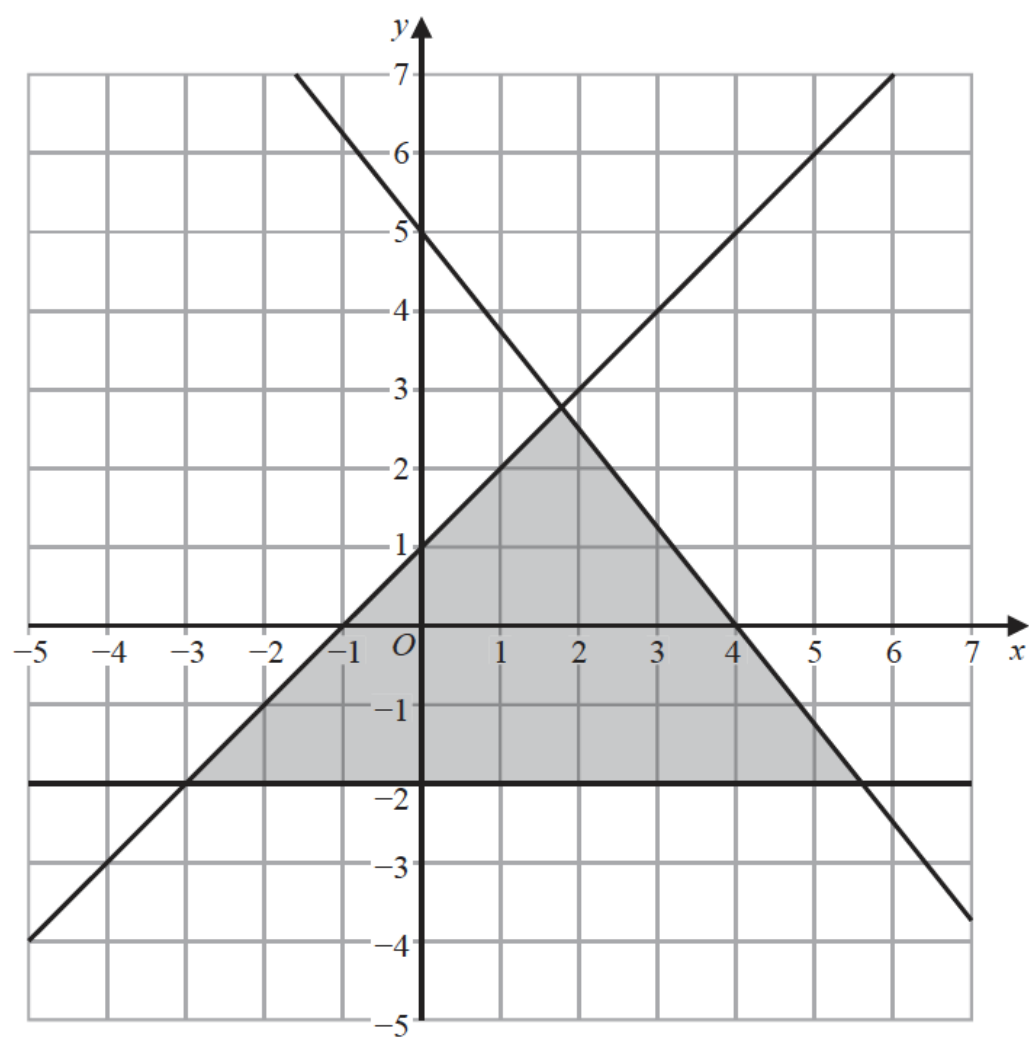
(*a*) Write down the inequalities that define the shaded region.

....

....

....

(3)

Natalie is asked to shade the region $y \geqslant x$ on a coordinate grid.

Here is her answer.
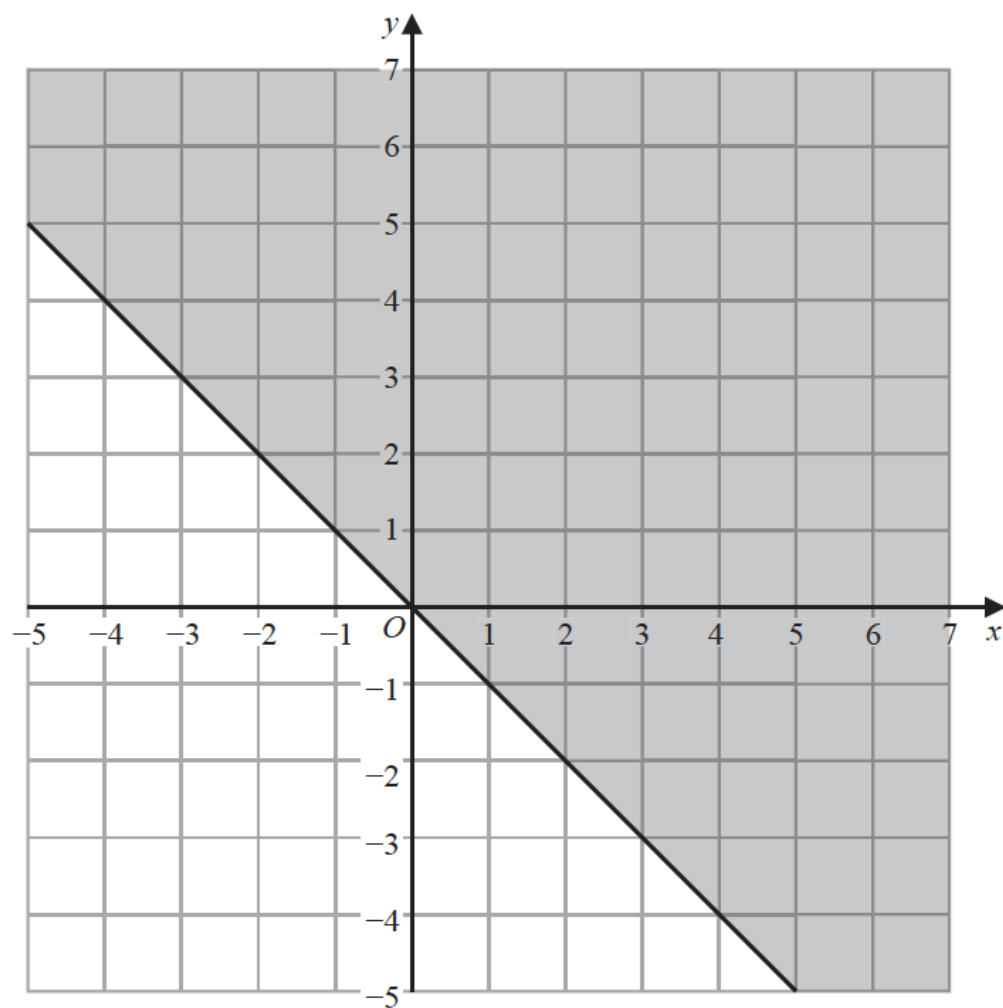
(*b*) What error has Natalie made?

....

....

....

(1)

(Total for Question 12 is 4 marks)

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

The ratio of the volume of solid **A** to the volume of solid **B** is 27 : 1000

The surface area of solid **A** is 810 cm^2

Calculate the surface area of solid **B**.

.... cm^2

(Total for Question 13 is 3 marks)

14
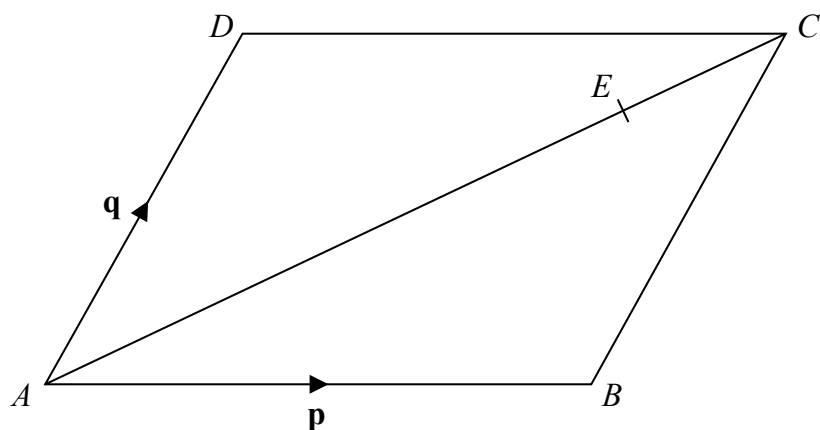
ABCD is a parallelogram.

$\overrightarrow{AB} = \mathbf{p}$

$\overrightarrow{AD} = \mathbf{q}$

The point *E* lies on *AC* such that *AE* : *EC* = 4 : 1

Find $\overrightarrow{DE}$ in terms of **p** and **q**.
Give your answer in its simplest form.

....

(Total for Question 14 is 4 marks)

15 Here is a speed-time graph.
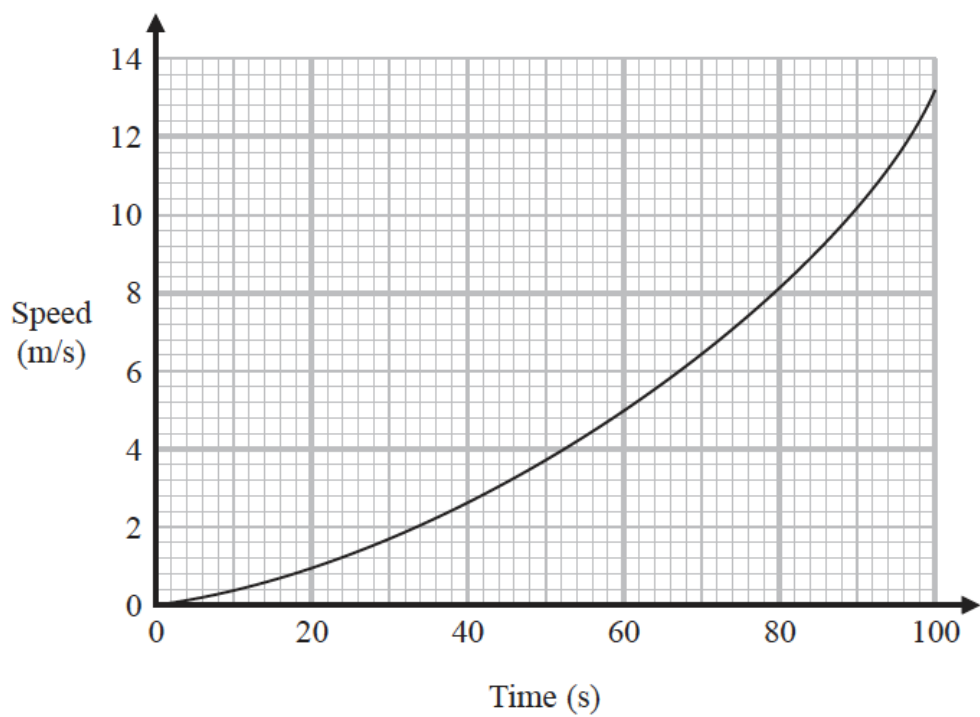
(*a*) Calculate an estimate of the gradient of the graph at time 50 seconds.
You must show how you get your answer.

....

(3)

(*b*) Describe what your answer to part (*a*) represents.

....

(1)

(Total for Question 15 is 4 marks)

16 Here is triangle *ABC*.
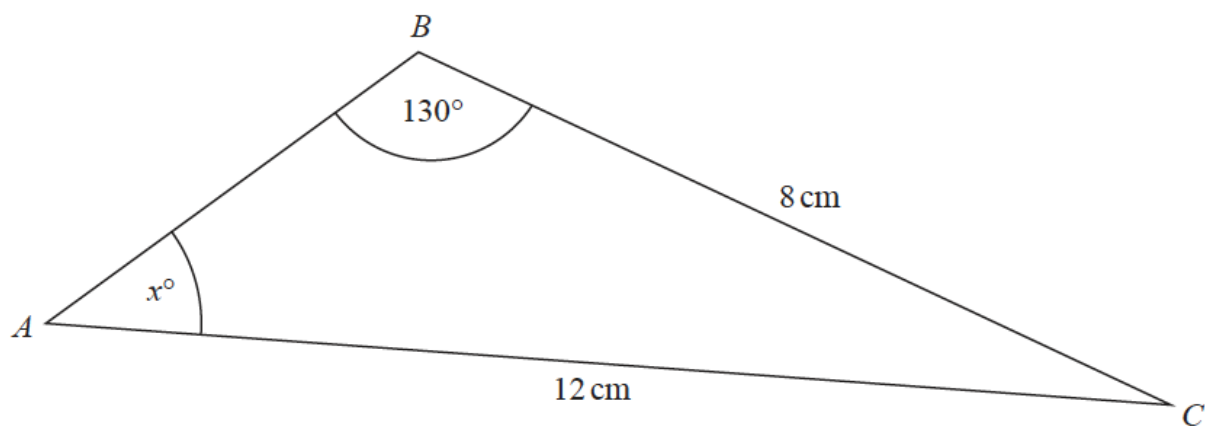
Calculate the value of *x*.
Give your answer correct to 3 significant figures.

....

(Total for Question 16 is 3 marks)

17 A disc is placed on horizontal ground.

The disc exerts a force of F newtons over an area of A cm^2 where

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

$F = 576.2$ correct to 1 decimal place
$A = 72$ correct to 2 significant figures.

The disc exerts a pressure of P newtons/cm^2 on the ground.

By considering bounds, calculate the value of P to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.

....

(Total for Question 17 is 5 marks)

18 Write the expression $\quad 4x^2 + 12x + 7\quad$ in the form $(ax + b)^2 + c$

....

(Total for Question 18 is 2 marks)

---

19 At the start of day n, the number of cells being used in an experiment is T_n

At the start of the next day, the number of cells being used in the experiment is T_{n+1} where

$$T_{n+1} = kT_n \text{ and } k \text{ is a positive constant.}$$

Given that

$\quad T_1 = 250\ 000$

$\quad T_3 = 490\ 000$

$\quad T_7 : T_4 = m : 1$

find the value of m.
Give your answer correct to 3 significant figures.

....

(Total for Question 19 is 5 marks)

20 Donna found out information about the areas, in m², of some fields.

The table shows some information about her results.

Area (p m²)	Frequency
$0 < p \leqslant 10\ 000$	4
$10\ 000 < p \leqslant 30\ 000$	16
$30\ 000 < p \leqslant 60\ 000$	15
$60\ 000 < p \leqslant 70\ 000$	
$70\ 000 < p \leqslant 110\ 000$	

Donna drew a histogram of her results.

The height of the bar for the class interval $70\ 000 < p \leqslant 110\ 000$ is twice the height of the bar for the class interval $0 < p \leqslant 10\ 000$

(*a*) Write down the frequency for the interval $70\ 000 < p \leqslant 110\ 000$

....

(1)

The height of the bar for the class interval $10\ 000 < p \leqslant 30\ 000$ is 4 cm.

(*b*) Work out the height of the bar for the class interval $30\ 000 < p \leqslant 60\ 000$

.... cm

(2)

(Total for Question 20 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS

WEEK 6 TASK 4

Estimated completion time = 90 minutes.

1 (*a*) Find the highest common factor (HCF) of 78 and 130

....

(2)

(*b*) Find the lowest common multiple (LCM) of 60 and 96

....

(2)

(Total for Question 1 is 4 marks)

2 Nik owns a stationery shop.
She bought 72 pencils for a total cost of £4.68

Nik sells all 72 pencils for 15p each.

Work out Nik's percentage profit.
Give your answer correct to 1 decimal place.

....%

(Total for Question 2 is 4 marks)

3 Joel is going to make candles.
He will pour melted wax into moulds.

Each mould is in the shape of a cylinder with diameter 12 cm and height 18 cm.

Joel has 15 kg of solid wax.
He knows that 1 kg of solid wax makes 1170 cm3 of melted wax.
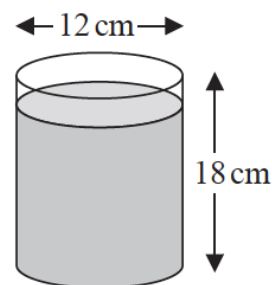
To make each candle, Joel will pour melted wax into a mould to $\dfrac{7}{8}$ of the height

of the mould.

He wants to make as many candles as he can.

How many candles can Joel make when using 15 kg of solid wax?
You must show your working.

....

(Total for Question 3 is 5 marks)

4   In January, Lamai worked 45 hours per week and got paid £12.50 per hour.

In February, the number of hours Lamai worked per week was 20% less than the number of hours she worked per week in January.

She was paid 32% more per hour in February than in January.

Work out how much more Lamai was paid per week in February than in January.

£...

(Total for Question 4 is 4 marks)

---

5   Jess rounds a number, n, to one decimal place.
The result is 15.6

Complete the error interval for n.

.... $\leqslant n <$ ....

(Total for Question 5 is 2 marks)

6 The table gives information about the weights, in kg, of 25 babies.

Weight (w kg)	Frequency
$2.5 < w \leqslant 3.0$	4
$3.0 < w \leqslant 3.5$	8
$3.5 < w \leqslant 4.0$	11
$4.0 < w \leqslant 4.5$	2

Work out an estimate for the mean weight.

.... kg

(Total for Question 6 is 3 marks)

7 Point A has coordinates $(-4, 2)$

Point A is translated to the point with coordinates $(-1, -3)$

Find, as a column vector, the vector that describes this translation.

$\begin{pmatrix} .... \\ .... \end{pmatrix}$

(Total for Question 7 is 2 marks)

8   It takes $4\frac{3}{4}$ hours to print some letters when 7 printers are used.

Work out the time taken to print the letters when 3 printers are used.
Give your answer in hours and minutes.

.... hours .... minutes

(Total for Question 8 is 3 marks)

9 Here is the graph of $y = 4 + 3x - x^2$ for values of x from -2 to 5
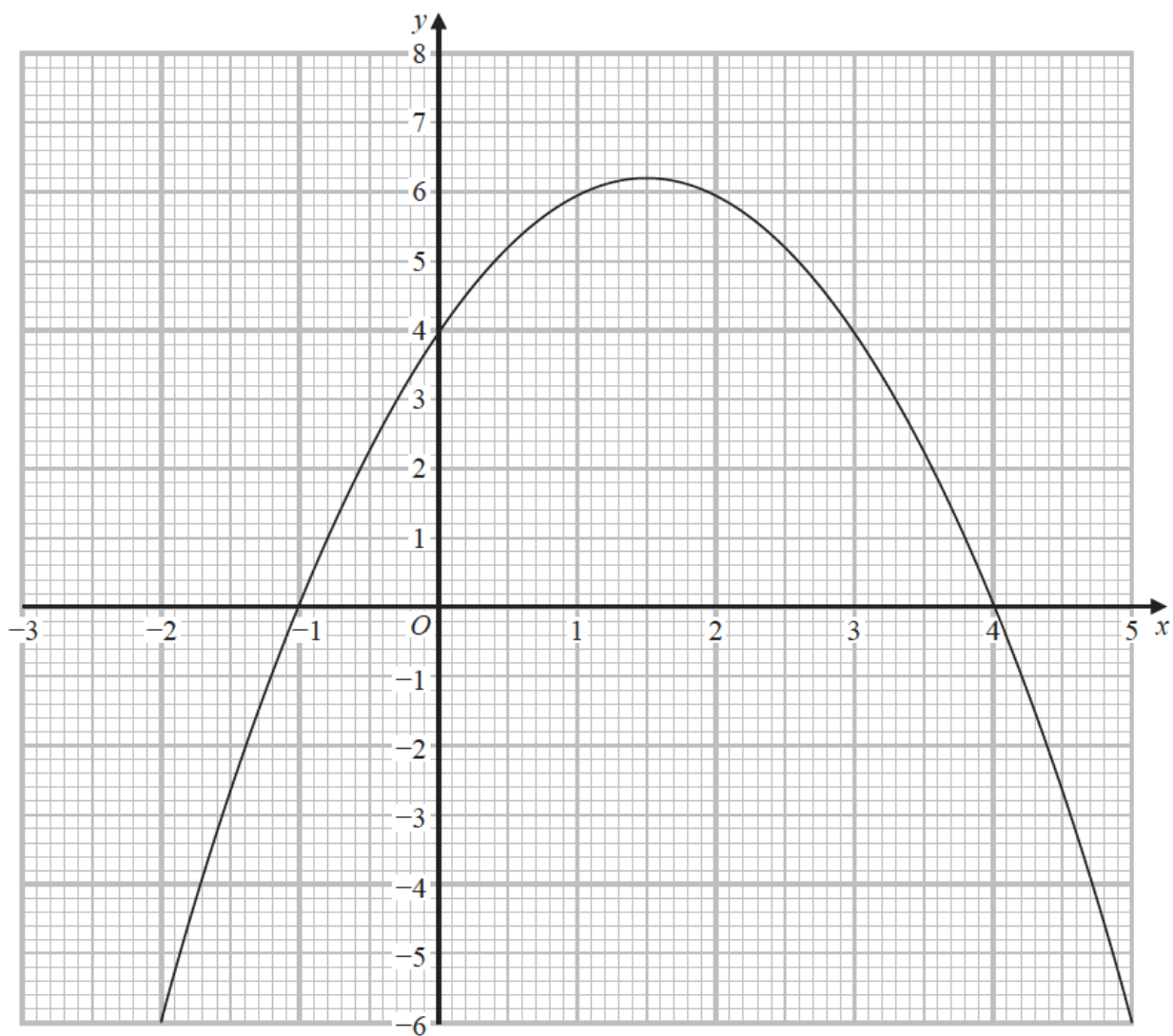
(*a*) Write down estimates for the coordinates of the turning point on the graph of $y = 4 + 3x - x^2$

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

(1)

(*b*) Use the graph to find estimates of the solutions to the equation $4 + 3x - x^2 = -2$

....

(2)

(Total for Question 9 is 3 marks)

10 Peter pays £5000 for a factory machine.

The value of the machine depreciates at a rate of x% per annum.
At the end of 6 years the value of the machine is £3493.62

Calculate the value of x.
Give your answer correct to 1 decimal place.

....

(Total for Question 10 is 3 marks)

11   *PQR* and *PST* are two triangles.
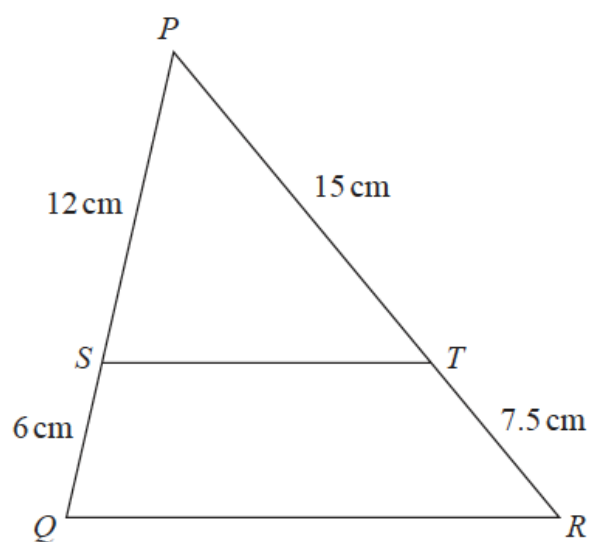
Are triangle *PQR* and triangle *PST* similar?
Justify your answer.

(Total for Question 11 is 2 marks)

12 The box plots give information about the distances a javelin is thrown by 60 male athletes and by 60 female athletes.
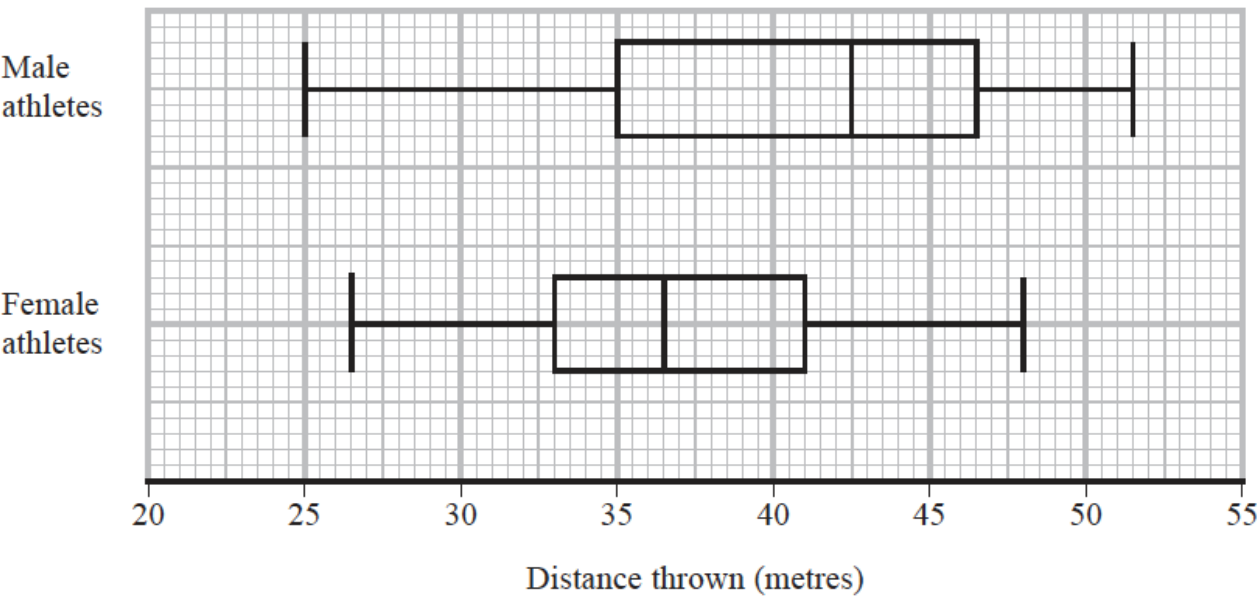
(a) Work out the interquartile range for the distances thrown by the male athletes.

.... m

(2)

Fayha says,

"The box plots show that the male athletes threw the javelin further than the female athletes."

(b) Is Fayha correct?
Give a reason for your answer.

....

....

....

(1)

(c) Work out an estimate for the number of the female athletes that threw the javelin a distance greater than 33 m.

....

(2)

(Total for Question 12 is 5 marks)

13 Here are the first six terms of a quadratic sequence.

$$10 \qquad 19 \qquad 34 \qquad 55 \qquad 82 \qquad 115$$

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

....

(Total for Question 13 is 3 marks)

---

14 Show that $\dfrac{2x^2 + 10x - 48}{x^2 - 64}$ can be written in the form $\dfrac{ax + b}{cx + d}$ where a, b, c and d are integers.

(Total for Question 14 is 3 marks)

15 *ABC* is a triangle.
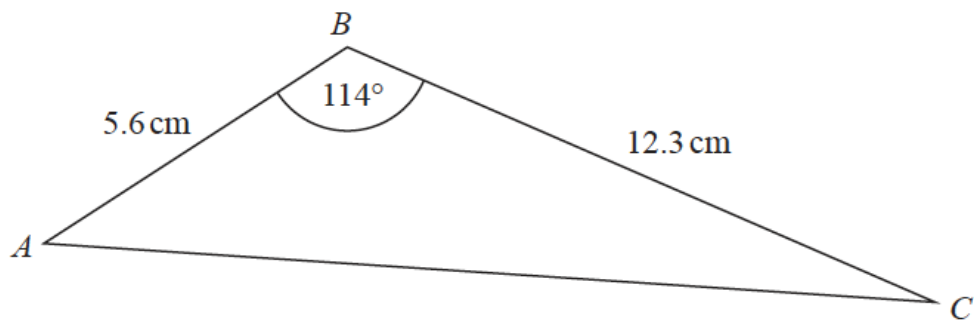
(*a*) Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

.... cm^2

(2)

(*b*) Calculate the length of *AC*.
Give your answer correct to 3 significant figures.

.... cm

(3)

(Total for Question 15 is 5 marks)

16 (*a*) Show that the equation $5x = x^3 - 9$ can be rearranged to give $x = \sqrt[3]{9 + 5x}$

(1)

(*b*) Starting with $x_0 = 3$,

use the iteration formula $x_{n+1} = \sqrt[3]{9 + 5x_n}$ three times to find an estimate for a solution of $5x = x^3 - 9$

Give your answer correct to 3 decimal places.

....

(3)

(Total for Question 16 is 4 marks)

17 Here is a speed-time graph for the first 40 seconds of an aeroplane's journey.
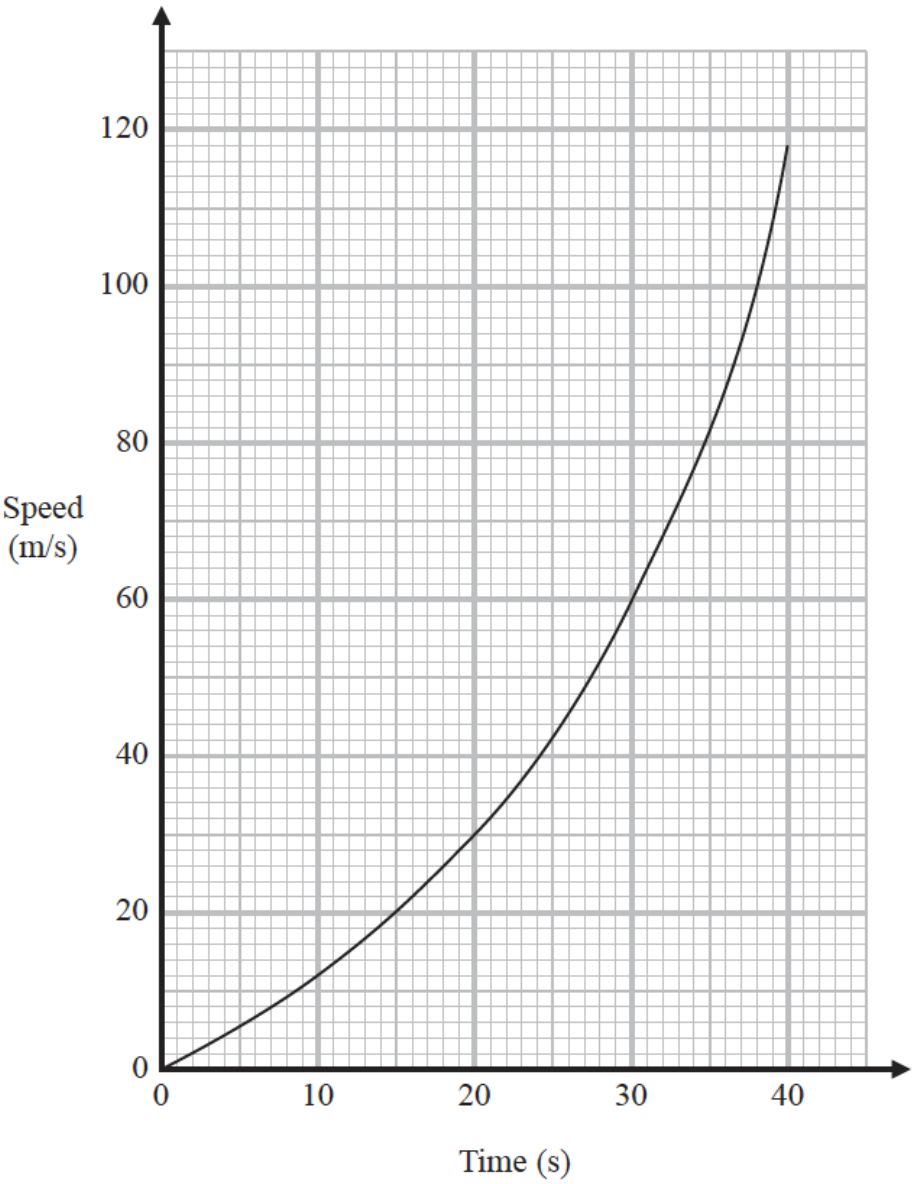
Work out an estimate for the distance the aeroplane travelled in the first 40 seconds of its journey. Use 4 strips of equal width.

.... m

(Total for Question 17 is 3 marks)

18 The centre of the base of a solid cone is placed at the centre of the flat face of a hemisphere to make a sculpture.
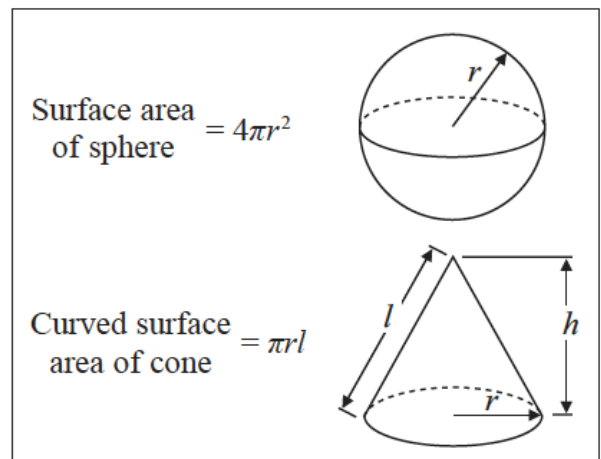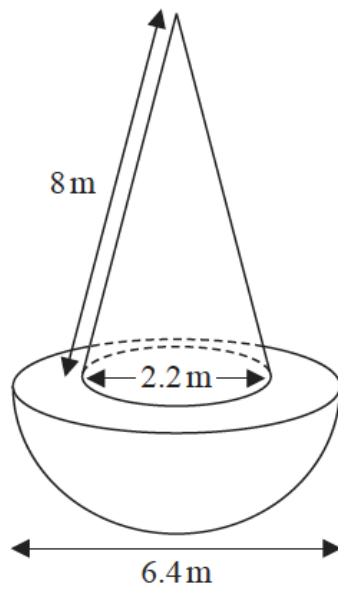
The diameter of the hemisphere is 6.4 m.
The diameter of the base of the cone is 2.2 m and the slant height of the cone is 8 m.

Callum is going to cover this sculpture with one coat of paint.
He assumes that each tin of paint will cover 8.5 m^2

Callum thinks he will need to buy 15 tins of paint.

(*a*) Will 15 tins of paint be enough?
You must show how you get your answer.

(5)

Callum finds out that each tin of paint will actually cover 7.5 m^2

(*b*) How does this affect your answer to part (*a*)?

....

....

....

(1)

(Total for Question 18 is 6 marks)

19 200 people were asked if they like any of running, cycling or swimming.

Of these people,
    8 like running, swimming and cycling
  16 like running and swimming but not cycling
  33 do not like any of these activities
  28 like cycling and swimming
  all 40 people who like cycling like at least one other activity
  124 like running

One of the people asked is chosen at random.

Given that this person likes swimming, find the probability that this person likes cycling.

....

(Total for Question 19 is 5 marks)

20 The diagram shows a triangular prism.
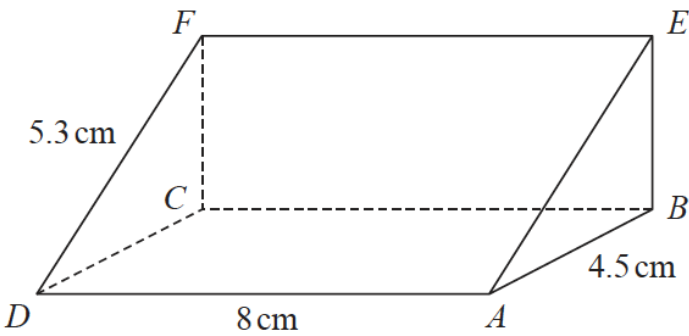
The base, *ABCD*, of the prism is a rectangle.
Angle *DCF* and angle *ABE* are right angles.

M is the point on *DA* such that *DM* : *MA* = 3 : 2

Calculate the size of the angle between *EM* and the base of the prism.
Give your answer correct to 1 decimal place.

....°

(Total for Question 20 is 4 marks)

21 The graph of $y = f(x)$ is shown on the grid below.
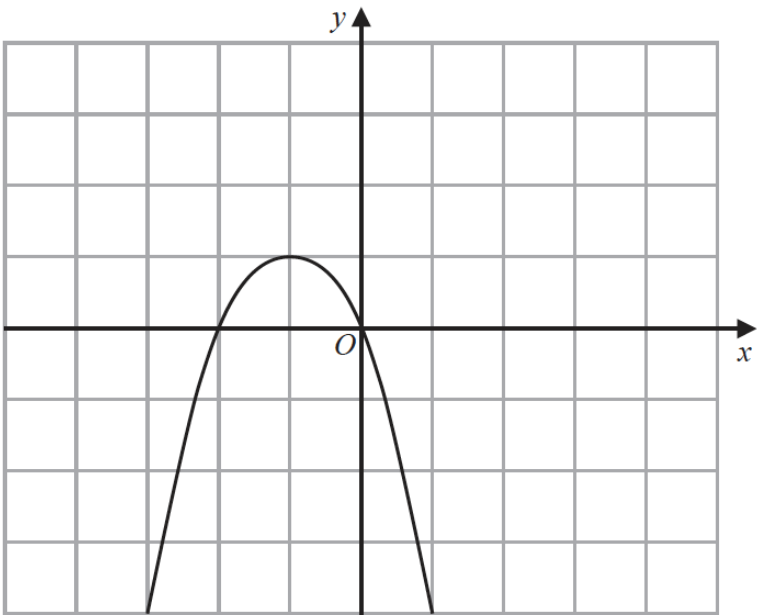
(a) On the grid above, sketch the graph of $y = -f(x)$

(1)

C is the circle with equation $x^2 + y^2 = 9$

The circle **C** is translated by the vector $\begin{pmatrix} -2 \\ 0 \end{pmatrix}$ to give circle **S**.

(b) Draw a sketch of circle **S**.
Label with coordinates the centre of circle **S** and any points of intersection with the x-axis.
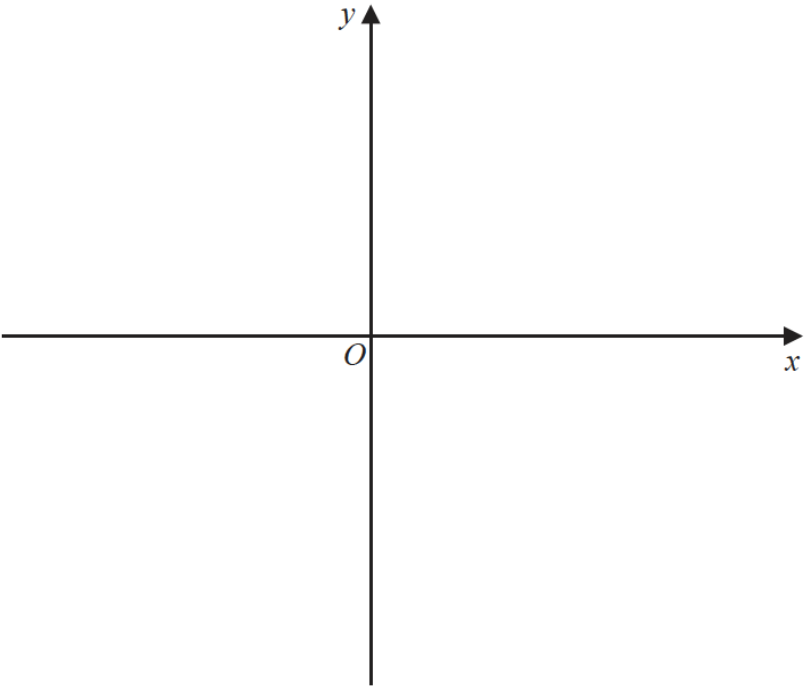
(3)

T is a circle with centre (0, 0)

P is the point on **T** with coordinates (12, −9)

(*c*) Find an equation of the tangent to **T** at the point *P*.

....
(3)

(Total for Question 21 is 7 marks)

TOTAL FOR PAPER IS 80 MARKS

WEEK 6 MARKSCHEMES
(Higher 4-6)

WEEK 6 TASK 1

Question	Answer	Mark	Mark scheme	Additional guidance
1	1.61	M1	for 5.706(...) or 3.108(...) or 3.109 or 2.597(...) or 2.598	
		A1	for 1.61(....)	
2 (i)	22.5	M1	for a method to find scale factor, eg $5 \div 2$ (= 2.5) or $2 \div 5$ (= 0.4) oe	May see evidence on diagram or as part of calculation, $9 \times 5 \div 2$ or 9/2
		A1	cao	Accept $22\frac{1}{2}$
(ii)	7.2	M1	for a method to find length of *BC*, eg $18 \div$ "2.5" or $18 \times$ "0.4" or $9 \times 18 \div$ "22.5" oe or $\frac{18}{5}$	May see evidence on diagram
		A1	cao	Accept $7\frac{1}{5}$ oe
3	37 800	M1	for finding 3 products within intervals (including end points)	<table><tr><td>Min *fx*</td><td>Max *fx*</td></tr><tr><td>5000</td><td>25 000</td></tr><tr><td>25 000</td><td>45 000</td></tr><tr><td>45 000</td><td>65 000</td></tr></table>
		M1	for Σ"*fx*" $\div (9 + 25 + 16)$ **or** $(15\,000 \times 9 + 35\,000 \times 25 + 55\,000 \times 16) \div (9 + 25 + 16)$ **or** ("135 000" + "875 000" + "880 000") $\div$ "50" **or** "1 890 000" $\div$ "50"	Σ"*fx*" **must** come from 3 products *fx* within intervals (including end points)
		A1	cao	
4	942	M1	for complete method, eg $\pi \times 5^2 \times 12$	May be seen in 2 stages
		A1	for value in the range 942 to 943	

Question		Answer	Mark	Mark scheme	Additional guidance
5		3.91	P1	for process to find 1.8% of 4000, eg 0.018 × 4000 (= 72) oe or 1.018 × 4000 (= 4072) oe	For process marks accept figures ±1 pence which do not need to be presented in money notation (to 2dp) or with monetary symbols. Award marks for correct processes shown, figures can be taken as implying the process.
			P1	for complete process to deal with compound interest eg 4000 × 1.018^3 (= 4219.91...) oe	
			P1	for complete process to deal with simple interest eg 4000 × 0.018 × 3 (= 216)	
			A1	for 3.91 or 3.92	
6		183.5, 184.5	B1	for 183.5 in the correct position	
			B1	for 184.5 in the correct position	Accept 184.4$\dot9$ or 184.499…
7		40.8	P1	for start of process to find the width of the rectangle eg. $\tan 35 = \frac{BC}{12}$ oe	
			P1	for complete process to find width eg 12 × tan 35 (= 8.40...) oe	
			P1	for process to find perimeter eg 2 × "8.40..."+ 2 × 12	
			A1	for answer in the range 40.80 to 40.81	
8	(a)	−25, (−6), 1, 2, (3), 10, 29	B2	for all values correct	
			(B1	for 3 or 4 missing values correct)	
	(b)	Curve drawn	M1	(dep B1) for plotting their values	
			A1	for correct smooth curve drawn	
	(c)	1.6	B1	for value in the range 1.5 to 1.7 ft (b)	

Question		Answer	Mark	Mark scheme	Additional guidance
9	(a)	62 300 000	B1	accept in standard form, 6.23×10^7	
	(b)	270	P1	for process to find total land area, eg $1.3 \times 10^5 + 8.0 \times 10^4 + 2.1 \times 10^4 \, (= 2.31 \times 10^5 \text{ oe})$	
			P1	for complete process, eg ("6.23×10^7") $\div$ ("2.31×10^5")	
			A1	for value in range 269 to 270	Accept standard form
10		135	P1	shows process to be used, eg $\frac{20}{8} \times 54$ oe or $\frac{54}{n} = \frac{8}{20}$ oe	
			A1	cao	
11		4.8	M1	for correct first step, eg $8 - 3x = 4(8 - 2x)$	
			M1	(dep M1) for isolating terms in x, eg $8x - 3x = 32 - 8$ or $5x = 24$	
			A1	for 4.8 or $4\frac{4}{5}$ or $\frac{24}{5}$	
12	(a)	224	B1	cao	
	(b)	91	M1	for recognising the non-replacement nature of the problem, eg $\frac{14 \times 13}{2}$ or 14×13 or $14^2 - 14$ or $14 \times 13 \times 2$	
			A1	cao	

Question		Answer	Mark	Mark scheme	Additional guidance
13	(a)	Correct statement	C1	for substituting both 1 and 2 into $x^4 - 3x - 1$ $(= -3$ and 9)	
			C1	for values –3 and 9 plus explanation that these are above and below 0 oe (thus implying a solution lies between 1 and 2)	Explanation need not be in words eg $-3 < 0$ and $9 > 0$
	(b)	Correct rearrangement	C1	for correct algebraic rearrangement	Stage $x^4 = 3x + 1 = 0$ must be seen
	(c)	1.414	B1	for 1.414(...)	
14	(a)	Result shown	P1	for process to use the formula for the circumference of a circle, eg $2\pi r$ or $2\pi(r + t)$ **or** for process to use the sector angle, eg $\frac{108}{360}$ oe	Fractions may be simplified at any stage
			P1	for a complete process to find the perimeter, eg $\frac{108}{360}\{2\pi r + 2I(r + t)\} + 2t$	
			P1	for process to use a common denominator, eg $\frac{108\{2\pi r + 2\pi(r+t)\} + 720t}{360}$	
			P1	for expansion of brackets and collection of terms, eg $432\pi r + 216\pi t + 720t$	
			C1	for completion of processes to get the result.	Need to see steps in working, not only the final expression
	(b)(i)	$6\pi + 20$	B1	cao	
	(ii)	explanation	C1	for explanation, eg this gives the perimeter of the sector (of circle, angle 108°, radius 10 cm)	

Question	Answer	Mark	Mark scheme	Additional guidance
15	$c = \dfrac{3}{d}$	M1	for $c = \dfrac{k}{d}$ oe, or $c \propto \dfrac{1}{d}$ may be implied by substitution	
		M1	for substitution to find k, eg $0.5 = \dfrac{k}{6}$	
		A1	for $c = \dfrac{3}{d}$ or $c = 3d^{-1}$	
16	Result shown	M1	for starting to work, eg with ratios B : G = 6 : 1 oe or B + G ; R + Y = 2 : 1 oe **OR** eg with fractions $B = \dfrac{6}{7}(B+G)$ oe or $B + G = \dfrac{2}{3}(B+G+R+Y)$ oe **OR** eg with numbers in the correct ratio 1G, 6B or 14 G + B, 7 R + Y	Students may work with ratios, fractions or numbers of counters Award marks for any appropriate method.
		M1	for complete method, eg using ratios B : G : R + Y = 6 : 1 : $3\tfrac{1}{2}$ oe **OR** eg using fractions $B = \dfrac{6}{7}(B+G)$ oe and $B + G = \dfrac{2}{3}(B+G+R+Y)$ oe **OR** eg using numbers of counters 2G, 12B, 7R + Y	
		M1	for method to find the proportion of blue counters, eg from ratios $\dfrac{[6]}{[6]+[1]+\left[3\frac{1}{2}\right]}$ oe **OR** eg from fractions $\dfrac{6}{7} \times \dfrac{2}{3}$ **OR** eg using numbers of counters $\dfrac{[12]}{[2]+[12]+[7]}$	
		C1	for figure rounding to 57 seen from correct working	

Question	Answer	Mark	Mark scheme	Additional guidance
17	185	P1	for using the sine rule to find angle QSR, eg $\frac{26}{\sin 120} = \frac{12}{\sin QSR}$ **OR** for using the cosine rule to find SR eg $26^2 = 12^2 + SR^2 - 2 \times 12 \times SR \times \cos 120$ oe	Accept values to 3 figures or more, rounded or truncated throughout.
		P1	for complete process to find expression for sin QSR, eg $\sin QSR = \frac{12 \times \sin 120}{26}$ (= 0.399....) or for $QSR = 23.55...$ **OR** for process to write rule as a quadratic equation in SR, eg $SR^2 + 12SR - 532$ (= 0)	
		P1	for process to find angle SQR, eg $180 - 120 - $ "23.5..." (= 36.44...) **OR** for process to find SR, eg substitution into the quadratic formula, $\frac{-12 \pm \sqrt{12^2 - 4 \times 1 \times -532}}{2x1}$ oe (= 17.8...)	
		P1	for process to find area of triangle, eg $\frac{1}{2} \times 26 \times 12 \times \sin$ "36.4..." (= 92.66...) **OR** for process to find area of triangle, eg $\frac{1}{2} \times$ "17.83" $\times 12 \times \sin 120$ (= 92.66...)	
		A1	for value in the range 185 to 186	Do not award marks for answer if not supported by working.

Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)(i)	1500	B1	cao	
(ii)	No (supported)	C1	for no with reason, eg five times the original is 7500 and investment is worth between 7200 and 7300 after 12 years	
(b)(i)	490	M1	for drawing a suitable tangent at $n = 7$	Drawing a right-angled triangle is insufficient without calculation shown
		M1	for a full method to find the gradient of the tangent at $n = 7$	Use of change in y over change in x
		A1	for answer in the range 450 to 500 from correct working or ft their tangent	
(ii)	Interpretation	C1	for explanation, **Acceptable examples** the rate at which the investment grows (at $n = 7$) the amount per year that the investment increases the investment increases at £490 per year (when $n = 7$ years) **Not acceptable examples** rate of change increase in the investment interest gained	
19	Completed histogram	M1	for method which begins to use area to find frequency eg 6 babies = 30 squares, may be implied by one correct frequency 20, 30 or 12	Frequencies represented on diagram are (6), 20, 30 and 12
		M1	for method to find correct frequencies, 20, 30 and 12	
		M1	for method to find frequency for 3 – 3.5 kg, eg 100 – 6 – "20" – "30" – "12" (= 32)	
		C1	for completing histogram by drawing bar of height 64	Do not award marks for answer if not supported by working.

Question	Answer	Mark	Mark scheme	Additional guidance
20	$\dfrac{86}{110}$	P1	for start of process to find probabilities for marble taken from **B**, eg P(G after G) = $\frac{9}{11}$ or P(R after G) = $\frac{2}{11}$ or P(G after R) = $\frac{8}{11}$ or P(R after R) = $\frac{3}{11}$	May be seen marked on a tree diagram.
		P1	for $\frac{6}{10} \times \frac{9}{11}$ or $\frac{4}{10} \times \frac{8}{11}$ or $\frac{6}{10} \times \frac{2}{11}$ or $\frac{4}{10} \times \frac{3}{11}$	
		P1	for complete process, eg $\frac{6}{10} \times \frac{9}{11} + \frac{4}{10} \times \frac{8}{11}$ or $1 - \left\{\frac{6}{10} \times \frac{2}{11} + \frac{4}{10} \times \frac{3}{11}\right\}$	Either complete process scores the first 3 marks.
		A1	for $\frac{86}{110}$ oe	
21	8.5, 3.5	M1	for equation using volume, eg $4xy = 119$	Equations may not be in simplest form, eg $x \times y \times 4 = 119$
		M1	for equation using total surface area, eg $2xy + 8y + 8x = 155.5$	
		M1	for method to find equation in one variable eg $y = \frac{119}{4x}$, $8x + 8 \times \frac{119}{4x} + 2 \times x \times \frac{119}{4x} = 155.5$ **or** $x = \frac{119}{4y}$, $8 \times \frac{119}{4y} + 8y + 2 \times \frac{119}{4y} \times y = 155.5$	
		M1	for method to write equation in form ready to solve, eg $4x^2 - 48x + 119 (= 0)$ oe or $4y^2 - 48y + 119 (= 0)$	Any equivalent equation in one variable with all terms on one side acceptable
		A1	for $x = 8.5, y = 3.5$	Do not award marks for answer if not supported by working.

WEEK 6 TASK 2

Question	Answer	Mark	Mark scheme	Additional guidance
1	5220 to 6000	M1	for rounding at least two figures to 9, 10, 290, 300 or 0.5 (which could be evidenced through partial calculation)	
		M1	for correct partial calculation using 2 rounded figures eg $\dfrac{2900}{0.5}$ **or** 290×20 **or** $\dfrac{3000}{0.5}$ **or** 300×20 **or** 600×10	
		A1	for answer in the range 5220 to 6000	
2	54	P1	for start of process to find side length eg $x \times x \div 2 = 18$ ($x = 6$) **or** finds side length of square as 12 **or** for process to find area of triangle *MBC* or *NCD* eg 18×2 (= 36) **or** states that *AMN* is 1/8 of square and *MBC* (or *NCD*) is 1/4 of square	
		P1	for process to find area of square eg 18×8 **or** ("6" × 2)² **or** "36" × 4 (= 144) **or** process to find area of *MCN* as a fraction of area of square eg $1 - 1/8 - 1/4 - 1/4$ (= 3/8)	
		P1	for a complete process eg "144" – 18 – "36" – "36" **or** 3 × 18	
		A1	cao	
3 (a)	Inequality shown	M1	for drawing a line from –1 to 4 **or** for an open circle at –1 **or** for a closed circle at 4	
		A1	cao	
(b)	$y < 5.5$	M1	for clear intention to add 7 to both sides of inequality or equation or divide all terms of inequality or equation by 4 **or** $4y < 22$ **or** 5.5 oe	Award 1 mark for answer of y?5.5 where ? is an = or any incorrect inequality symbol, or for an answer shown as just 5.5
		A1	$y < 5.5$ oe as final answer	

Question	Answer	Mark	Mark scheme	Additional guidance
4	32	P1	for process to find number of red balloons eg $\frac{20}{100} \times 140$ oe (= 28)	
		P1	for process to find number of yellow balloons eg $140 \div 7 \times 2$ (= 40)	
		P1	(dep P1) for a full process to find the number of blue/green balloons eg 140 – [red balloons] – [yellow balloons] (= 72)	
		P1	(dep on previous P1) for a process to find the number of green balloons eg "72" $\div 9 \times 4$	Accept 5 + 4 for 9
		A1	cao	
5 (a)	$\frac{1}{100}$	B1	for $\frac{1}{100}$ or 0.01	
(b)	3.75×10^8	B1	cao	
(c)	0.005 82 5.82×10^{-2} 0.582×10^5 582×10^3	M1	for conversion to same format **OR** for 3 in the correct order (ignoring one)	582 000　　5.82×10^5 0.0582　　(5.82×10^{-2}) (0.00582)　　5.82×10^{-3} 58 200　　5.82×10^4
		A1	for correct order	Accept expressed in any equivalent form

Question	Answer	Mark	Mark scheme	Additional guidance
6	70	P1	for using distance = speed × time to find total distance, eg 62 × 30 **or** 62 × 30 ÷ 60 oe (= 31)	
		P1	for using time = distance ÷ speed to find time from **A** to **B**, eg 10 ÷ 50 (= 0.2) **or** 10 ÷ 50 × 60 oe (= 12)	
		P1	for a complete method eg ("31" – 10) ÷ (30 – "12") × 60 oe (= 70)	
		A1	cao	
7	300	M1	for a complete method eg 360 ÷ (100 + 20) × 100 oe **or** 360 ÷ 1.2 oe	
		A1	cao	
8 (a)	10, 2, 1, 0.5	B2	for all 4 values correct 10, (4), 2, 1, 0.5, (0.4)	
		(B1	for 2 or 3 values correct)	
(b)	Correct curve	M1	ft (dep on B1 in (a)) for plotting at least 5 points from their table correctly	
		A1	for a fully correct curve	Accept freehand curves that are not line segments
9	Yes and correct working	P1	for process to work out gradient between any relevant pair of points, eg $\frac{1-5}{1--2}(=-\frac{4}{3})$ **or** $\frac{-23-1}{19-1}(=-\frac{24}{18})$ **or** $\frac{-23-5}{19--2}(=-\frac{28}{21})$	
		P1	(dep) for process to work out gradient between another pair of points that can be used for comparison or for using their gradient to work out the equation of a line in the form $y = mx + c$ and substituting in an appropriate point	
		A1	for "Yes" and a correct explanation based on correct working	

Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	24	B1	cao	
(b)	8	M1	ft for LQ = 19 or UQ = 27	
		A1	cao	
(c)	15	P1	for a clear process to read off the cf graph at 30	Sight of 51 or 9 implies P1
		P1	for a full process to find the percentage eg (60 – "51") ÷ 60 × 100	
		A1	cao	
11	Mistake identified	C1	for identifying the mistake **Acceptable examples** She didn't square the 2 She didn't put any brackets around 2d It should start with 4, not 2 **Not acceptable examples** It should be h^2 She didn't divide both sides by 3	
12	$\dfrac{3}{22}$	M1	for 0.13636... **or** 0.1 + 0.03636... **or** (10 × 0.1$\dot{3}\dot{6}$ =) 1.$\dot{3}\dot{6}$ or 1.3636... **or** (100 × 0.1$\dot{3}\dot{6}$ =) 13.$\dot{6}\dot{3}$ or 13. 6363... **or** (1000 × 0.1$\dot{3}\dot{6}$ =) 136.$\dot{3}\dot{6}$ or 136.3636...	
		M1	for finding two correct recurring decimals that when subtracted would result in a terminating decimal or integer, eg 136.3636...– 1.3636... **or** 13. 6363... – 0.13636... **or** 136.$\dot{3}\dot{6}$ – 1.$\dot{3}\dot{6}$ **or** 13.$\dot{6}\dot{3}$ – 0.1$\dot{3}\dot{6}$ **OR** for $\dfrac{135}{990}$ or $\dfrac{13.5}{99}$	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
13	enlargement scale factor $-\dfrac{1}{2}$ centre (2, 0)	C2 (C1	for **all** of: enlargement, (scale factor =) $-\dfrac{1}{2}$ oe, (centre =) (2, 0) for **two** of enlargement, (scale factor =) $-\dfrac{1}{2}$ oe, (centre =) (2, 0)) NB: award no marks if more than one transformation is given	
14 (a)	No, with reason	C1	for No and reason **Acceptable examples** No, when r is divided by 2, m is not multiplied by 2 No, $2\times20 = 40$ but $6\times16 = 96$ No, when m is multiplied by a number r should be divided by the same number No, if r is inversely proportional to m then $m\times r$ is constant **Not acceptable examples** No, m is multiplied by 3 Yes, he is correct, when m goes up r goes down	
(b)	200, 8, 10	M1	for setting up a proportional relationship between x and y, eg $y \propto \dfrac{1}{x^2}$ **or** $y = \dfrac{k}{x^2}$ **OR** for $50 \times 2^2 (= 200)$	Condone the use of '$\propto$' instead of '=' for the first two M marks Relationship may be implied by substitution
		M1	for process to substitute at least 2 values, eg $50 = \dfrac{k}{2^2}$ $(k = 200)$ **OR** $50 \times 2^2 = y \times 1^2$ oe **or** $50 \times 2^2 = y \times 5^2$ oe **or** $50 \times 2^2 = 2 \times x^2$ oe	
		A2	for all 3 values correct	
		(A1	for 1 correct value)	1 correct value gets M2A1

Question	Answer	Mark	Mark scheme	Additional guidance
15	40	M1	for angle OAE = 90 or angle OCE = 90, may be marked on the diagram	Angle could be shown by a right-angle symbol
		M1	for using angle at centre is twice the angle at the circumference, eg reflex angle AOC = 2 × 110 (= 220) **OR** for using opposite angles of a cyclic quadrilateral, eg angle ADC = 180 – 110 (= 70)	Correct method can be implied from angles on the diagram if no ambiguity or contradiction. Reasons need not be given.
		M1	for a complete method eg 360 – 90 – 90 – (360 – "220") or 360 – 90 – 90 – (2 × "70")	
		A1	cao	
16	$12\sqrt{5}$	M1	for working unambiguously with $\sqrt{45}$, eg $\sqrt{9 \times 5}$ **or** $\sqrt{9} \times \sqrt{5}$ or $3\sqrt{5}$	This mark can be awarded whenever this is seen, which might be later in the process
		M1	for method to rationalise the denominator eg multiplying by $\dfrac{\sqrt{5}}{\sqrt{5}}$	May be seen as the first step
		A1	for $12\sqrt{5}$ accept a = 12	
17	Proof	M1	for finding expression for nth term eg $3n – 1$	May be implied by two consecutive terms
		M1	for the sum of the squares of two consecutive terms expressed algebraically, eg $(3n – 1)^2 + (3n + 2)^2$ **or** $(3n + 2)^2 + (3n + 5)^2$ **or** $(3n – 1)^2 + (3(n +1) – 1)^2$	
		A1	for correct expansion and simplification eg $9n^2 – 6n + 1 + 9n^2 + 12n + 4 = 18n^2 + 6n + 5$	
		C1	complete proof from fully correct algebra eg $18n^2 + 6n + 5 + 1 = 18n^2 + 6n + 6 = 6(3n^2 + n + 1)$	

Question	Answer	Mark	Mark scheme	Additional guidance
18	20	P1	for interpretation eg area equated to 1000 m	Expression for area need not be correct for this mark
		P1	for process to form an equation to find V eg $40 \times V + (60 - 40) \times V \div 2 = 1000$	
		A1	cao	
19	$24 + 5\pi$	P1	for process to find arc CD eg $\dfrac{40}{360} \times \pi \times 24$ oe $(= \dfrac{8}{3}\pi)$	
		P1	for process to find arc AF – arc BE eg $\dfrac{100}{360} \times \pi \times 14 - \dfrac{40}{360} \times \pi \times 14$ oe $(= \dfrac{7}{3}\pi)$	Accept process to find $AB + EF$ (assumes that logo is symmetrical)
		P1	(dep P1) for "$\dfrac{8}{3}\pi$" + "$\dfrac{7}{3}\pi$" + at least 2 from OA, OF, BC, ED **OR** for 5π	
		A1	for $24 + 5\pi$ from correct calculations	

Question	Answer	Mark	Mark scheme	Additional guidance
20 (a)	Shown	M1	for $\frac{1}{9} \times \frac{1}{8}$ $(= \frac{1}{72})$ or 9×8 $(= 72)$	
		C1	for a complete argument eg $\frac{1}{72} + \frac{1}{72} = \frac{1}{36}$	
(b)	$\frac{8}{84}$	P1	for $\frac{1}{9} \times \frac{1}{8} \times \frac{1}{7}$ $(= \frac{1}{504})$ **OR** finds that there are 8 possible lines of 3	
		P1	for process to find probability of one particular arrangement of 3 circles eg $\frac{1}{9} \times \frac{1}{8} \times \frac{1}{7} \times 6$ oe $(= \frac{1}{84})$ **OR** process to find number of different arrangements of 3 circles eg $9 \times 8 \times 7 \div 6$ $(= 84)$	
		A1	for $\frac{8}{84}$ oe	

Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	$\dfrac{4-3x}{x}$	M1	first step to change the subject of $y = \dfrac{4}{x+3}$ **or** $x = \dfrac{4}{y+3}$ eg $y(x + 3) = 4$ or $x(y + 3) = 4$	
		A1	for $\dfrac{4-3x}{x}$ oe eg $\dfrac{4}{x} - 3$	
(b)	$a > 2.5$	P1	for method to find gf(x), eg $3 \times \dfrac{4}{x+3} + 1$ oe **or** gf($2a$) eg $3 \times \dfrac{4}{2a+3} + 1$ oe	May be seen as part of an equation
		P1	for setting up equation and reducing to form $ax^2 + bx + c \ (= 0)$, eg $2a^2 + a - 15 \ (= 0)$ or $-2a^2 - a + 15 \ (= 0)$	
		P1	(dep on P2) for process to solve quadratic equation eg $(2a - 5)(a + 3) \ (= 0)$ **or** $\dfrac{-1 \pm \sqrt{1^2 - 4 \times 2 \times -15}}{2 \times 2}$	
		A1	for critical values -3, 2.5	
		A1	for any statement that a is greater than 2.5	Need not be given as an inequality statement

WEEK 6 TASK 3

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	1.25	B1		
(b)	0.0837(7972887)	M1	for 6.25 **or** 1.15 **or** 1.07238.... **or** a truncated or rounded version of 0.08377972887 to less than 4 dp	Answer must be given to at least 4 decimal places rounded or truncated
		A1	0.0837(7972887)	Accept a clear indication of the decimal point. Check first 4 decimal places only
2 (a)	0.32	M1 A1	for complete method eg $(1 - 0.16 - 0.2) \div 2 (= 0.32)$ cao	
(b)	8	M1 A1	for complete method eg $0.16 \times 50 (=8)$ cao	
3 (a)	Plots point	B1	Plots (22,46)	Allow normal tolerance
(b)	Negative	C1		
(c)	80	M1	for drawing a suitable line of best fit **or** for a line from $x = 10$ **or** for a point marked on the grid at $(10, y)$, y in the range 70 to 90	Line at $x = 10$ does not have to be full length of grid but should be in or reach the data set.
		A1	answer in the range 76 to 84	
4 (a)	8.25	P1	for working with perimeter to set an equation eg $3x - 12 + x + 4 = 38 \div 2$ or $2(3x - 12) + 2(x + 4) = 38$	
		P1	for process to isolate terms in x eg $4x = 27$	
		P1	for substituting in their value of x to find AD eg $3 \times$ "6.75" $- 12$	
		A1	8.25 oe	
(b)	No and reason	C1	Eg No because the constant terms have not been altered	

Question	Answer	Mark	Mark scheme	Additional guidance
5	See table	B3 (B2 B1	All rows correct 3 or 4 rows correct 2 rows correct)	
6	210	P1 P1 P1 P1 A1	for use of Pythagoras eg $17^2 = 15^2 + AE^2$ for process to find AE eg $\sqrt{(17^2 - 15^2)}$ $(= 8)$ for process to find length AD eg ("8" ÷ 4)× (4 + 3) (= 14) for full process to find the area "14" × 15 (= 210) cao	
7	1.07	P1 P1 A1	for conversion from pints to litres eg 0.5×0.568 (= 0.284) for full process eg "303"÷ (0.284×1000) (=1.0669..) 1.06 to 1.07	
8	153.78	M1 M1 A1	for beginning to work with percentage eg 1.025^3 (= 1.0768..) or 2000×1.025 (= 2050) for 2000×1.025^3 (= 2153.78125) oe cao	An answer of 2153.78 gains M2 A0
9	8.27	P1 P1 P1 A1	for correct use of tan eg tan 23 = $\frac{\text{opp}}{30}$ for process to find CD or CB eg CD = 30 × tan 23 (= 18.746..) for a complete process eg 30 tan 35 – 30 tan 23 (= 8.27198..) 8.27 to 8.272	

Question		Answer	Mark	Mark scheme	Additional guidance
10	(a)	Comparable figure	M1	for working with one set of options eg $17 \times 15 \times 26$ (= 6630) or $17 \times 15 \times 14$ (= 3570) **or** combining the desert and snack $26 + 14$ (=40)	
			M1	for a complete method to find figures to compare eg "6630" + "3570" (= 10200) **or** 10000 – "6630" (= 3370) **or** 10000 – "3570" (= 6430) or $17 \times 15 \times 40$ (= 10200)	
			A1	10200 **or** 3370 and 3570 **or** 6630 and 6430 **or** 200	
	(b)	Explanation	C1	for statement eg Because snacks only affects one set of options.	
11	(a)	$3x^3 + 17x^2 + 18x - 8$	M1	for a method to find the product of two linear expressions eg 3 correct terms out of 4 terms or 4 terms ignoring signs	Note that (eg) $5x - 2$ in expansion of $(x + 2)(3x - 1)$ is to be regarded as 3 correct terms.
			M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $3x^3 + 5x^2 + 20x + 12x^2 - 2x - 8$	First product must be quadratic but need not be simplified or may be simplified incorrectly
			A1	cao	
	(b)	8.5	M1	for a correct first step eg $23 - 2y = 4(y - 7)$	
			M1	for isolating terms is y eg $4y + 2y = 23 + 28$	
			A1	oe	
	(c)	2.11 and -1.11	M1	for a correct substitution into the quadratic formula	
			M1	for simplifying to the form $\frac{3 \pm \sqrt{93}}{6}$ or one correct solution eg 2.10 to 2.1073 or -1.10 to -1.1073	
			A1	2.10 to 2.1073 and -1.10 to -1.1073	
12	(a)	Correct inequalities	M1	for 2 correct equations eg $y = -2$, $y = x + 1$ or $5x + 4y = 20$	Use of any inequality signs to imply straight line relationships
			M1	for 3 correct equations eg $y = -2$ and $y = x + 1$ and $5x + 4y = 20$	

Question	Answer	Mark	Mark scheme	Additional guidance
		A1	$y \geq -2$ and $y \leq x + 1$ and $5x + 4y \leq 20$ oe	
(b)	Statement	C1	for statement eg Line drawn is not $y = x$	
13	9000	M1	for finding the scale factor of the lengths eg $\sqrt[3]{27}$ (= 3) and $\sqrt[3]{1000}$ (= 10)	
		M1	for a complete method to find the surface area of solid **B** eg $810 \div$ "3"² $\times$ "10"²	
		A1	cao	
14	$\frac{4}{5}\mathbf{p} - \frac{1}{5}\mathbf{q}$	P1	for showing $\overrightarrow{AC} = \mathbf{p} + \mathbf{q}$ or $\overrightarrow{CA} = -\mathbf{p} - \mathbf{q}$ or $-(\mathbf{p} + \mathbf{q})$	
		P1	For using ratio correctly eg $\overrightarrow{AE} = (\frac{4}{4+1})\,\overrightarrow{AC}$	
		P1	for showing a correct vector in terms of **p** and **q** eg $\mathbf{p} + (\frac{1}{4+1})(-\mathbf{p} - \mathbf{q})$ **or** $-\mathbf{q} + (\frac{4}{4+1})(\mathbf{p} + \mathbf{q})$	
		A1		
15 (a)	0.1 to 0.15	M1	draws a tangent at $t = 50$	Tangent must be seen to award marks
		M1	dep (M1) for a full method to find the gradient eg $10 \div (100 - 20)$ (= 0.125)	$6 \div 50 = 0.12$ scores no marks
		A1	0.1 to 0.15 or ft their acceptable tangent	
(b)	Description	C1	eg acceleration	
16	30.7	M1	for correct substitution into the sine rule eg $\frac{12}{\sin 130} = \frac{8}{\sin x}$	
		M1	for a complete method to find the value of x eg $\sin^{-1}(\frac{8 \sin 130}{12}) =$	

Question	Answer	Mark	Mark scheme	Additional guidance
		A1	(30.71022077....) for 30.7 - 30.73	
17	8 with statement	B1	for 576.15 or 576.25 or 576.24999...	
		B1	for 71.5 or 72.5 or 72.4999...	
		P1	for a correct process to find a bound for pressure, eg [upper bound of force] ÷ [lower bound of area] where 576.2 < [UB of force] ≤ 576.25 and 71.5 ≤ [LB of area] < 72 **or** for [lower bound of force] ÷ [upper bound of area] where 576.15 ≤ [LB of force] < 576.2 and 72< [UB of area] ≤ 72.5	
		A1	(dep on all previous marks) for 7.94(68..) **and** 8.05(9..) with both values clearly coming from working with correct values	Accept bounds truncated or rounded to at least 4 sig fig
		C1	for 8 from 7.946... and 8.059... **and** statement that both LB and UB round to 8	
18	$(2x + 3)^2 - 2$	M1 A1	for working with $(2x + b)^2$ as a first step c	
19	2.74	P1	for initial use of the formula eg $490000 = kT_2$ or $T_2 = 250000k$ oe	

Question		Answer	Mark	Mark scheme	Additional guidance
			P1	for method to find k^2 eg (k^2=) $\frac{490000}{250000}$ oe	
			P1	for setting up the relationship $T_7 = k^3 T_4$ or method to find T_4, T_5, T_6 and T_7	$T_4 = 686000$ $T_5 = 960400$ $T_6 = 1344560$, $T_7 = 1882384$
			P1	for evaluating k^3 eg $(\sqrt{\frac{490000}{250000}})^3 (= \frac{343}{125})$ **or** "1882384"÷ "686000"(=2.744)	
			A1	cao	
20	(a)	32	B1	cao	
	(b)	2.5	M1	for a complete method to work with proportion eg 20 000 × 4 α 16 **or** 2 × 4 α 16 **or** 1 square unit represents 2 frequency **and** 15 ÷ 3 = 5 and 5 ÷ "2" = 2.5	
			A1	cao	

Qu 5

Equation	Line parallel to the x-axis	Line parallel to the y-axis	Line with positive gradient	Line with negative gradient
$y = 3$	✓			
$y = 3x + 2$			✓	
$3y = x + 2$			✓	
$x = 3$		✓		
$x + 3y = 2$				✓

WEEK 6 TASK 4

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	26	M1	for listing factors of 78 and 130, at least 4 correct for each (with no more than 1 incorrect in each list), could be in factor pairs **OR** for the prime factors of 78 (2, 3, 13) **or** 130 (2, 5, 13)	Factors of 78: 1, 2, 3, 6, 13, 26, 39, 78 Factors of 130: 1, 2, 5, 10, 13, 26, 65, 130
		A1	for 26 **or** 2×13	2, 13 is not enough, it must be a product
(b)	480	M1	for listing at least 3 multiples of both 60 and 96 (with no more than 1 incorrect in each list) **OR** for the prime factors of 60 (2, 2, 3, 5) **or** 96 (2, 2, 2, 2, 2, 3)	60, 120, 180, … 96, 192, 288, …
		A1	cao	
2	130.8	P1	for process to compare cost of the same number of pencils eg £4.68 ÷ 72 (=0.065 or 6.5) or 72 × 15p (= 10.80 or 1080)	
		P1	for beginning process to find percentage profit using a box or a single pencil eg "10.80" – 4.68 (=6.12) **or** 15 – "6.5" (=8.5) **or** "10.80" ÷ 4.68 (=2.307…) "0.15" ÷ "0.065" (=2.307…)	
		P1	for full process to find percentage profit eg "6.12" ÷ 4.68 × 100 oe **or** "8.5" ÷ "6.5" × 100 oe "2.307…" × 100 – 100	
		A1	for answer in the range 130 to 131	

Question	Answer	Mark	Mark scheme	Additional guidance
3	9	P1	for process to find volume or process to work with fraction eg $\pi \times 6^2 \times 18$ (=2035.75…) **OR** $18 \div 8 \times 7$ (=15.75)	allow π to be 3.14 or better
		P1	for process to find fractional volume eg "2035.75…" $\div 8 \times 7$ (=1781.28…) **OR** $\pi \times 6^2 \times$ "15.75" (=1781.28…)	
		P1	for process to find amount of melted wax available eg 1170×15 (= 17550)	Independent mark
		P1	(dep on 1 of first 2 process marks) for process to find the number of candles that can be made eg "17550" $\div$ "1781.28…" (= 9.85…)	
		C1	cao	
4	31.50	P1	for process to find new hours worked eg 45×0.8 (=36)	
		P1	for process to find new hourly rate of pay or find weekly pay at old hourly rate eg 12.5×1.32 (=16.5) **OR** $12.5 \times$ "36" (=450)	
		P1	for full process to find difference in weekly pay eg ("36" $\times$ "16.5") – (12.5 $\times$ 45) **OR** ("450" $\times$ 1.32) – (12.5 $\times$ 45)	
		A1	for 31.50 (accept 31.5)	

Question	Answer	Mark	Mark scheme	Additional guidance
5	$15.55 \leq n <$ 15.65	B2	for $15.55 \leq n < 15.65$	
		(B1	for 15.55 **or** 15.65 **or** 15.64$\dot{9}$)	
6	3.47	M1	for finding 4 products within intervals (including end points)	
		M1	for Σ"fx" $\div$ (4 + 8 + 11 + 2) **or** (2.75×4 +3.25×8 + 3.75×11 +4.25×2) $\div$ (4 + 8 + 11 + 2) **or** ("11" + "26" + "41.25" + "8.5") $\div$ "25" **or** "86.75" $\div$ "25"	Σ"fx" **must** come from 4 products fx within intervals (including end points)
		A1	cao	
7	$\begin{pmatrix} 3 \\ -5 \end{pmatrix}$	M1	for finding 3 or −5 eg −1 − (−4) (=3) **or** −4 to −1 (=3) **or** −3 − 2 (=−5) or 2 to −3 (=−5) **or** $\begin{pmatrix} 3 \\ y \end{pmatrix}$ **or** $\begin{pmatrix} x \\ -5 \end{pmatrix}$	
		A1	cao	

For question 6, Additional guidance table:

Min fx	Max fx
10	12
24	28
38.5	44
8	9

Question		Answer	Mark	Mark scheme	Additional guidance
8		11 hours 5 mins	P1	for process to find time eg $4.75 \times 7 \div 3$ (=11.083…)	
			P1	for complete process eg "11.083…" $\times 60$ (=665) **or** "0.083…" $\times 60$ (=5)	
			A1	cao	
9	(a)	1.5, 6.25	B1	accept 6.2 to 6.3 for 6.25	Brackets are given on the answer line, ignore any extra brackets
	(b)	−1.4 and 4.4	B2	for $x = -1.35$ to -1.4 and $x = 4.35$ to 4.4	
			(B1	for one correct solution in the given range)	
10		5.8	P1	for y^6 oe or $3493.62 \div 5000$ (=0.698…)	eg where $y = 1 - (x \div 100)^6$
			P1	for a process to find $1 - (x \div 100)$ eg $\sqrt[6]{(3493.62 \div 5000)}$ or 0.942…	
			A1	for 5.8	Accept 5.7 – 5.8
11		Yes supported	M1	for method to find comparative figures eg $18 \div 12$ (=1.5) **and** $22.5 \div 15$ (=1.5) **OR** $12 \div 18$ (=0.66…) **and** $15 \div 22.5$ (=0.66..)	
			C1	for correct conclusion with 2 correct comparative figures **and** statement that angle P is common	

Question	Answer	Mark	Mark scheme	Additional guidance
12 (a)	11.5	M1	for evidence of using the LQ (35) **and** UQ (46.5) eg 46.5 – 35	
		A1	cao	
(b)	Yes and reason	C1	for a correct comparative statement eg Yes because all measures except the shortest/minimum distance for the male athletes are higher than values for the females **or** Yes because median for males is higher	
(c)	45	M1	for a method to find ¾ of 60	
		A1	cao	
13	$3n^2 + 7$	M1	begins to work with second differences	9 15 21 27 33 $\quad$ 6 6 6 6
		M1	identifies $3n^2$ as part of the expression, eg gives the sequence 3, 12, 27, 48, … or gives a quadratic expression which includes the term $3n^2$	A quadratic expression of the form $3n^2 + bn + c$ can be awarded the first 2 marks
		A1	for $3n^2 + 7$ oe	
14	$\dfrac{2x - 6}{x - 8}$	M1	for factorising the denominator $(x + 8)(x – 8)$	
		M1	for factorising the numerator, eg $(2x \pm 6)(x \pm 8)$ or $2(x \pm 3)(x \pm 8)$	
		A1	for $\dfrac{2x - 6}{x - 8}$ oe	

Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	31.5	M1	for $\frac{1}{2} \times 12.3 \times 5.6 \times \sin 114$	
		A1	for area in the range 31.4 to 31.5	
(b)	15.4	M1	for correct substitution, eg $(AC^2 =) 5.6^2 + 12.3^2 - 2 \times 5.6 \times 12.3 \times \cos114$	
		M1	for correct order of operations, eg $(AC =) \sqrt{182.65 - (-56.03\ldots)}$ or $(AC^2 =)$ 238.68204	
		A1	for AC in the range 15.4 – 15.5	
16 (a)	Shown	C1	for correct algebraic rearrangement	
(b)	2.856	M1	for substitution of 3 into formula, eg $\sqrt[3]{9 + 5 \times 3}$ (= 2.8844991…)	$x_1 = 2.8844991\ldots$ $x_2 = 2.8611747\ldots$ $x_3 = 2.85641824\ldots$
		M1	for a substitution of x_1 to give x_2 (= 2.8611747…)	Accept an accuracy of 2dp or more rounded or truncated for values of x_1 and x_2
		A1	for answer in the range 2.856 to 2.86	

Question	Answer	Mark	Mark scheme	Additional guidance
17	1610	M1	for splitting the area into strips and correct process to find the area of one strip, eg $\dfrac{10 \times 12}{2}$ (=60) **or** $\dfrac{(12 + 30)}{2} \times 10$ (=210) **or** $\dfrac{(30 + 60)}{2} \times 10$ (=450) **or** $\dfrac{(60 + 118)}{2} \times 10$ (= 890)	Strips may be rectangluar
		M1	for complete process using at least 4 strips to find the area under the curve, eg "60" + "210" + "450" + "890" (= 1610)	Allow one error in the reading of speeds
		A1	for answer in the range 1605 to 1615 from correct working using at least 4 strips	

Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	Yes supported	P1	for process to find the surface area of the hemisphere, eg $4 \times \pi \times 3.2^2 \div 2$ (=64.33…)	
		P1	for process to find the curved surface area of the cone, eg $\pi \times 1.1 \times 8$ (27.64…)	
		P1	for process to consider area of circular face needing to be painted, eg $\pi \times 3.2^2 - \pi \times 1.1^2$ (=28.36…) **OR** for process to use coverage with one or more relevant area eg "64.33…" ÷ 8.5 (=7.56…) **OR** for process to work with coverage of 15 tins eg 8.5×15 (=127.5)	
		P1	for process to use coverage, eg ("64.33…" + "27.64…" + "28.36…") ÷ 8.5 (=14.159…) **OR** ("64.33…" + "27.64…" + "28.36…" (=120.35..) **and** 8.5×15 (=127.5)	May be seen as each area ÷ 8.5 then combined 120.2934 using 3.14 for π
		C1	for conclusion "Yes" supported by accurate figures eg 14.1(59…) rounds to 15 **OR** 120(.35...) < 127.5	14.152… using 3.14 for π
(b)	Explanation	C1	for valid explanation eg will increase the number of tins needed or Callum will not have enough tins of paint	

Question	Answer	Mark	Mark scheme	Additional guidance
19	$\dfrac{28}{67}$	P1	for start to process information, eg draws Venn diagram and shows at least 1 unknown amount, eg 20 like cycling and swimming but not running	See Venn diagram at end of mark scheme – rectangle not needed
		P1	for process to find at least 3 unknown amounts from eg 20 like cycling and swimming but not running 12 like running and cycling but not swimming 88 like running only 0 like cycling only	
		P1	for complete process to find the number of people who only like swimming (=23)	
		P1	for process to work with probability, eg $\dfrac{8 + "20"}{b}$ where $b > a$ **or** $\dfrac{a}{16 + 8 + "20" + "23"}$ where $a < b$ oe	
		A1	for $\dfrac{28}{67}$ oe	eg 0.41(79…) or 41(.79…)%

Question	Answer	Mark	Mark scheme	Additional guidance
20	26.9	P1	for $BE = \sqrt{5.3^2 - 4.5^2}$ or $\sqrt{7.84}$ or $BE = 2.8$ **OR** finding the length $MA = \frac{2}{5} \times 8$ (=3.2) **or** $DM = \frac{3}{5} \times 8$ (=4.8) **OR** showing the required angle on a diagram eg with an arc	Check diagram for working
		P1	for, eg $MB = \sqrt{4.5^2 + "3.2"^2}$ or $\sqrt{30.49}$ or 5.5(2...) **OR** $ME = \sqrt{"3.2"^2 + 5.3^2}$ or $\sqrt{38.33}$ or 6.1(9…)	
		P1	for using appropriate trigonometry ratio to set up an equation in angle EMB eg tan θ = "2.8" ÷ "5.5(2...)" **or** cos θ = "5.5(2...)" ÷ "6.1(9…)" **or** sin θ = "2.8" ÷ "6.1(9…)"	
		A1	for answer in the range 26.8 to 27	If an answer is shown in the range in working and then incorrectly rounded award full marks.

Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	Sketch	B1	for appropriate sketch showing $y=\text{f}(x)$ reflected in the x-axis	

(b)	Circle radius 3 centre $(-2, 0)$ and $(-5, 0)$ and $(1, 0)$ labelled	M1	for 1 of
			    centre $(-2, 0)$ implied by drawing or label
			  or a circle of radius 3
			  or intersection on the x-axis at -5 or 1 implied by drawing or labels	

		M1	for 2 of
			    centre $(-2, 0)$ implied by drawing or label
			  or a circle of radius 3
			  or intersection on the x-axis at -5 or 1 implied by drawing or labels	

		A1	for a fully correct answer	
(c)	$y = \dfrac{4}{3}x - 25$	M1	for method to find gradient of OP, eg $-9 \div 12$ $\left(= -\dfrac{3}{4}\text{ or } -0.75\right)$ oe	
		M1	(dep) for method to find gradient of tangent, m, eg $-\dfrac{9}{12} \times m = -1$ or $m = \dfrac{4}{3}$ or $1.33\ldots$	
		A1	for $y - (-9) = \dfrac{4}{3}(x - 12)$ **or** $y + 9 = \dfrac{4}{3}(x - 12)$ oe	$12x - 9y = 225$ $4x - 3y = 75$

Q19

ℰ

running

cycling

88 **12** **0**

(8)

(16) **20**

23

(33)

swimming