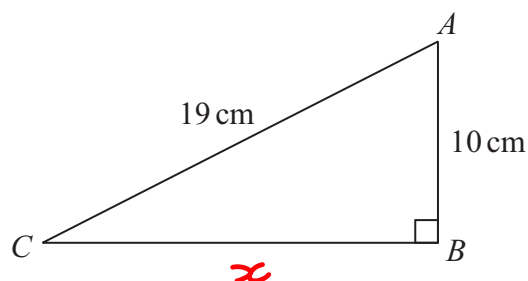




- 1 ABC is a right-angled triangle.



Work out the length of CB .

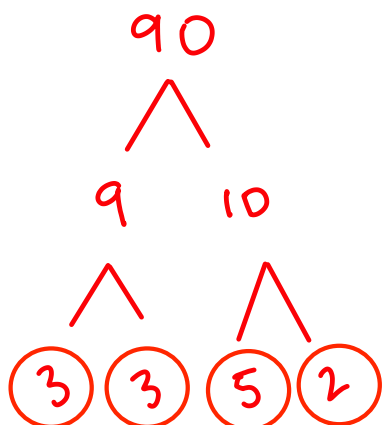
Give your answer correct to 3 significant figures.

$$19^2 - 10^2 = 261$$
$$\sqrt{261} = 16.155\dots$$

..... 16.2 cm

(Total for Question 1 is 2 marks)

- 2 (a) Write 90 as a product of its prime factors.



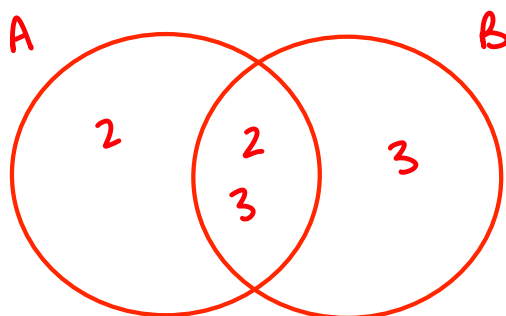
$$2 \times 3^2 \times 5$$

(2)

$$A = 2^2 \times 3$$

$$B = 2 \times 3^2$$

- (b) Write down the lowest common multiple (LCM) of A and B .



$$36$$

(1)

(Total for Question 2 is 3 marks)

$$LCM = 2 \times 2 \times 3 \times 3$$

- 3 The number of hours, H , that some machines take to make 5000 bottles is given by

$$H = \frac{72}{n} \quad \text{where } \underline{n \text{ is the number of machines.}}$$

On Monday, 6 machines made 5000 bottles.

On Tuesday, 9 machines made 5000 bottles.

The machines took more time to make the bottles on Monday than on Tuesday.

How much more time?

Monday : $H = \frac{72}{6} = 12 \text{ hours}$

Tuesday : $H = \frac{72}{9} = 8 \text{ hours}$

4 hours

(Total for Question 3 is 2 marks)

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- 4 There are only red discs, blue discs and yellow discs in a bag.
There are 24 yellow discs in the bag.

Mel is going to take at random a disc from the bag.

The probability that the disc will be yellow is 0.16 = 16 %.

the number of red discs : the number of blue discs = 5 : 4 = 84 %.

Work out the number of red discs in the bag.

$$\begin{array}{lcl}
 \div 16 & 16 \% = 24 & \div 6 \\
 \downarrow & & \downarrow \\
 & 1 \% = 1.5 & \\
 \downarrow \times 100 & & \downarrow \times 100 \\
 & 100 \% = 150 &
 \end{array}$$

150 discs in total

Yellow = 24

Red + Blue = 126

$$126 \div 9 = 14 \text{ (1 part)}$$

$$\begin{array}{lcl}
 & R : B & \\
 \times 14 & 5 : 4 & \times 14 \\
 \downarrow & & \downarrow \\
 & 70 : 56 &
 \end{array}$$

70

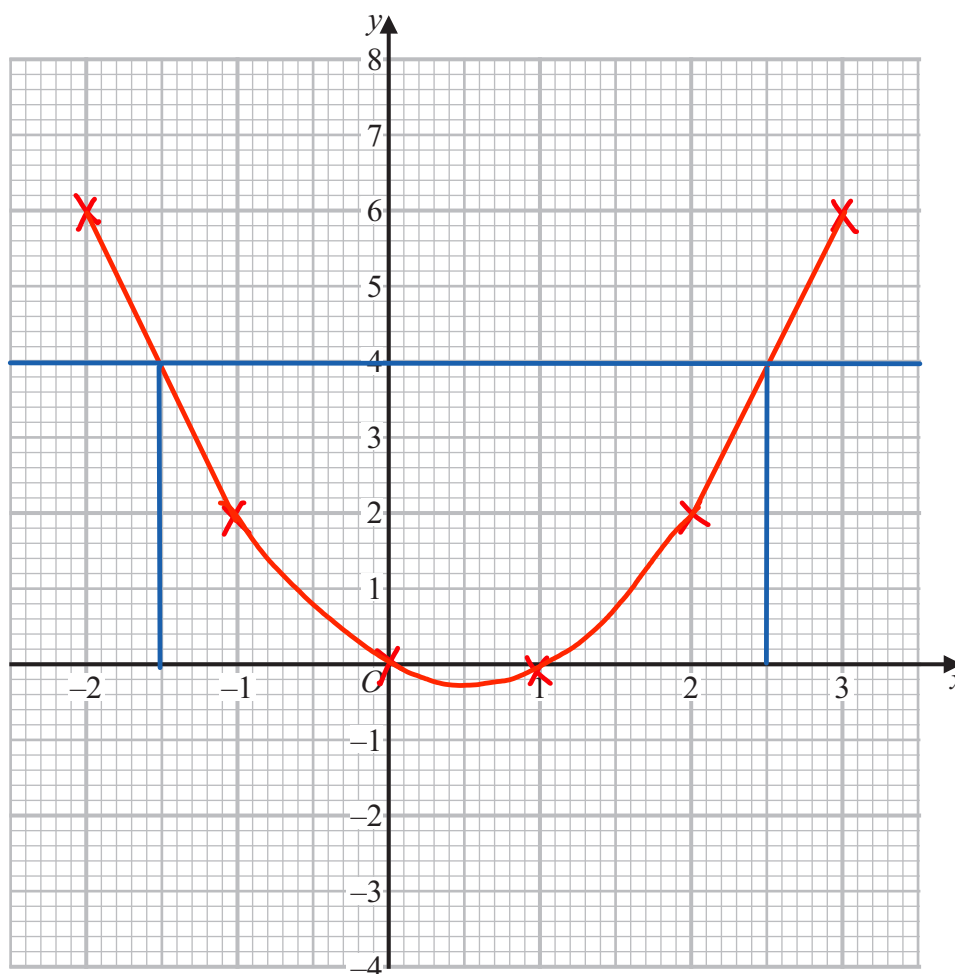
(Total for Question 4 is 4 marks)

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

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

(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 $x^2 - x = 4$

-1.5 and 2.5
 (-1.7 to -1.5 and 2.5 to 2.7)

(Total for Question 5 is 6 marks)



- 6 Andy, Luke and Tina share some sweets in the ratio 1:6:14

Tina gives $\frac{3}{7}$ of her sweets to Andy.

Tina then gives $12\frac{1}{2}\%$ of the rest of her sweets to Luke.

Tina says,

“Now all three of us have the same number of sweets.”

Is Tina correct?

You must show how you get your answer.

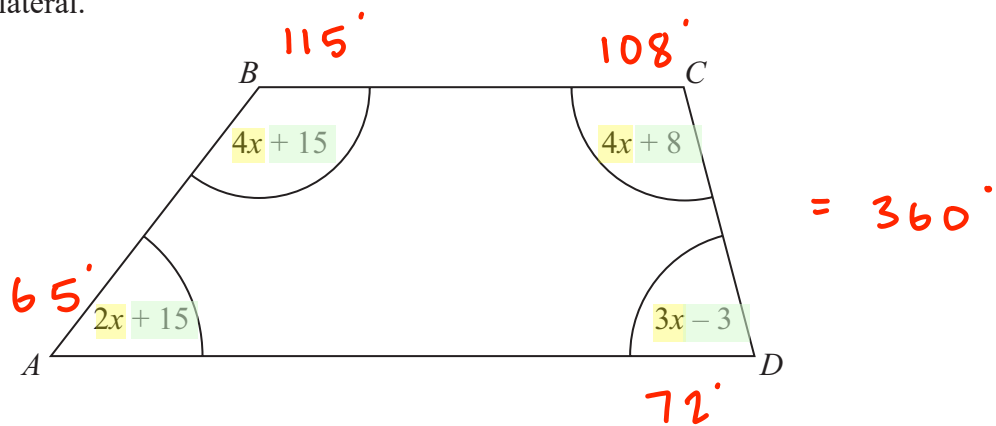
$$\frac{3}{7} \text{ of } 14 = 6 \rightarrow \begin{array}{ccc} A & : & L & : & T \\ 7 & : & 6 & : & 8 \end{array}$$

$$12.5\% \text{ of } 8 = 1 \rightarrow \begin{array}{ccc} A & : & L & : & T \\ 7 & : & 7 & : & 7 \end{array}$$

yes!

(Total for Question 6 is 4 marks)

7 $ABCD$ is a quadrilateral.



All angles are measured in degrees.

Show that $ABCD$ is a trapezium.

$$\begin{array}{r|l}
 13x + 35 & = 360 \\
 - 35 & - 35 \\
 \hline
 13x & = 325 \\
 \div 13 & \div 13 \\
 \hline
 x & = 25
 \end{array}$$

AD and BC are parallel:

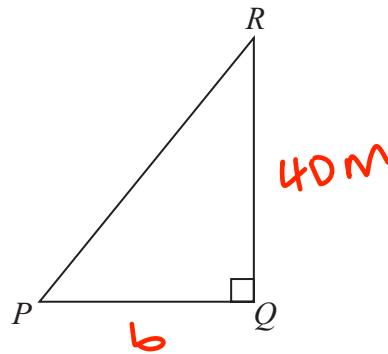
$$115^\circ + 65^\circ = 180^\circ$$

So $\angle ABC$ and $\angle BAD$ are co-interior angles.

Therefore $ABCD$ is a Trapezium

(Total for Question 7 is 4 marks)

- 8 A playground is in the shape of a right-angled triangle.



Dan makes a scale drawing of the playground.

He uses a scale of 1 cm represents 5 m

The area of the playground on the scale drawing is 28 cm^2

The real length of QR is 40 m

Work out the real length of PQ .

$$1 \text{ cm} = 5 \text{ m}$$

$$LSF = 5$$

$$ASF = 5^2 = 25$$

$$28 \times 25 = 700 \text{ cm}^2$$

35

..... m

(Total for Question 8 is 3 marks)

$$\begin{array}{r|l}
 \begin{array}{r}
 b \times 40 \\
 \hline
 2 \\
 \times 2 \\
 \hline
 b \times 40 \\
 \div 40 \\
 \hline
 b
 \end{array}
 &
 \begin{array}{l}
 = 700 \\
 \\
 \times 2 \\
 = 1400 \\
 \div 40 \\
 = 35
 \end{array}
 \end{array}$$

- 9 A number N is rounded to 2 significant figures.
The result is 7.3

(a) Write down the least possible value of N .

7.25

(1)

Leila says,

“The value of N cannot be greater than 7.349 because 7.350 would round up to 7.4”

(b) Is Leila correct?

You must give a reason for your answer.

No, the greatest value of N
is 7.349

(1)

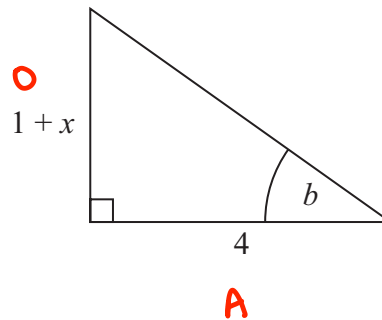
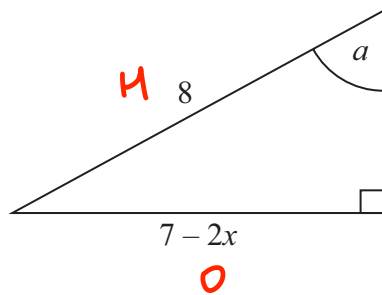
(Total for Question 9 is 2 marks)

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10 The diagram shows two right-angled triangles.



All lengths are measured in centimetres.

Given that

$$\sin a = \tan b$$

work out the value of x .

S O H C A M T O A

$$\frac{7-2x}{8} = \frac{1+x}{4}$$

$$\frac{7-2x}{8} = \frac{2+2x}{8} \quad \text{--- } \times 2$$

$$x = 1.25$$

(Total for Question 10 is 3 marks)

$$\begin{array}{r|l} 7-2x & = \\ +2x & +2x \\ \hline 7 & = 2+4x \\ -2 & -2 \\ \hline 5 & = 4x \\ \div 4 & \div 4 \\ 1.25 & = x \end{array}$$

11 The frequency table gives information about the weights of 60 parcels.

Weight (w kg)	Frequency
$0 < w \leq 2$	7
$2 < w \leq 4$	21
$4 < w \leq 6$	15
$6 < w \leq 8$	11
$8 < w \leq 10$	6

(a) Complete the cumulative frequency table.

Weight (w kg)	Cumulative frequency
$0 < w \leq 2$	7
$0 < w \leq 4$	28
$0 < w \leq 6$	43
$0 < w \leq 8$	54
$0 < w \leq 10$	60

(1)

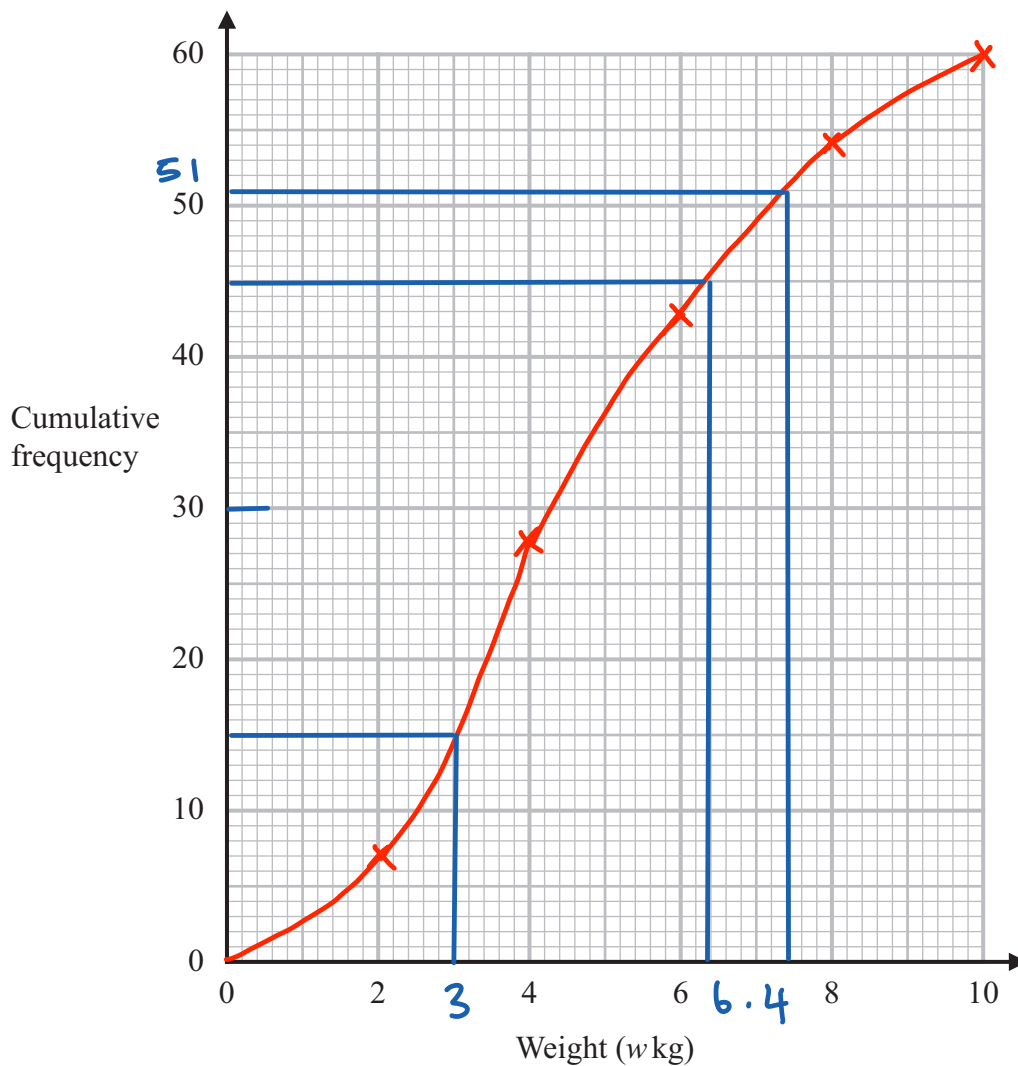
(b) On the grid opposite, draw a cumulative frequency graph for your table.

(2)

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- (c) Use your graph to find an estimate for the interquartile range.

$$6.4 - 3$$

$$\frac{(3.4 - 4)^{(2)}}{3.4} \text{ kg}$$

- (d) Use your graph to find an estimate for the number of these parcels with a weight greater than 7.4 kg.

$$60 - 51$$

$$\frac{9}{(7-10)^{(2)}}$$

(Total for Question 11 is 7 marks)

12 f is inversely proportional to d^2

$$f = 3.5 \text{ when } d = 8$$

(a) Find an equation for f in terms of d .

$$\begin{array}{lcl} f & = & \frac{k}{d^2} \\ 3.5 & = & \frac{k}{8^2} \\ \times 8^2 & & \times 8^2 \\ 224 & = & k \end{array}$$

$$f = \frac{224}{d^2} \quad (2)$$

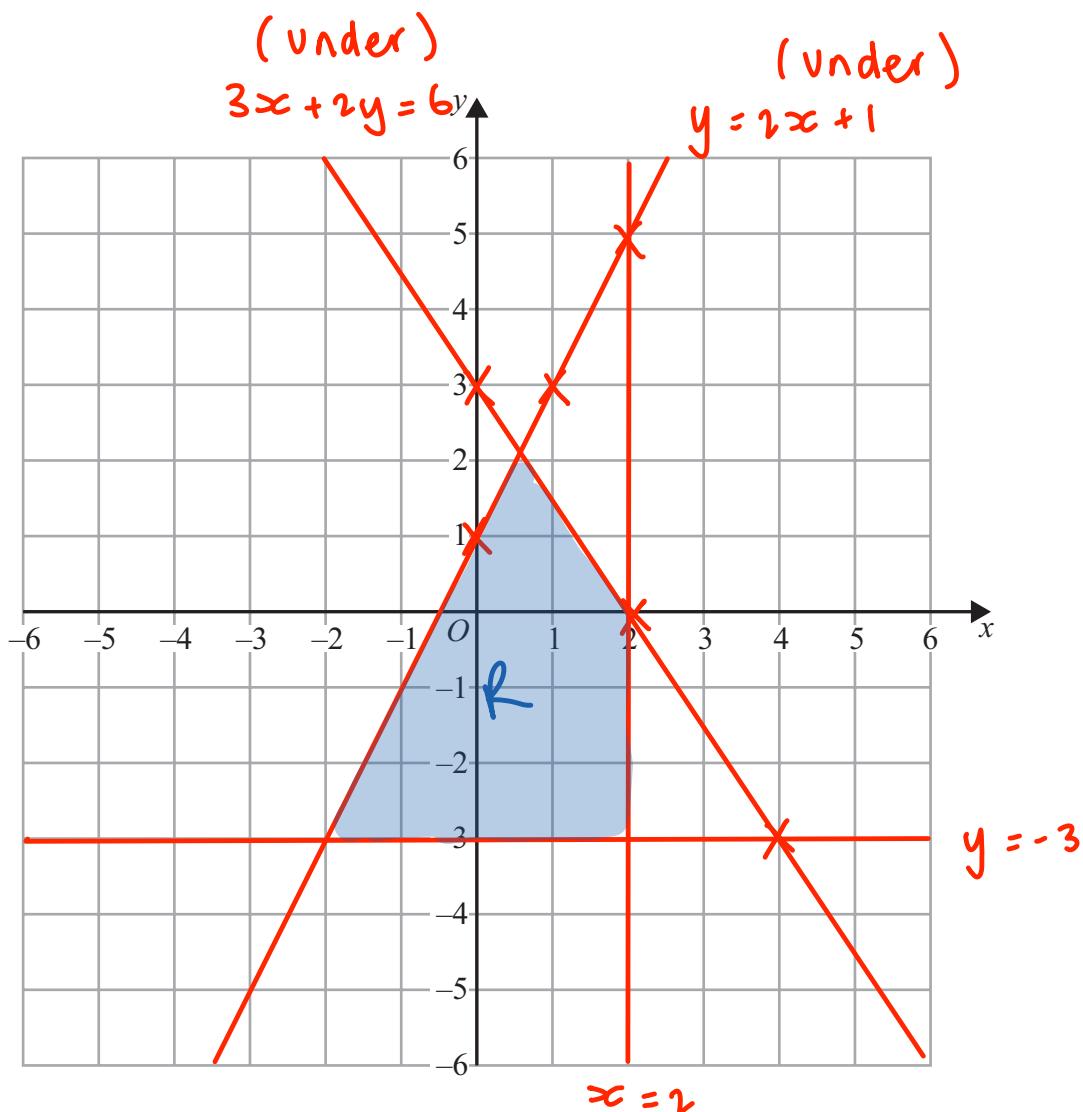
(b) Find the positive value of d when $f = 10$
Give your answer correct to 3 significant figures.

$$\begin{array}{lcl} 10 & = & \frac{224}{d^2} \\ \times d^2 & & \times d^2 \\ 10d^2 & = & 224 \\ \div 10 & & \div 10 \\ d^2 & = & 22.4 \\ \sqrt{} & & \sqrt{} \\ d & = & \pm 4.73 \end{array}$$

$$d = 4.73 \quad (2)$$

(Total for Question 12 is 4 marks)

13



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

$$x \leq 2$$

$$y \geq -3$$

$$y \leq 2x + 1$$

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

Label the region **R**.

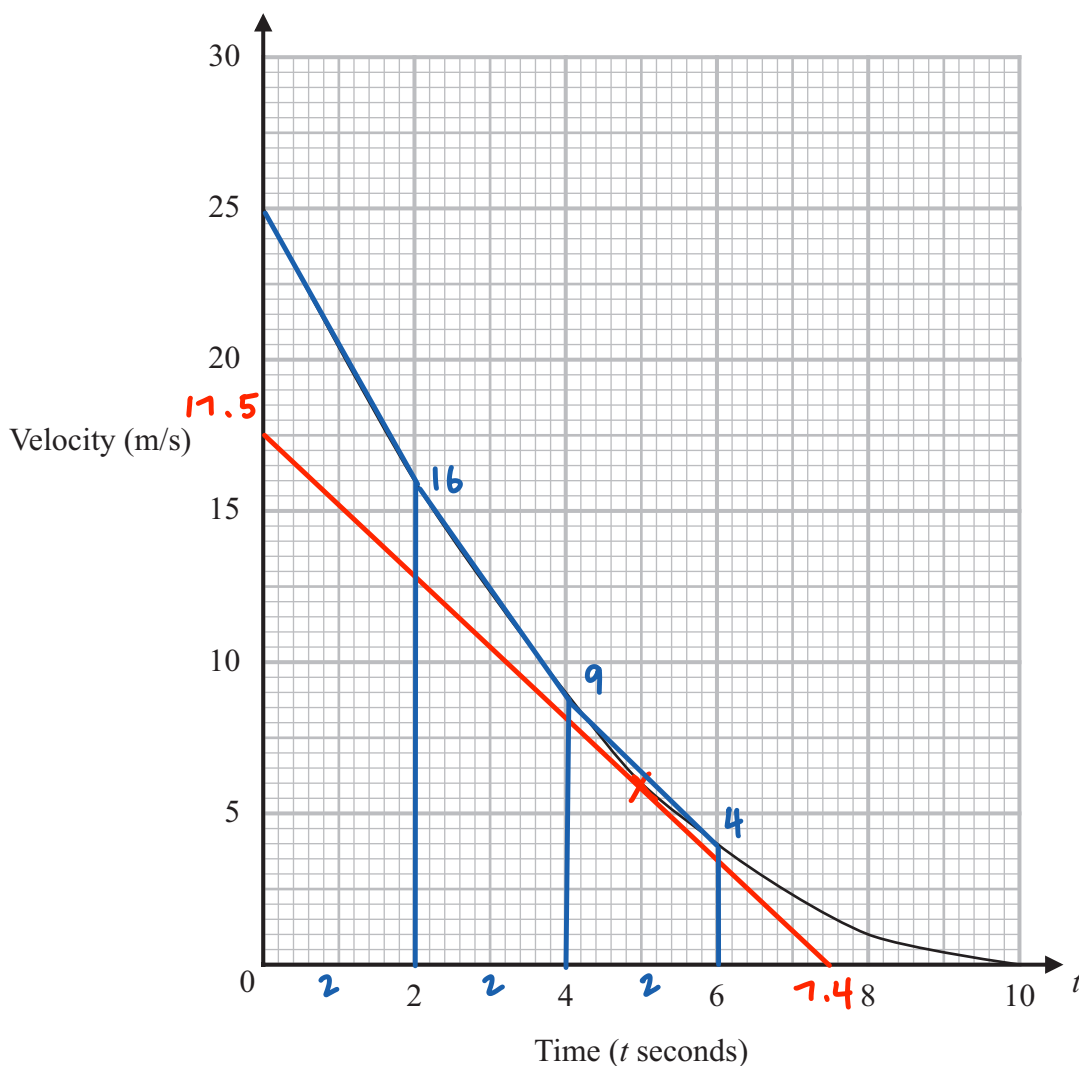
$$\begin{array}{c|ccc} x & 0 & 1 & 2 \\ \hline y & 1 & 3 & 5 \end{array}$$

$$\begin{aligned} 2y &\leq 6 - 3x \\ y &\leq \frac{6 - 3x}{2} \end{aligned}$$

$$\begin{array}{c|ccc} x & 0 & 2 & 4 \\ \hline y & 3 & 0 & -3 \end{array}$$

(Total for Question 13 is 3 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.

$$\text{Gradient} = \frac{\text{rise}}{\text{run}}$$

$$\frac{17.5}{7.4}$$

$$\frac{-2.36}{(3)} \text{ m/s}^2$$

negative gradient
 $\uparrow$ $(-2 \text{ to } -2.8)$

- (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.

$$\frac{1}{2}(25 + 16) \times 2 = 41$$

$$\frac{1}{2}(16 + 9) \times 2 = 25$$

$$\frac{1}{2}(9 + 4) \times 2 = 13$$

79

..... m

78 or 79⁽³⁾

(Total for Question 14 is 6 marks)

$$41 + 25 + 13 = 79$$



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

$$\frac{1}{(\sqrt{a} + 1)} \times \frac{\sqrt{a} - 1}{(\sqrt{a} - 1)}$$

$$= \frac{\sqrt{a} - 1}{a - \sqrt{a} + \sqrt{a} - 1}$$

$$\frac{\sqrt{a} - 1}{a - 1}$$

(Total for Question 15 is 2 marks)

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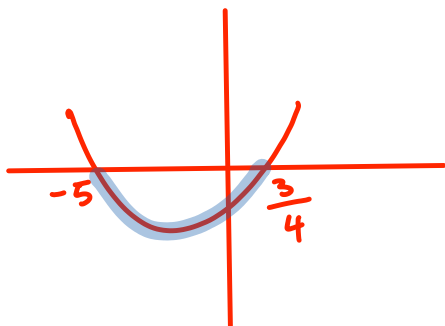
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16 Solve $(4x - 3)(x + 5) < 0$

$$x = \frac{3}{4} \quad \text{or} \quad x = -5$$



$$-5 < x < \frac{3}{4}$$

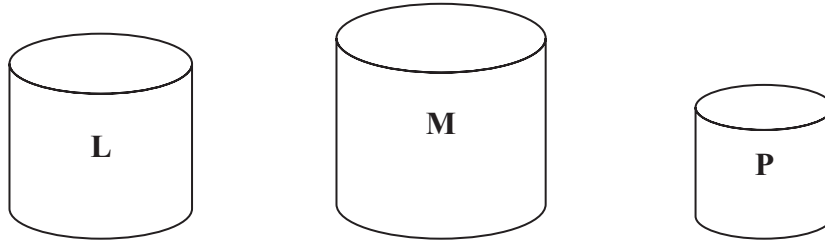
(Total for Question 16 is 2 marks)

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17 L, M and P are three similar solid cylinders made from the same material.



L has a mass of 64 g

M has a mass of 125 g

M has a total surface area of 144 cm^2

P has a total surface area of 16 cm^2

Work out

height of cylinder L : height of cylinder M : height of cylinder P = L S F

$$\begin{array}{l} \text{L} \\ \text{A} \\ \checkmark \end{array} \quad \begin{array}{l} \underline{L : M} \\ 4 : 5 \\ 16 : 25 \\ 64 : 125 \end{array}$$

$$\begin{array}{l} \text{L} \\ \text{A} \\ \checkmark \end{array} \quad \begin{array}{l} \underline{m : P} \\ 12 : 4 \\ 144 : 16 \end{array}$$

$$\begin{array}{cc} L : m & m : P \\ \begin{array}{l} 4 : 5 \\ \times 12 \downarrow \\ 48 : 60 \end{array} & \begin{array}{l} 12 : 4 \\ \times 5 \downarrow \\ 60 : 20 \end{array} \end{array}$$

$$48 : 60 : 20$$

(Total for Question 17 is 4 marks)

- 18 There are only 4 red counters, 3 yellow counters and 1 green counter in a bag.

Tony takes at random three counters from the bag.

$$\text{Total} = 8$$

Work out the probability that there are now more yellow counters than red counters in the bag.

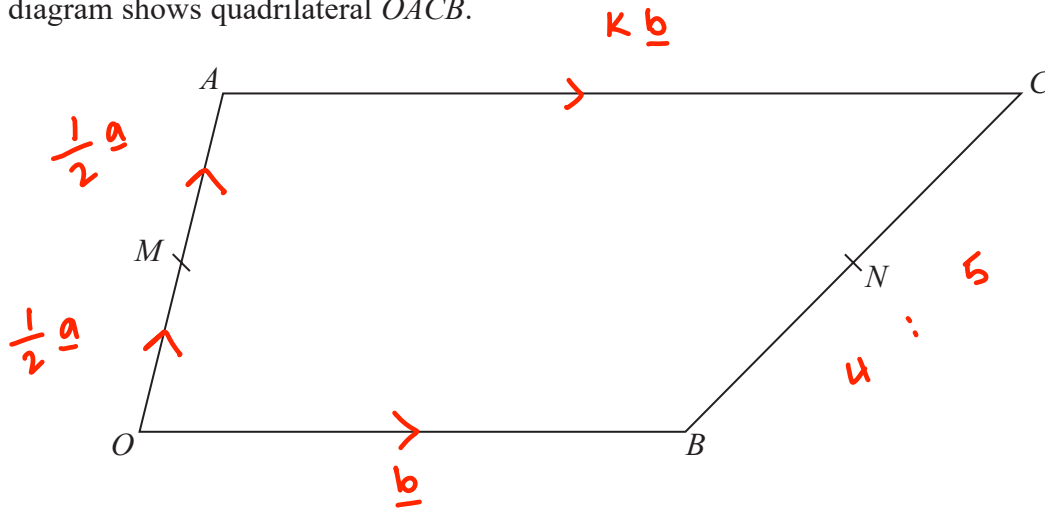
You must show all your working.

$$\begin{aligned}
 R, R, G &= \frac{4}{8} \times \frac{3}{7} \times \frac{1}{6} = \frac{1}{28} \\
 R, G, R &= \frac{4}{8} \times \frac{1}{7} \times \frac{3}{6} = \frac{1}{28} \\
 G, R, R &= \frac{1}{8} \times \frac{4}{7} \times \frac{3}{6} = \frac{1}{28} \\
 R, R, R &= \frac{4}{8} \times \frac{3}{7} \times \frac{2}{6} = \frac{1}{14}
 \end{aligned}
 \left. \vphantom{\begin{aligned} R, R, G \\ R, G, R \\ G, R, R \\ R, R, R \end{aligned}} \right\} \frac{5}{28}$$

$$\frac{5}{28}$$

(Total for Question 18 is 5 marks)

19 The diagram shows quadrilateral $OACB$.



M is the midpoint of OA .

N is the point on BC such that $BN:NC = 4:5$

$\vec{OA} = \mathbf{a}$ $\vec{OB} = \mathbf{b}$ $\vec{AC} = k\mathbf{b}$ where k is a positive integer.

- (a) Express $\vec{MN}$ in terms of k , $\mathbf{a}$ and $\mathbf{b}$.
Give your answer in its simplest form.

$$\vec{MN} = \vec{MO} + \vec{OB} + \vec{BN}$$

$$\vec{BC} = -\mathbf{b} + \mathbf{a} + k\mathbf{b}$$

$$\vec{BN} = \frac{4}{9}(-\mathbf{b} + \mathbf{a} + k\mathbf{b}) = -\frac{4}{9}\mathbf{b} + \frac{4}{9}\mathbf{a} + \frac{4}{9}k\mathbf{b}$$

$$\vec{MN} = -\frac{1}{2}\mathbf{a} + \mathbf{b} - \frac{4}{9}\mathbf{b} + \frac{4}{9}\mathbf{a} + \frac{4}{9}k\mathbf{b}$$

$$= -\frac{1}{18}\mathbf{a} + \frac{5}{9}\mathbf{b} + \frac{4}{9}k\mathbf{b}$$

$$= -\frac{1}{18}\mathbf{a} + \left(\frac{5}{9} + \frac{4}{9}k\right)\mathbf{b}$$

(4)

- (b) Is MN parallel to OB ?
Give a reason for your answer.

NO, $\vec{MN}$ is not a multiple of $\mathbf{b}$ ($\vec{OB}$)

(1)

(Total for Question 19 is 5 marks)

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

Find the coordinates of the turning point on C.

Tip: If you are asked to find the turning point you have to complete the square

$$\begin{aligned}y &= 2x^2 - 12x + 7 \\&= 2 \left[x^2 - 6x + \frac{7}{2} \right] \\&= 2 \left[(x-3)^2 - 9 + \frac{7}{2} \right] \\&= 2 \left[(x-3)^2 - \frac{11}{2} \right] \\&= 2(x-3)^2 - 11\end{aligned}$$

(3 , -11)

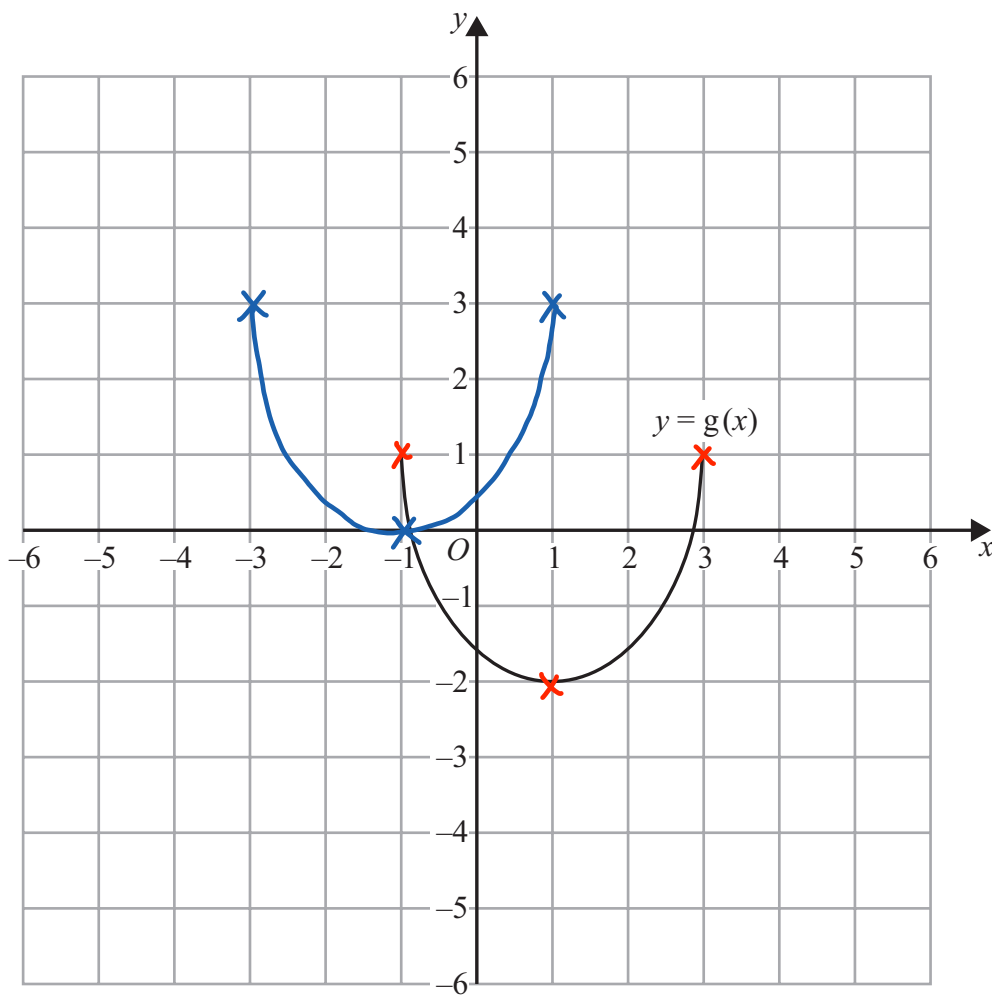
(Total for Question 20 is 3 marks)

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



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

change the sign of x coordinates
add 2 to y coordinates

(Total for Question 21 is 2 marks)

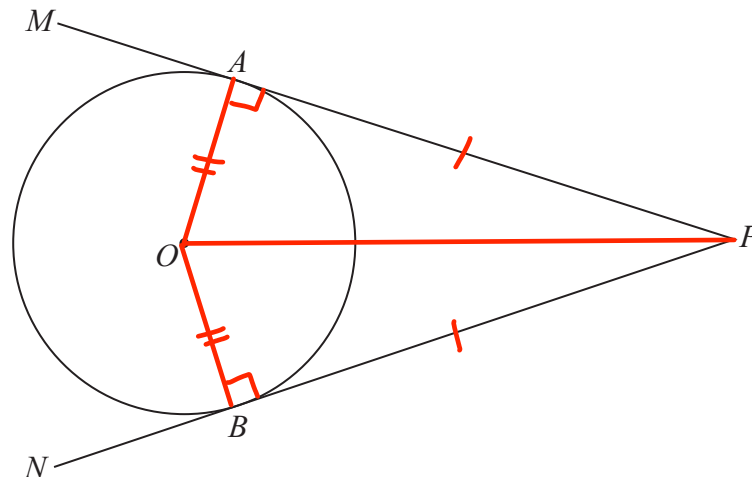
$$(-1, 1) \rightarrow (1, 3)$$

$$(1, -2) \rightarrow (-1, 0)$$

Turn over for Question 22

$$(3, 1) \rightarrow (-3, 3)$$

22 A and B are points on a circle, centre O .



MAP and NBP are tangents to the circle.

Prove that $AP = BP$

Tangent meets the radius at 90°
 $\angle OAP = 90^\circ$
 $\angle OBP = 90^\circ$

$OA = OB$ as both the radius
 Triangle OAP and OBP share OP

Therefore congruent triangles
 using SAS

So AP must be the same
 length as BP

$$AP = BP$$

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS