



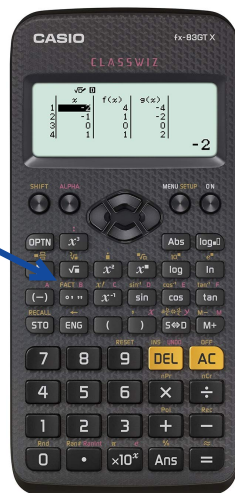
- 1 (a) Write 84 as a product of its prime factors.

Tip: You can use your calculator to write a number as the product of its prime factors

Step 1: put 84 into your calculator and press the equals button

Step 2: Tap Shift

Step 3: Tap the 'FACT' Button



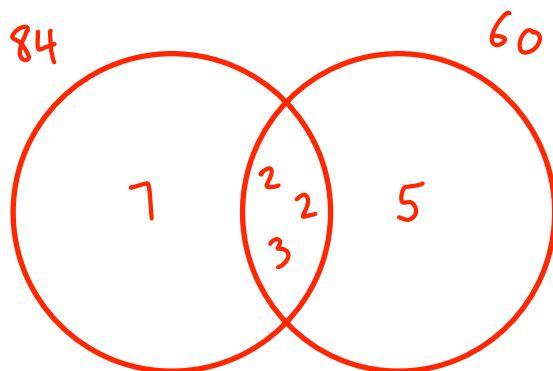
$$2^2 \times 3 \times 7$$

(2)

- (b) Find the lowest common multiple (LCM) of 60 and 84

$$84 = 2 \times 2 \times 3 \times 7$$

$$60 = 2 \times 2 \times 3 \times 5$$



$$\text{LCM} = 7 \times 2 \times 2 \times 3 \times 5 = 420$$

$$420$$

(2)

(Total for Question 1 is 4 marks)

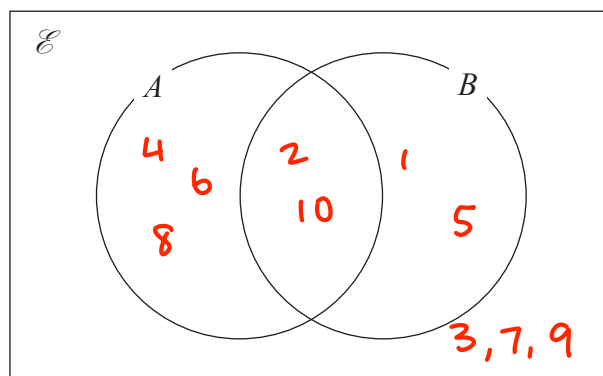


2 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{\text{even numbers}\}$

$B = \{\text{factors of 10}\}$

(a) Complete the Venn diagram for this information.



(3)

A number is chosen at random from the universal set, $\mathcal{E}$

(b) Find the probability that this number is in the set $A \cap B$

$$\frac{2}{10}$$

(2)

(Total for Question 2 is 5 marks)

- 3 Carlo puts tins into small boxes and into large boxes.

He puts 6 tins into each small box.

He puts 20 tins into each large box.

Carlo puts a total of 3000 tins into the boxes so that

number of tins in small boxes : number of tins in large boxes = 2 : 3

Carlo says that less than 30% of the boxes filled with tins are large boxes.

Is Carlo correct?

You must show all your working.

$$3000 \div 5 = 600 \text{ (1 part)}$$

Small box : Large box
(tins) (tins)

$$1200 : 1800$$

$$1200 \div 6 = 200 \text{ small boxes}$$

$$1800 \div 20 = 90 \text{ large boxes}$$

$$200 + 90 = 290 \text{ boxes}$$

$$30\% \text{ of } 290 = 87 < 90$$

NO, more than 30% are large boxes

(Total for Question 3 is 5 marks)

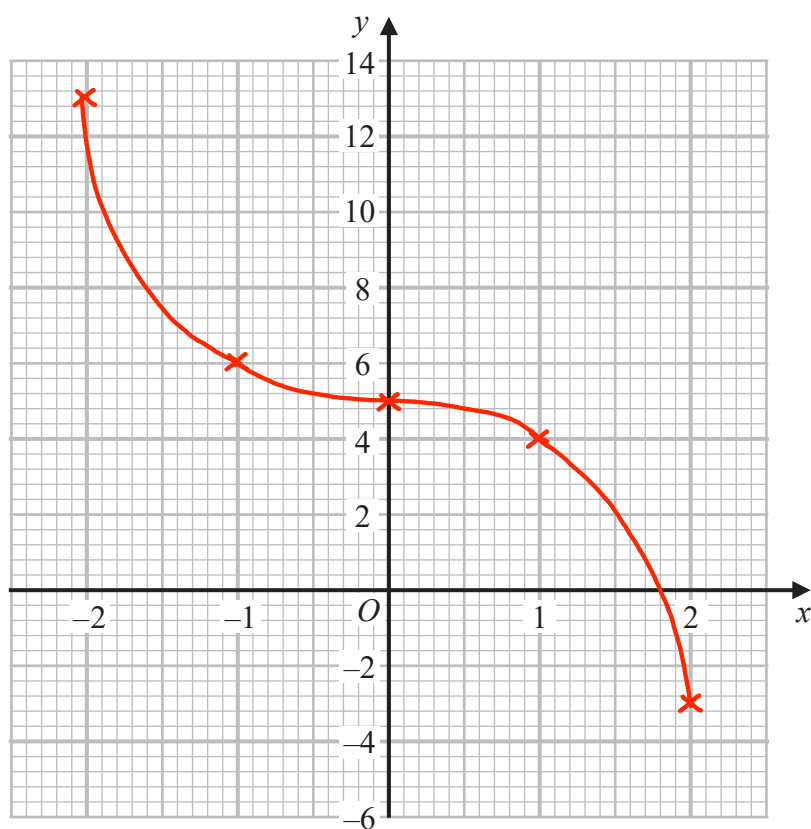


- 4 (a) Complete the table of values for $y = 5 - x^3$

x	-2	-1	0	1	2
y	13	6	5	4	-3

(2)

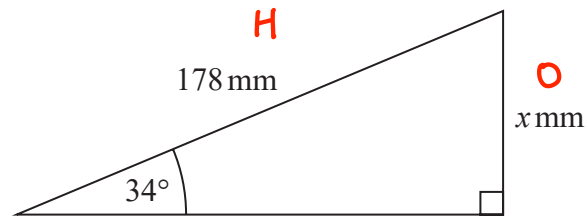
- (b) On the grid below, draw the graph of $y = 5 - x^3$ for values of x from -2 to 2



(2)

(Total for Question 4 is 4 marks)

5



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

$$\sin(34) \times 178 \\ = 99.53...$$

~~S~~ H C ^A H T ^O A

99.5

(Total for Question 5 is 2 marks)

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6 $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$

Find $2\mathbf{a} - 3\mathbf{b}$ as a column vector.

$$2\mathbf{a} = \begin{pmatrix} 6 \\ 8 \end{pmatrix} \quad 3\mathbf{b} = \begin{pmatrix} 15 \\ -6 \end{pmatrix}$$

$$2\mathbf{a} - 3\mathbf{b} = \begin{pmatrix} 6 - 15 \\ 8 - (-6) \end{pmatrix} = \begin{pmatrix} -9 \\ 14 \end{pmatrix}$$

(Total for Question 6 is 2 marks)

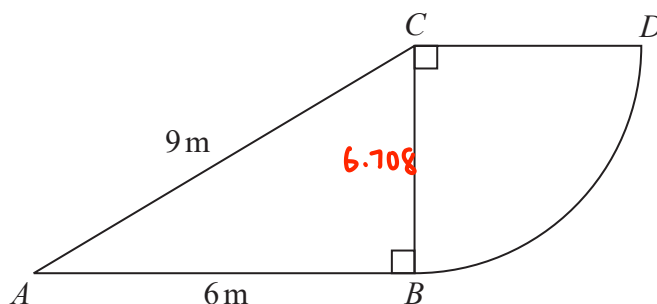
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- 7 The diagram shows a right-angled triangle and a quarter circle.



The right-angled triangle ABC has angle $ABC = 90^\circ$
 The quarter circle has centre C and radius CB .

Work out the area of the quarter circle.
 Give your answer correct to 3 significant figures.
 You must show all your working.

$$CB = 9^2 - 6^2 = 45$$

$$\sqrt{45} = 6.708...$$

$$\pi r^2 = \pi \times 6.708^2 = 45\pi$$

$$45\pi \div 4 = 35.3429..$$

35.3 m²

(Total for Question 7 is 4 marks)

8 Tariq buys a laptop.

$\rightarrow 95\%$

He gets a discount of 5% off the normal price.

Tariq pays £551 for the laptop.

(a) Work out the normal price of the laptop.

$$\begin{array}{lcl} \div 95 & 95\% & = 551 \\ & 1\% & = 5.8 \\ \times 100 & 100\% & = 580 \end{array}$$

£ 580
(2)

Joan invests £6000 in a savings account.

The savings account pays compound interest at a rate of

2.4% for the first year

1.7% for each extra year.

(b) Work out the value of Joan's investment at the end of 3 years.

$$\begin{array}{l} 6000 \times 1.024^1 = 6144 \\ 6144 \times 1.017^2 = 6354.67 \end{array}$$

£ 6354.67
(3)

(Total for Question 8 is 5 marks)

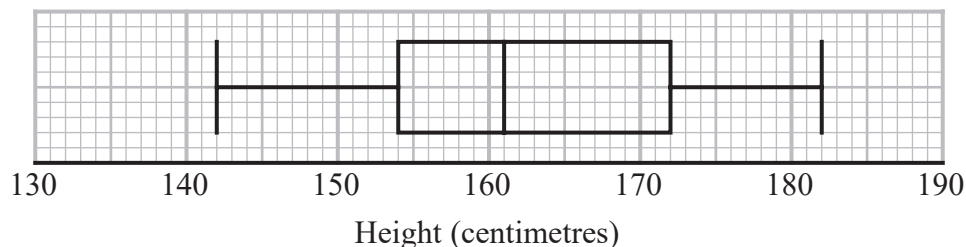


- 9 Aisha recorded the heights, in centimetres, of some girls.
She used her results to work out the information in this table.

Least height	142 cm
Lower quartile	154 cm
Interquartile range	17 cm
Median	162 cm
Range	40 cm

$$VQ = 154 + 17 = 171$$

Aisha drew this box plot for the information in the table.
The box plot is **not** fully correct.



Write down the two things Aisha should do to make the box plot fully correct.

1 The VQ should be 171, not 172.

2 The median should be 162, not 161.

(Total for Question 9 is 2 marks)

10 (a) Simplify $\left(\frac{1}{m^2}\right)^0$ Tip: Anything to the power of 0 = 1

1

(1)

(b) Simplify $\frac{8(x-4)}{(x-4)^2}$

$$\frac{8(\cancel{x-4})}{(x-4)(\cancel{x-4})}$$

8

(x-4)

(1)

(c) Simplify $(3n^4w^2)^3$

$$27n^{12}w^6$$

(2)

(Total for Question 10 is 4 marks)

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11 Jack is in a restaurant.

There are 5 starters, 8 main courses and some desserts on the menu.

Jack is going to choose one starter, one main course and one dessert.

He says there are 240 ways that he can choose his starter, his main course and his dessert.

Could Jack be correct?

You must show how you get your answer.

$$\begin{array}{rcl} 5 \times 8 \times d & = & 240 \\ 40 \times d & = & 240 \\ \div 40 & & \div 40 \\ d & = & 6 \end{array}$$

yes, if there are 6 desserts

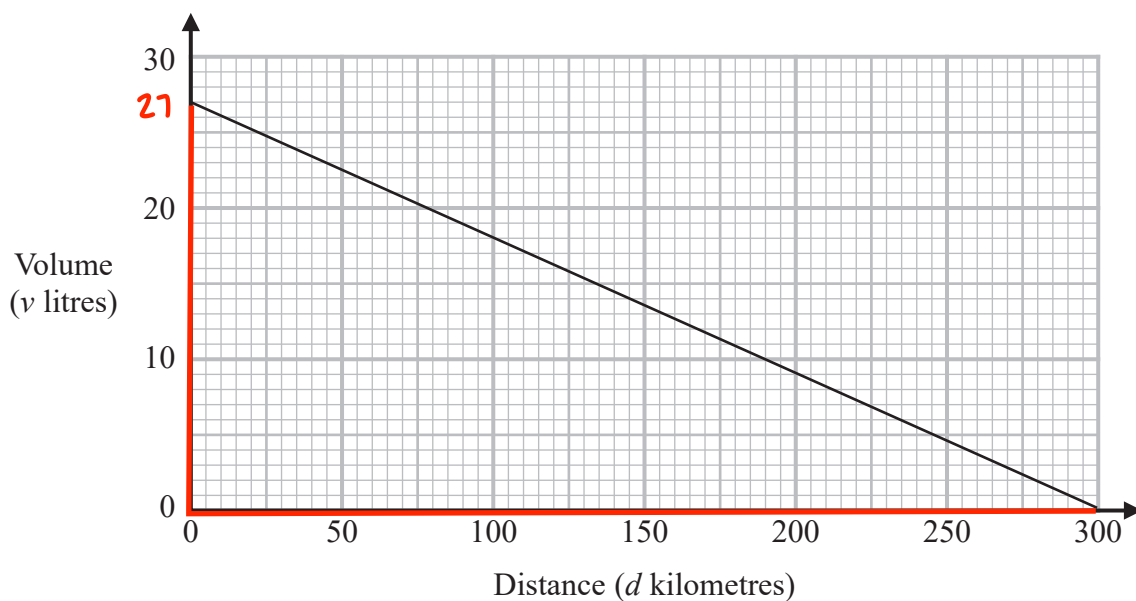
(Total for Question 11 is 2 marks)

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- 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.

$$27 \div 300 = 0.09$$

$$\frac{-0.09}{(2)}$$

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

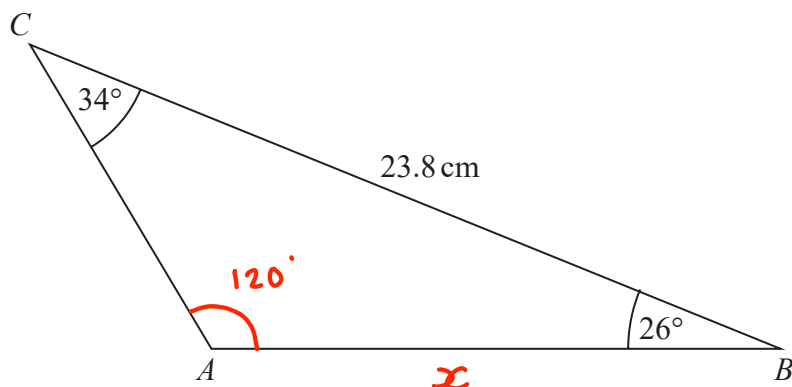
Volume of petrol used each km

(1)

(Total for Question 12 is 3 marks)



13 Here is triangle ABC .



Work out the length of AB .

Give your answer correct to 1 decimal place.

$$\frac{x}{\sin(34)} = \frac{23.8}{\sin(120)}$$

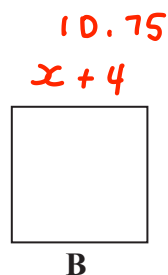
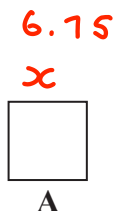
$$x = \frac{23.8}{\sin(120)} \times \sin(34) = 15.367...$$

15.4 cm

(Total for Question 13 is 3 marks)



14 Here are two squares, A and B.



The length of each side of square B is 4 cm greater than the length of each side of square A.
The area of square B is 70 cm^2 greater than the area of square A.

Find the area of square B.

Give your answer correct to 3 significant figures.

You must show all your working.

$$\begin{aligned} \text{Area A} &= x \times x = x^2 \\ \text{Area B} &= (x + 4)(x + 4) = x^2 + 4x + 4x + 16 \\ &= x^2 + 8x + 16 \end{aligned}$$

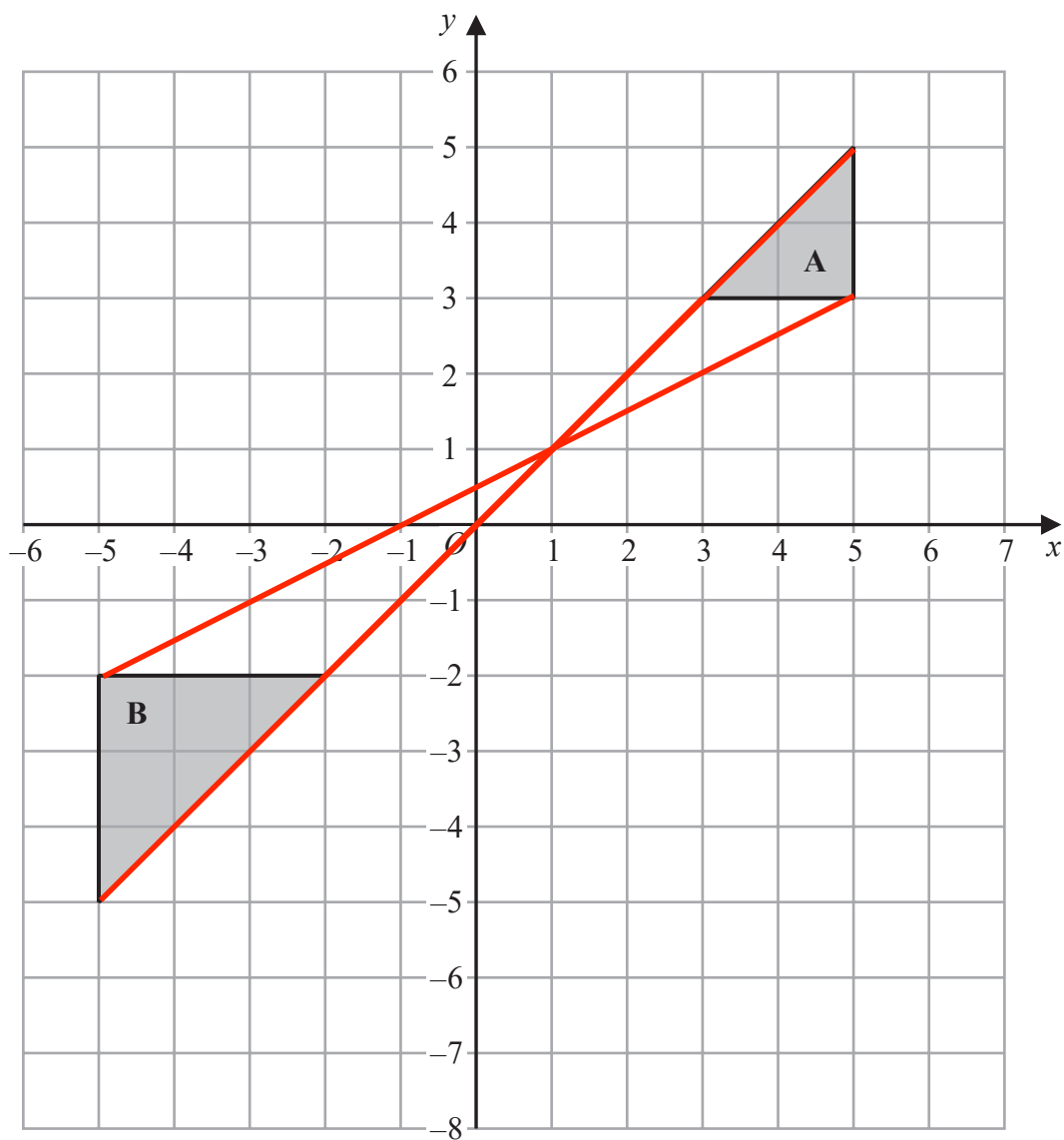
$$\begin{array}{rcl} x^2 + 8x + 16 - 70 & = & x^2 \\ x^2 + 8x - 54 & = & x^2 \\ -x^2 & & -x^2 \\ \hline 8x - 54 & = & 0 \\ + 54 & & + 54 \\ \hline 8x & = & 54 \\ \div 8 & & \div 8 \\ \hline x & = & 6.75 \end{array}$$

$$10.75 \times 10.75 = 115.5625 \quad \dots\dots\dots 116 \text{ cm}^2$$

(Total for Question 14 is 4 marks)



15



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

Enlarged by SF -1.5 about (1, 1)

(Total for Question 15 is 2 marks)



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

$$10 \quad 21 \quad 38 \quad 61 \quad 90$$

$\xrightarrow{+11}$ $\xrightarrow{+17}$ $\xrightarrow{+23}$
 $\xrightarrow{+6}$ $\xrightarrow{+6}$

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

$$\rightarrow 3n^2$$

terms	10	21	38
- $3n^2$	3	12	27
	7	9	11

n^2	1	4	9
$3n^2$	3	12	27

$$\begin{array}{ccc}
 2 & 4 & 6 \\
 7, & 9, & 11 \\
 \xrightarrow{+2} & \xrightarrow{+2} &
 \end{array}
 = 2n + 5$$

$$3n^2 + 2n + 5$$

(Total for Question 16 is 3 marks)

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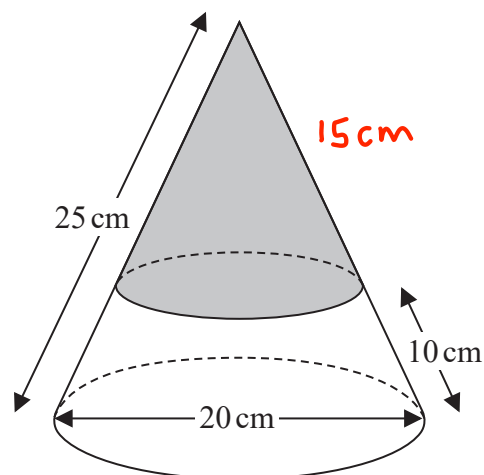
17 Write down the coordinates of the turning point on the graph of $y = (x + 12)^2 - 7$

(-12 , -7)

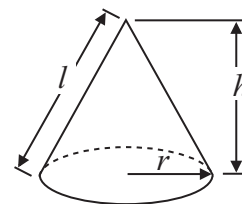
(Total for Question 17 is 1 mark)



18 The diagram represents a solid cone.



Curved surface
area of cone = $\pi r l$



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The cone has a base diameter of 20 cm and a slant height of 25 cm.

A circle is drawn around the surface of the cone at a slant height of 10 cm above the base. The curved surface of the cone above the circle is painted grey.

Work out the area of the curved surface of the cone that is **not** painted grey.

Give your answer as a multiple of π

You must show all your working.

$$\begin{array}{l}
 \begin{array}{c} 15 \\ \triangle \\ 12 \end{array} \quad \begin{array}{c} 25 \\ \triangle \\ 20 \end{array} \\
 \quad \quad \quad \times \frac{5}{3}
 \end{array}
 \qquad
 \begin{array}{l}
 25 \div 15 = \frac{5}{3} \\
 20 \div \frac{5}{3} = 12
 \end{array}$$

$$\begin{aligned}
 \text{Curved SA Large cone} &= \pi \times 10 \times 25 \\
 &= 250\pi
 \end{aligned}$$

$$\begin{aligned}
 \text{Curved SA Small cone} &= \pi \times 6 \times 15 \\
 &= 90\pi
 \end{aligned}$$

$$250\pi - 90\pi = 160\pi$$

$$160\pi \text{ cm}^2$$

(Total for Question 18 is 4 marks)



- 19 A hot air balloon is descending.

The height of the balloon n minutes after it starts to descend is h_n metres.

The height of the balloon $(n+1)$ minutes after it starts to descend, h_{n+1} metres, is given by

$$h_{n+1} = K \times h_n + 20 \quad \text{where } K \text{ is a constant.}$$

The balloon starts to descend from a height of 1200 metres at 09 15

At 09 16 the height of the balloon is 1040 metres.

Work out the height of the balloon at 09 18

$$h_0 = 1200 \quad (09:15)$$

$$h_1 = K \times 1200 + 20 = 1040 \quad (09:16)$$

$$\begin{array}{r|l} 1200K + 20 & = 1040 \\ -20 & -20 \\ \hline 1200K & = 1020 \\ \div 1200 & \div 1200 \\ \hline K & = 0.85 \end{array}$$

$$h_{n+1} = 0.85 \times h_n + 20$$

$$h_2 = 0.85 \times 1040 + 20 = 904 \quad (09:17)$$

$$h_3 = 0.85 \times 904 + 20 = 788.4$$

788.4 m

(Total for Question 19 is 4 marks)



20 There are only red sweets and yellow sweets in a bag.

There are n red sweets in the bag.

There are 8 yellow sweets in the bag.

$$\text{Total} = n + 8$$

Sajid is going to take at random a sweet from the bag and eat it.

He says that the probability that the sweet will be red is $\frac{7}{10}$

Tip: When you have two fractions equal to each other you can cross multiply to solve

(a) Show why the probability cannot be $\frac{7}{10}$

$$P(\text{Red}) = \frac{n}{n+8}$$

$$\frac{n}{n+8} = \frac{7}{10}$$

$$10n = 7n + 56$$

$$\begin{array}{r|l} 10n & = 7n + 56 \\ -7n & -7n \\ \hline 3n & = 56 \\ \div 3 & \div 3 \\ n & = \frac{56}{3} \end{array}$$

n has to be a whole number

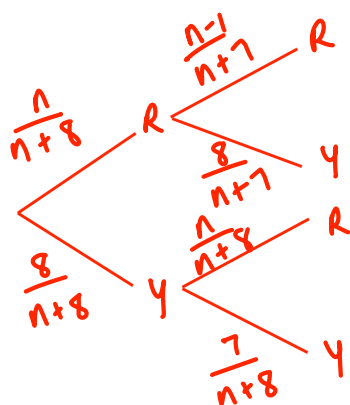
(3)

After Sajid has taken the first sweet from the bag and eaten it, he is going to take at random a second sweet from the bag.

Given that the probability that both the sweets he takes will be red is $\frac{3}{5}$

(b) work out the number of red sweets in the bag.

You must show all your working.



$$P(R, R) = \frac{n}{n+8} \times \frac{n-1}{n+7} = \frac{3}{5}$$

$$\frac{n^2 - n}{n^2 + 15n + 56} = \frac{3}{5}$$

$$5n^2 - 5n = 3n^2 + 45n + 168$$

$$2n^2 - 50n - 168 = 0$$

$$\div 2 \quad n^2 - 25n - 84 = 0$$

$$(n - 28)(n + 3) = 0$$

$$n = 28 \quad n = -3$$

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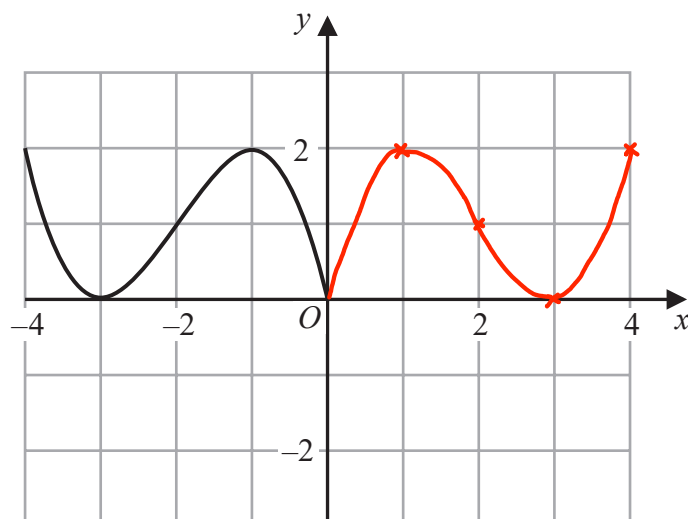
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(5)

(Total for Question 20 is 8 marks)

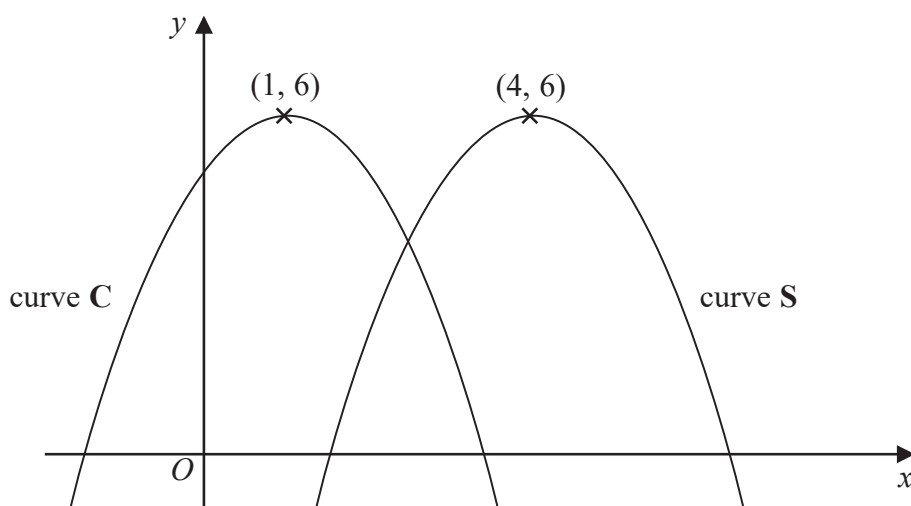


21 The graph of the curve with equation $y = f(x)$ is shown on the grid below.



(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**.

$$+3 \text{ to } x \\ = f(x-3)$$

$$y = 5 + 2(x-3) - (x-3)^2$$

(2)

(Total for Question 21 is 4 marks)

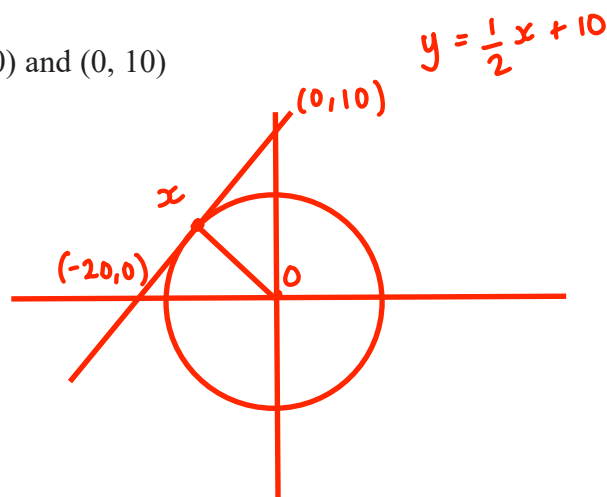


22 C is a circle with centre the origin.

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.



$$\text{Gradient of Tangent} = \frac{10-0}{0-(-20)} = \frac{1}{2}$$

$$\text{Gradient radius} = -2$$

$$\therefore \text{OX} = y = -2x + 0$$

$$y = 2x$$

$$\begin{array}{rcl} \text{To find } x : & \frac{1}{2}x + 10 & = -2x \\ & + 2x & + 2x \\ & 2.5x + 10 & = 0 \\ & -10 & -10 \\ & 2.5x & = -10 \\ & x & = -4 \end{array}$$

$$\begin{array}{l} y = 2x \\ = 2(-4) \\ = -8 \end{array}$$

$$x = (-4, 8)$$

$(-4, 8)$



$$\begin{aligned} r^2 &= (4)^2 + (8)^2 \\ &= 80 \\ r &= \sqrt{80} \end{aligned}$$

$$x^2 + y^2 = r^2$$

$$x^2 + y^2 = 80$$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS