

- 1 Use your calculator to work out the value of

$$\sqrt{\frac{208.3 - 15.7}{5.694 + 1.8^2}}$$

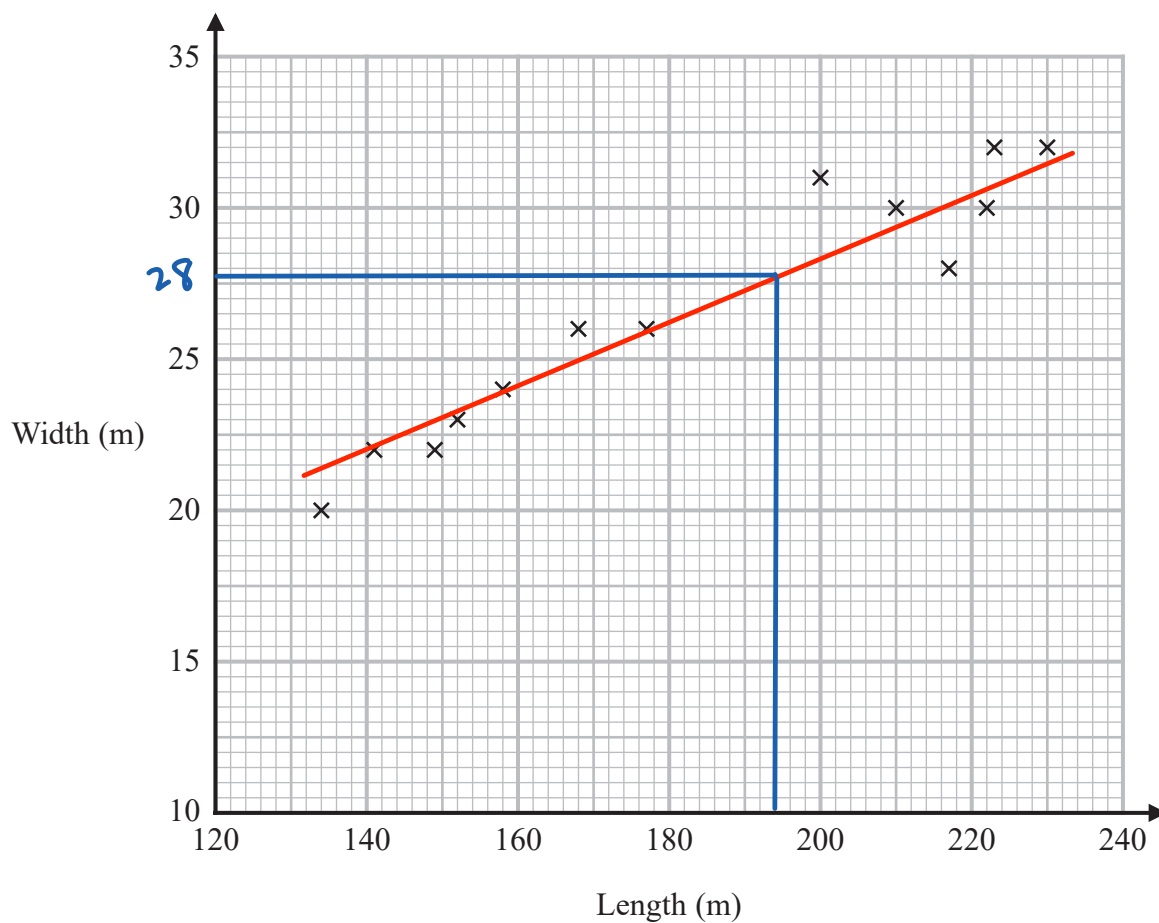
Write down all the digits on your calculator display.

4.643069317

(Total for Question 1 is 2 marks)



- 2 The scatter graph shows information about some ships.
It shows the length and the width of each ship.



- (a) What type of correlation does this scatter graph show?

Positive

(1)

- (b) Draw a line of best fit on the scatter graph.

(1)

A different ship has a length of 194 metres.

- (c) Use your line of best fit to find an estimate for the width of this ship.

28 metres
(26.5 to 29.5)(1)

(Total for Question 2 is 3 marks)

3

Choci bar 200 g £3.50	Choci bar 360 g 7.20 Swiss francs
London	Zurich

In London, a 200 g Choci bar costs £3.50

In Zurich, a 360 g Choci bar costs 7.20 Swiss francs.

The exchange rate is £1 = 1.25 Swiss francs.

In which city is the Choci bar the better value for money, in London or in Zurich?

You must show how you get your answer.

$$£3.50 \times 1.25 = 4.375 \text{ SF}$$

<u>London</u>	<u>Zurich</u>
$\div 200$ $200 \text{ g} = 4.375$ $\downarrow$ $1 \text{ g} = 0.022$	$360 \text{ g} = 7.20$ $\div 360$ $\downarrow$ $1 \text{ g} = 0.020$

Zurich is
better value!

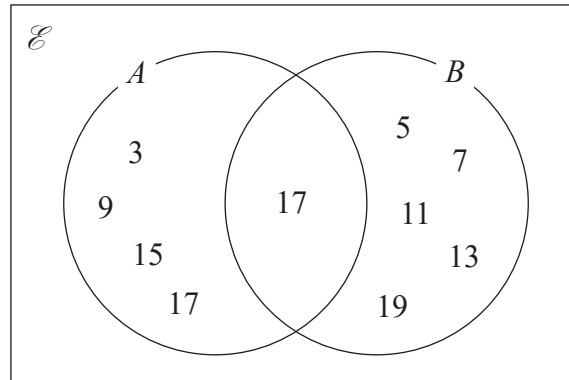
(Total for Question 3 is 3 marks)

4 $\mathcal{E} = \{\text{odd numbers between 0 and 20}\}$

$A = \{3, 9, 15, 17\}$

$B = \{5, 7, 11, 13, 17, 19\}$

Tom was asked to draw a Venn diagram for this information.
Here is his answer.



Write down two things Tom should do to make his answer fully correct.

1 **Number 1 has not been included, it should be on the outside region**

2 **17 should only be in the middle, not also in A**

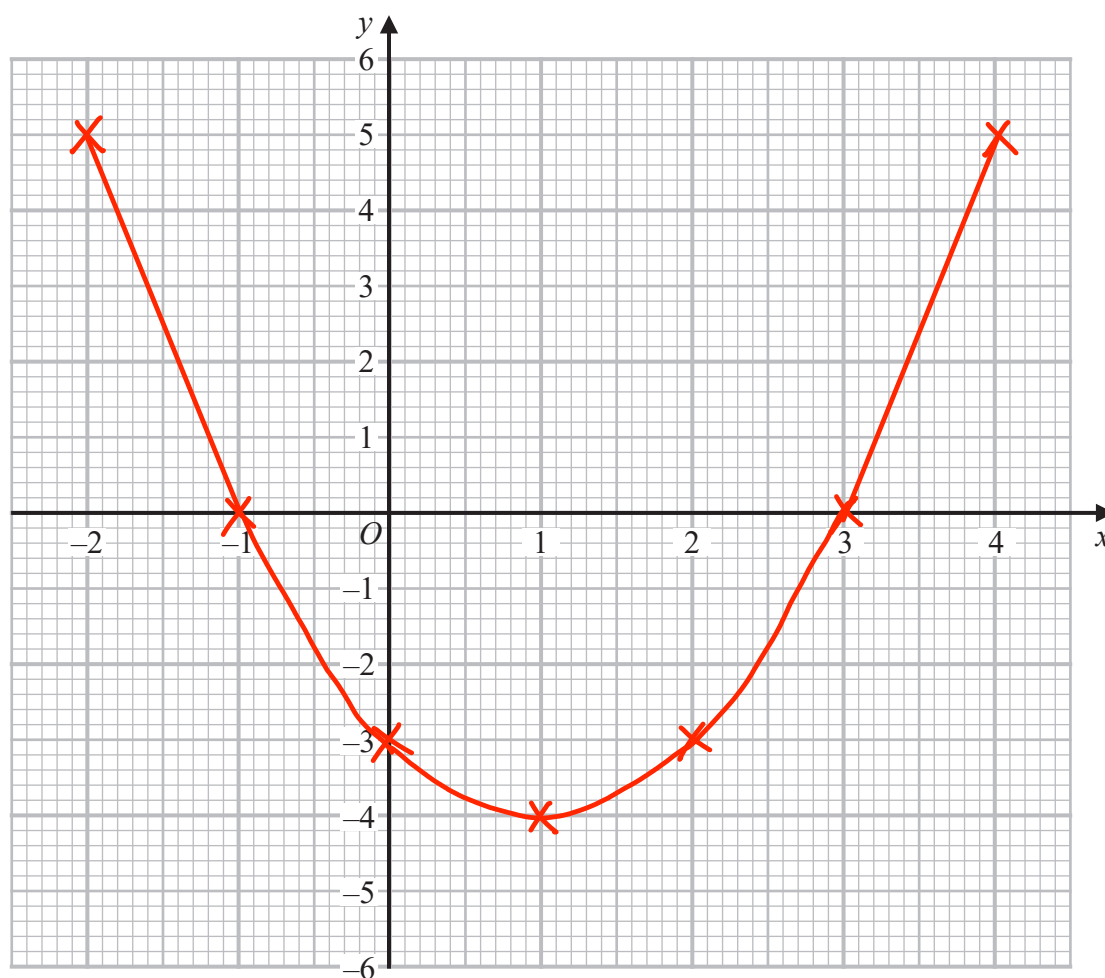
(Total for Question 4 is 2 marks)

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

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

(2)

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



(2)

(Total for Question 5 is 4 marks)

- 6 The cost of a first class stamp increased from 76p to 85p.
The cost of a second class stamp increased from 65p to 66p.

Filip says,

“The percentage increase in the cost of a first class stamp is more than 7 times the percentage increase in the cost of a second class stamp.”

Is Filip correct?

You must show all your working.

$$\frac{\text{Change}}{\text{Original}} \times 100$$

$$\text{first class} = \frac{85-76}{76} \times 100 = 11.84\%$$

$$\text{Second class} = \frac{66-65}{65} \times 100 = 1.54\%$$

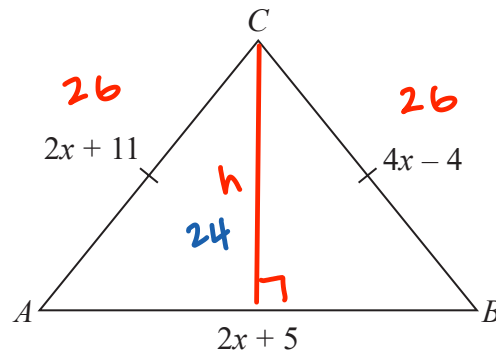
$$11.84 \div 1.54 = 7.696$$

yes!

(Total for Question 6 is 4 marks)



7 The diagram shows triangle ABC .



In the diagram, all measurements are in centimetres.

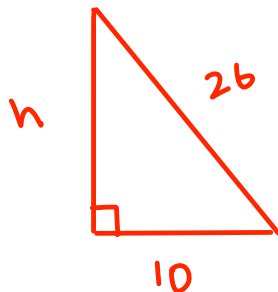
$$AC = BC$$

The perimeter of the triangle is 72 cm.

Work out the area of the triangle.

$$2x + 11 + 4x - 4 + 2x + 5 = 72$$

$$\begin{array}{r|l} 8x + 12 & = 72 \\ - 12 & - 12 \\ \hline 8x & = 60 \\ \div 8 & \div 8 \\ \hline x & = 7.5 \end{array}$$



$$\begin{aligned} 26^2 - 10^2 &= 576 \\ \sqrt{576} &= 24 \end{aligned}$$

$$\text{area} = \frac{b \times h}{2} = \frac{20 \times 24}{2}$$

$$240 \text{ cm}^2$$

(Total for Question 7 is 5 marks)

8 $1.25 \times 10^{-12} = k \times (4 \times 10^{-20})$

Work out the value of k .

Give your answer in standard form.

$$k = (1.25 \times 10^{-12}) \div (4 \times 10^{-20})$$

$$= 0.3125 \times 10^8$$

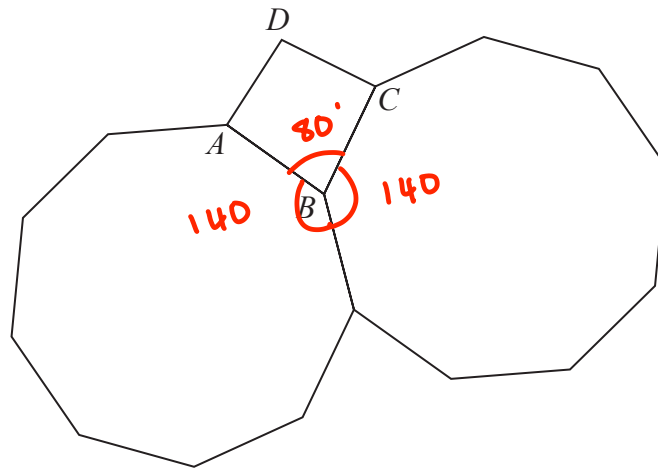
$$= 3.125 \times 10^7$$

$$k = 3.125 \times 10^7$$

(Total for Question 8 is 2 marks)



- 9 The diagram shows two congruent regular 9-sided polygons. $ABCD$ is a quadrilateral.



Show that $ABCD$ is **not** a square.

$$(9 - 2) \times 180 = 1260$$

$$1260 \div 9 = 140$$

$$360 - 140 - 140 = 80^\circ$$

$ABCD$ can not be a square
(all angles would be 90°)

(Total for Question 9 is 3 marks)

10 Use algebra to solve the simultaneous equations

$$4x - 5y = 20 \quad \times 6$$

$$6x + 7y = -57 \quad \times 4$$

You must show all your working.

$$\begin{array}{r} 24x - 30y = 120 \\ - 24x + 28y = -228 \\ \hline -58y = 348 \\ \div -58 \quad \quad \div -58 \\ y = -6 \end{array}$$

$$4x - 5y = 20$$

$$4x - 5(-6) = 20$$

$$\begin{array}{r} 4x + 30 = 20 \\ -30 \quad \quad -30 \\ 4x = -10 \\ \div 4 \quad \quad \div 4 \\ x = -2.5 \end{array}$$

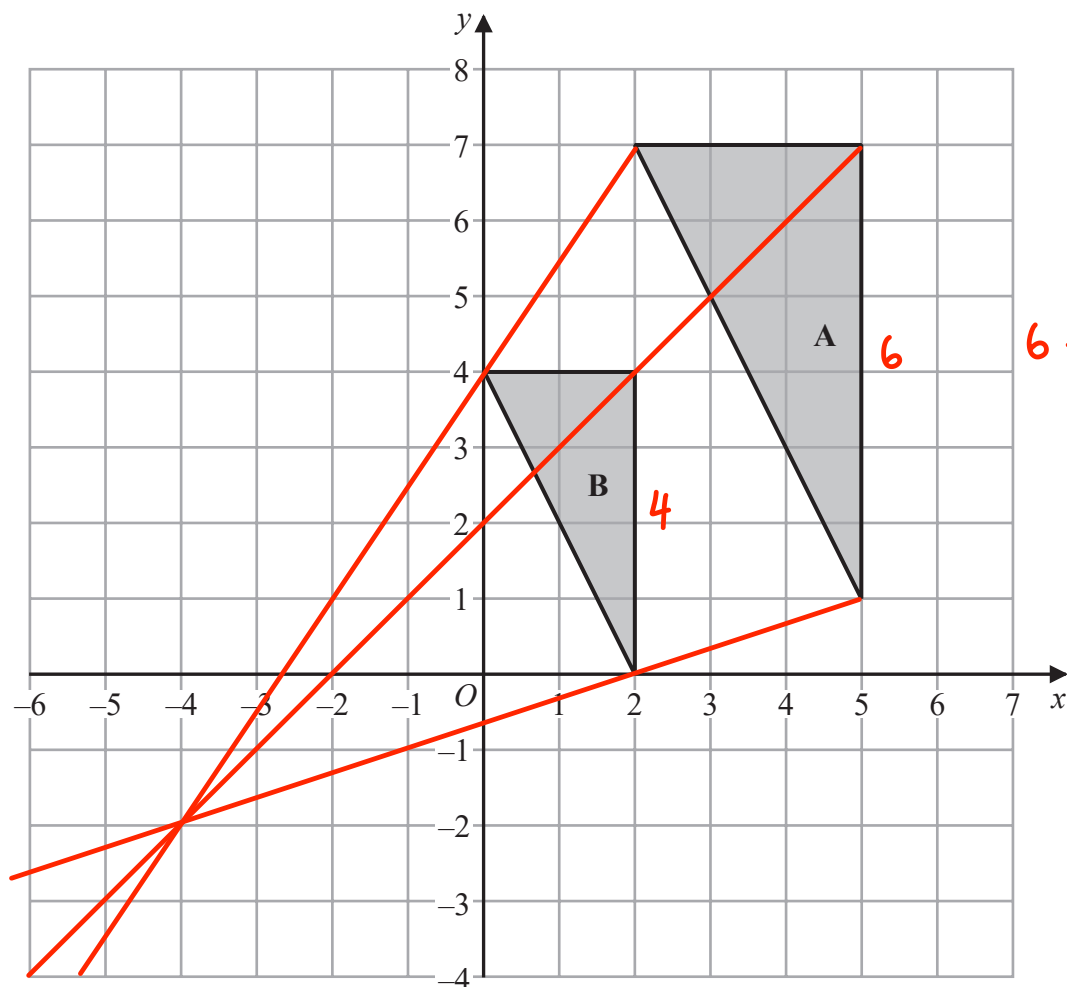
$$x = -2.5$$

$$y = -6$$

(Total for Question 10 is 4 marks)



11



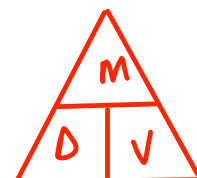
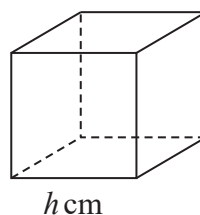
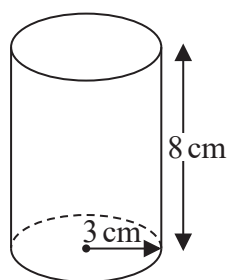
Describe fully the single transformation that maps triangle A onto triangle B.

enlarged by SF $\frac{3}{2}$ centre $(-4, -2)$

(Total for Question 11 is 2 marks)



- 12 The diagram shows a solid cylinder with base radius 3 cm and height 8 cm.
It also shows a solid cube with side length h cm.



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The cylinder is made from steel with a density of 7.86 g/cm^3
The cube is made from brass with a density of 8.5 g/cm^3

The mass of the cylinder is equal to the mass of the cube.

Work out the value of h .

Give your answer correct to 1 decimal place.

$$\begin{aligned} \text{Cylinder Volume } (\pi r^2 h) &= \pi \times 3^2 \times 8 = 72\pi \\ \text{Cube Volume} &= h \times h \times h = h^3 \end{aligned}$$

<u>Cylinder</u>	<u>Cube</u>
$D = 7.86$	$D = 8.5$
$M = 1777.89$	$M = 1777.89$
$V = 72\pi$	$V = 209.164$

$$\begin{aligned} h^3 &= 209.164 \\ \sqrt[3]{\quad} & \quad \sqrt[3]{\quad} \\ h &= 5.936.. \end{aligned}$$

$$h = 5.9$$

(Total for Question 12 is 5 marks)



13 Here is a table of values of x and y .

x	2	4	6	8
y	0	4	8	12

Nadia says that y is directly proportional to x because the value of y increases by 4 as the value of x increases by 2

(a) Is Nadia correct?

You must give a reason for your answer.

NO, $4 \div 2 = 2$ and $8 \div 4 = 2$

(1)

w is directly proportional to the square root of t .

$$w \propto \sqrt{t}$$

$w = 140$ when $t = 64$

(b) (i) Calculate the value of w when $t = 7.84$

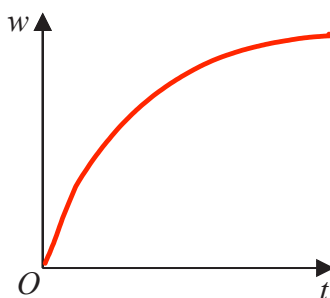
$$\begin{aligned} w &= k\sqrt{t} \\ 140 &= k\sqrt{64} \\ \div \sqrt{64} & \\ 17.5 &= k \end{aligned}$$

$$\begin{aligned} w &= 17.5\sqrt{t} \\ w &= 17.5 \times \sqrt{7.84} \end{aligned}$$

$$w = 49$$

(3)

(ii) On the axes below, sketch a graph to show the relationship between w and t .



(1)

(Total for Question 13 is 5 marks)

- 14 There are 10 football teams in a league.
Each team plays every other team 4 times.

Work out the total number of games played.

$$10 \times 9 = 90 \div 2 = 45$$

Tip: Because there are two teams in each game and we are picking from the same group we need to divide our answer by 2 to remove duplicate selections. For example:

Team A, Team B
Team B, Team A

$$45 \times 4 = 180$$

180

(Total for Question 14 is 2 marks)

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

3 20 47 84 131

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

3, 20, 47, 84, 131

+17 +27 +37
+10 +10

$$\boxed{5n^2} \quad \begin{array}{r} n^2 = 1 \ 4 \ 9 \\ 5n^2 = 5 \ 20 \ 45 \end{array}$$

terms	3	20	47
$- 5n^2$	5	20	45
	-4	-2	0 2
		+2	+2

$$\boxed{2n - 4}$$

$$5n^2 + 2n - 4$$

(3)

The terms of a different sequence are given by the rule $u_{n+1} = ku_n + k$ where k is a constant.

$$0.4u_n + 0.4$$

Given that $u_1 = 9$ and $u_2 = 4$

(b) find the value of u_4

$$u_1 = 9$$

$$u_2 = k(9) + k = 4$$

$$u_3 = 0.4(4) + 0.4 = 2$$

$$u_4 = 0.4(2) + 0.4 = 1.2$$

$$\begin{aligned} 9k + k &= 4 \\ 10k &= 4 \\ k &= 0.4 \end{aligned}$$

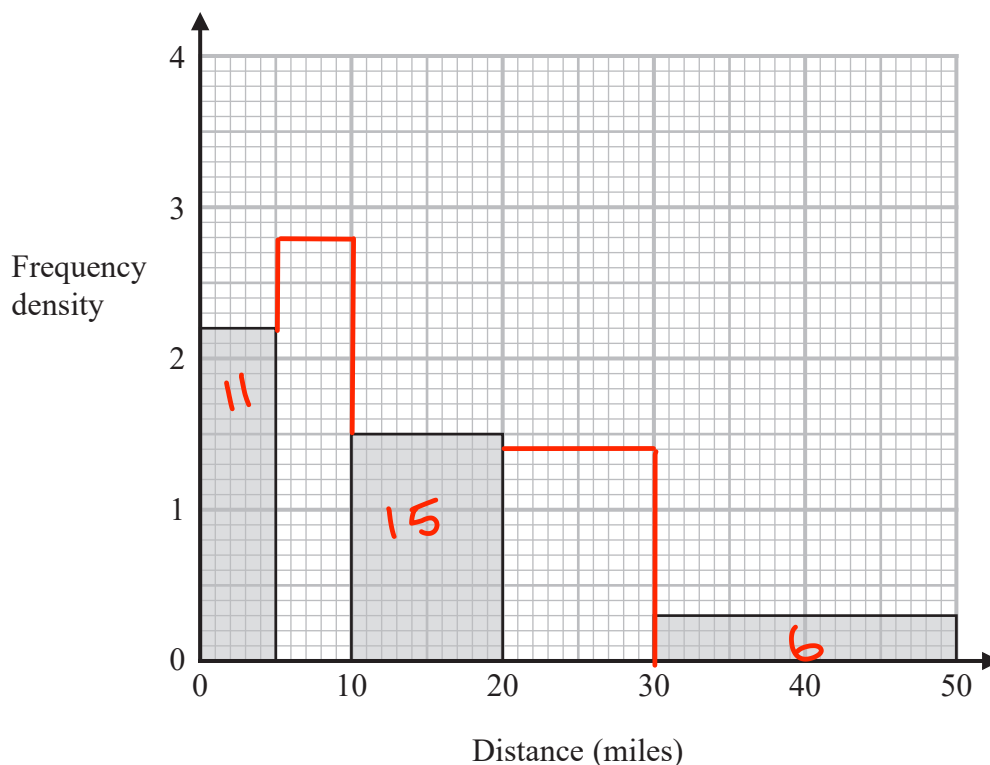
$$u_4 = 1.2$$

(3)

(Total for Question 15 is 6 marks)

- 16 The histogram gives information about the distances that 60 teachers travelled to school on Monday.

The histogram is incomplete.



11 of the teachers travelled between 0 miles and 5 miles.

None of the teachers travelled a distance greater than 50 miles.

The number of teachers who travelled between 5 miles and 10 miles is the same as the number of teachers who travelled between 20 miles and 30 miles.

Complete the histogram.

$$1.5 \times 10 = 15$$

$$0.3 \times 20 = 6$$

$$60 - 11 - 15 - 6 = 28$$

$$28 \div 2 = 14$$

$$14 \div 5 = 2.8$$

$$14 \div 10 = 1.4$$

(Total for Question 16 is 4 marks)



17 Show that $\frac{6x-y}{10xy} + \frac{1}{2x} - \frac{2y-7x}{5xy}$ simplifies to $\frac{k}{y}$ where k is an integer.

$\downarrow$ $\downarrow$
 $\times 5y$ $\times 2$

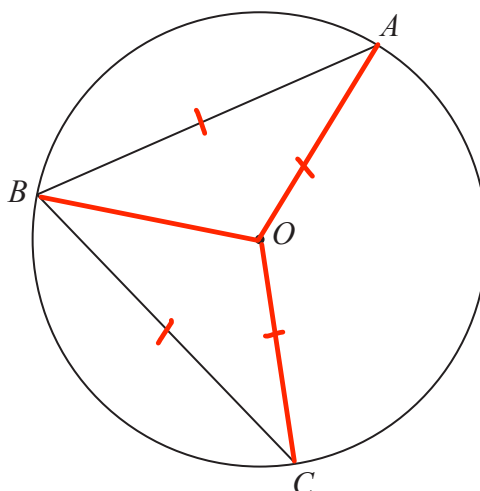
$$\frac{6x-y}{10xy} + \frac{5y}{10xy} - \frac{4y-14x}{10xy}$$

$$= \frac{20x}{10xy} = \frac{2x}{xy} = \frac{2}{y}$$

(Total for Question 17 is 3 marks)



18 A , B and C are three points on a circle, centre O .



$$BA = BC$$

Prove that OB bisects angle ABC .

↳ cuts in half

$$BA = BC$$

$$OA = OC \text{ (Both the radius)}$$

They share OB , so triangle ABO and BOC are congruent as SSS.

$$\text{Therefore } \angle ABO = \angle OBC$$

So OB bisects ABC

(Total for Question 18 is 3 marks)

19 $T = \frac{w}{a - c}$

$432.5 \quad 437.5$

$w = 435$ correct to the nearest 5

$a = 9.8$ correct to 2 significant figures. $9.75 \quad 9.85$

$c = 2.5$ correct to 2 significant figures. $2.45 \quad 2.55$

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

$$T_L = \frac{w_L}{a_u - c_L} = \frac{432.5}{9.85 - 2.45} = 58.4459...$$

$$T_u = \frac{w_u}{a_L - c_u} = \frac{437.5}{9.75 - 2.55} = 60.7638...$$

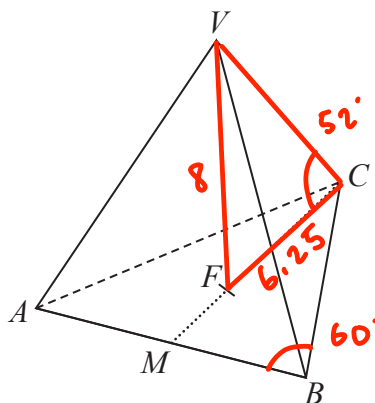
$$T = 60$$

Both the upper and lower bound round to 60 to the nearest 10

(Total for Question 19 is 5 marks)



- 20 $VABC$ is a solid pyramid.
 ABC is an equilateral triangle.



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M is the midpoint of AB .

F is the point on MC such that $MF:FC = 1:2$

The vertex V is vertically above F .

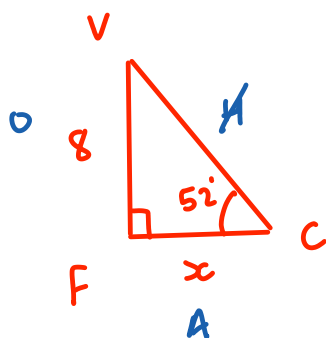
$VA = VB = VC$

$VF = 8$ cm Angle $VCM = 52^\circ$

Work out the side length of the equilateral triangle ABC .

Give your answer correct to 1 decimal place.

S O C H T O A



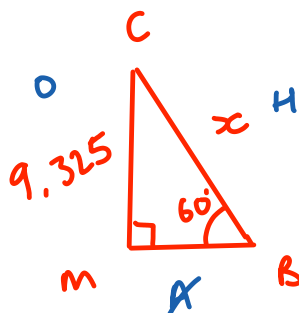
T O A

$$\frac{O}{T} = \frac{8}{\tan(52)}$$

$$= 6.25$$

$$MF:FC$$

$$3.125:6.25 = 1:2$$



S O A

$$\frac{O}{S} = \frac{9.325}{\sin(60)}$$

$$= 10.825$$

10.8

..... cm

(Total for Question 20 is 3 marks)



21 The point P has coordinates $(-4, 5)$

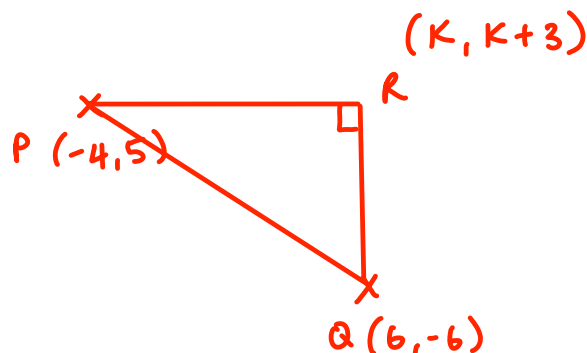
The point Q has coordinates $(6, -6)$

The point R has coordinates $(k, k+3)$

Given that angle PRQ is a right angle,

find the possible values of k .

You must show all your working.



PR and RQ are perpendicular

$$\text{Grad } PR = \frac{k+3-5}{k-(-4)} = \frac{k-2}{k+4}$$

$$\text{Grad } RQ = \frac{k+3-(-6)}{k-6} = \frac{k+9}{k-6}$$

$$\frac{(k-2)}{(k+4)} \times \frac{(k+9)}{(k-6)} = -1$$

$$\frac{k^2 + 7k - 18}{k^2 - 2k - 24} = -1$$

$$k^2 + 7k - 18 = -k^2 + 2k + 24$$

$$2k^2 + 5k - 42 = 0$$

$$\frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-42)}}{2(2)}$$

3.5 or -6

(Total for Question 21 is 5 marks)

$$k = 3.5$$

$$k = -6$$



22 There are only red counters and yellow counters in a box.

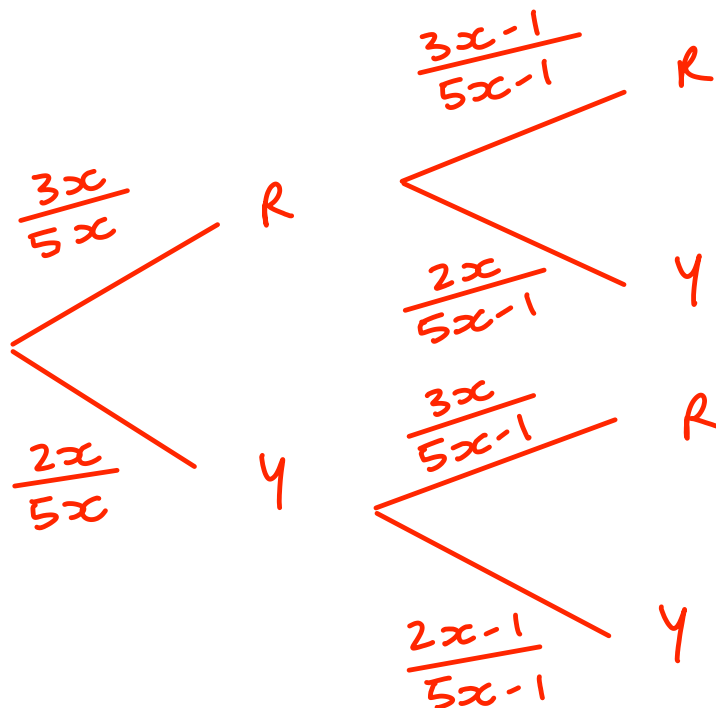
$\frac{3}{5}$ of the counters are red.

Sophie takes at random two counters from the box.

The probability that the two counters are the same colour is $\frac{41}{80}$

Work out the number of yellow counters in the box.
You must show all your working.

$$\begin{aligned}\text{Red} &= 3x \\ \text{Yellow} &= 2x \\ \text{Total} &= 5x\end{aligned}$$



$$\begin{aligned}P(R, R) &= \frac{3x}{5x} \times \frac{3x-1}{5x-1} \\ &= \frac{9x^2 - 3x}{25x^2 - 5x}\end{aligned}$$

$$\begin{aligned}P(Y, Y) &= \frac{2x}{5x} \times \frac{2x-1}{5x-1} \\ &= \frac{4x^2 - 2x}{25x^2 - 5x}\end{aligned}$$

$$\frac{9x^2 - 3x}{25x^2 - 5x} + \frac{4x^2 - 2x}{25x^2 - 5x} = \frac{13x^2 - 5x}{25x^2 - 5x} = \frac{13x - 5}{25x - 5}$$

$$\frac{13x - 5}{25x - 5} = \frac{41}{80}$$

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

$$\begin{aligned}1040x - 400 &= 1025x - 205 \\ 15x &= 195 \\ x &= 13\end{aligned}$$

$$\begin{aligned}\text{yellow} &= 2x \\ &= 26\end{aligned}$$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS