Ed-H | Nov '24 | P2 - Calc

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

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.

$\sqrt{21.55809268}$

4.64306 9317

(Total for Question 1 is 2 marks)

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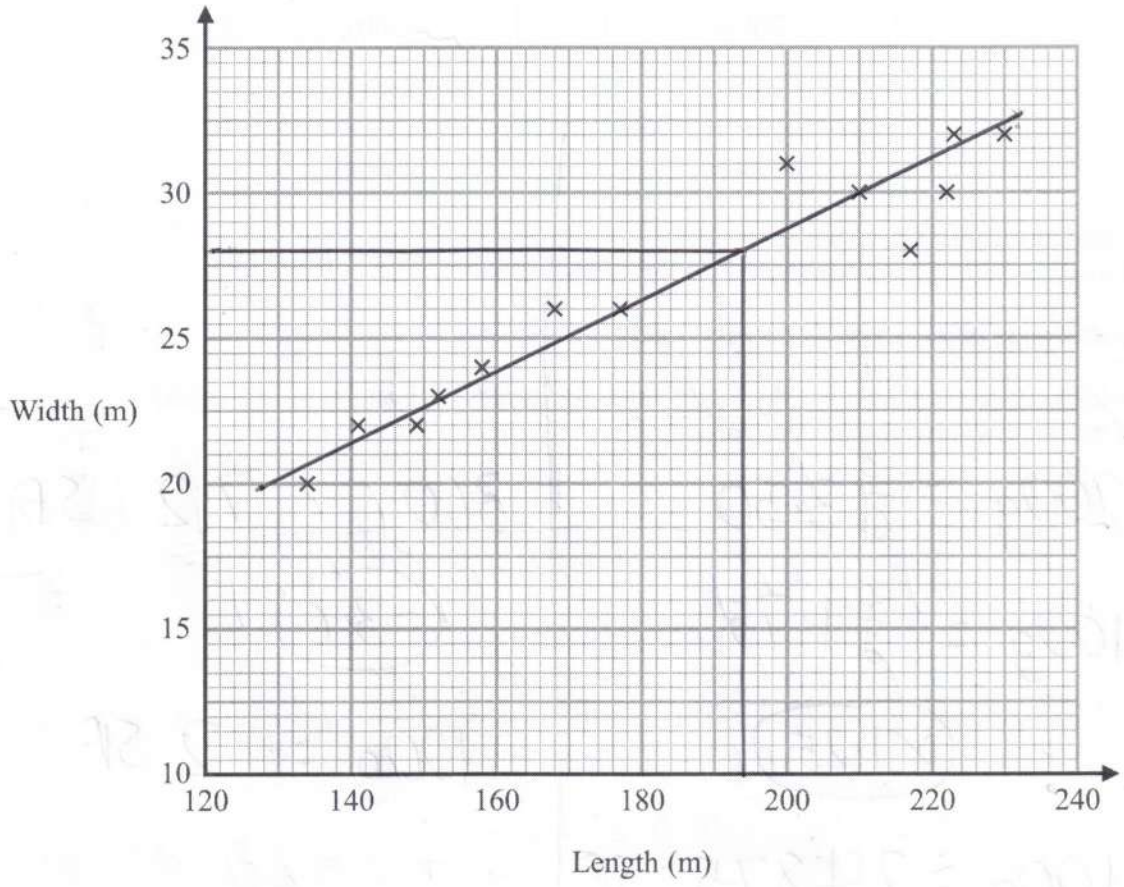
2 The scatter graph shows information about some ships.
It shows the length and the width of each ship.



(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

(1)

(Total for Question 2 is 3 marks)

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3

Choci bar	Choci bar
200 g	360 g
£3.50	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.

200g = £3.50

100g = £1.75

×1.25

100g = 2.1875 SF

360g = 7.2 SF

÷3.6

100g = 2 SF

100g is cheaper in Zurich

(Total for Question 3 is 3 marks)

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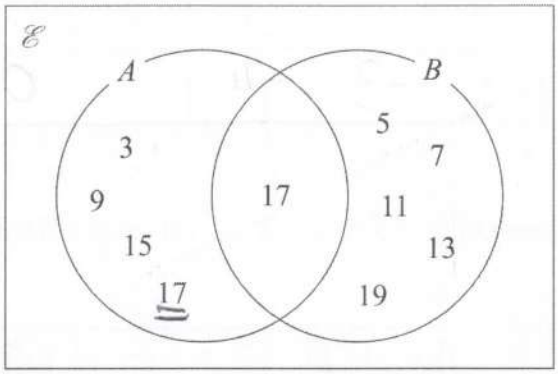
4 $\mathscr{E}$ = {odd numbers between 0 and 20}
A = {3, 9, 15, 17}
B = {5, 7, 11, 13, 17, 19}

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 17 should only be in the intersection

2 Add 1 into the diagram

(Total for Question 4 is 2 marks)

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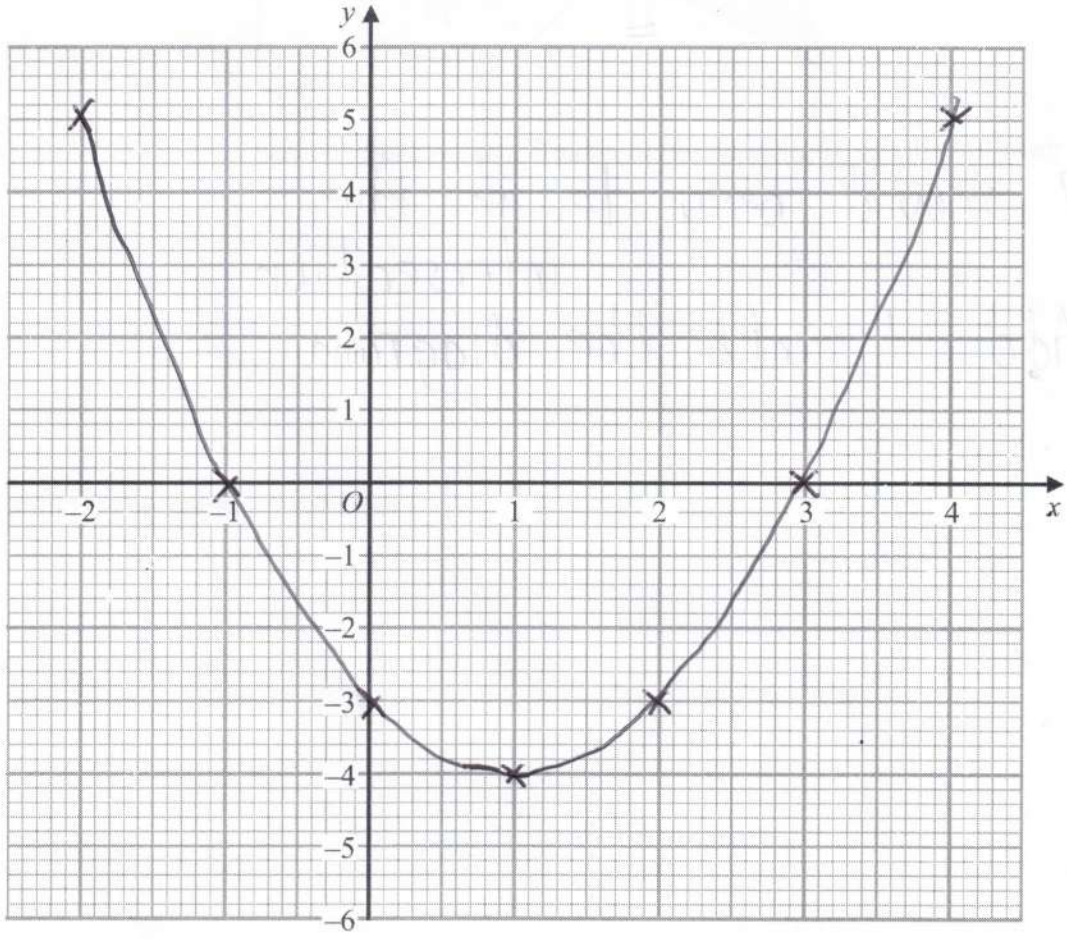
5 (a) Complete the table of values for $y = x^2 - 2x - 3$

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)

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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.

① $\frac{9}{76} \times 100 = 11.84\ldots\%$

② $\frac{1}{65} \times 100 = 1.538\ldots\%$

$1.538 \times 7 = 10.77\%$

Yes Filip is correct
as $11.84 > 1.538 \times 7$

(Total for Question 6 is 4 marks)

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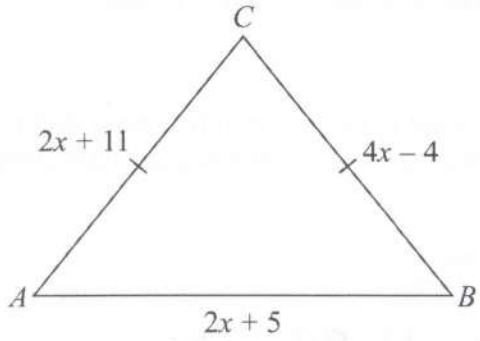
7 The diagram shows triangle ABC.



In the diagram, all measurements are in centimetres.

$AC = BC$

The perimeter of the triangle is 72 cm.

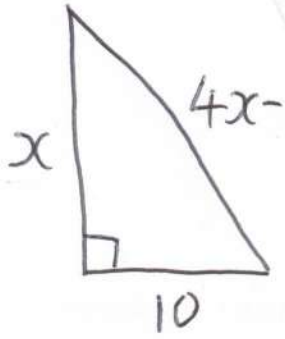
Work out the area of the triangle.

$2x + 11 = 4x - 4$

$15 = 2x$

$x = 7.5$

base $= 2 \times 7.5 + 5 = 20$



$4x - 4 = 4 \times 7.5 - 4$

$= 26$

$x = \sqrt{26^2 - 10^2}$

$= 24$

Area $= \frac{1}{2} \times 20 \times 24$

$= 240$

..... cm^2

(Total for Question 7 is 5 marks)

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

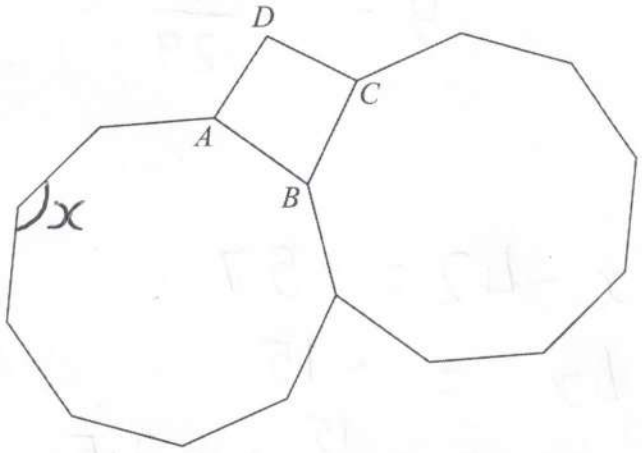
Work out the value of k.
Give your answer in standard form.

$$K = \frac{1.25 \times 10^{-12}}{4 \times 10^{-20}} = 31250000$$

$k =$ 3.125×10^{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.

$$x = \frac{(9-2) \times 180}{9} = 140$$

$\angle ABC = 360 - 2 \times 140$
$= 80$ hence cannot be a square.

(Total for Question 9 is 3 marks)

10 Use algebra to solve the simultaneous equations

① $4x - 5y = 20$ $\times 3$

② $6x + 7y = -57$ $\times 2$

You must show all your working.

$$12x - 15y = 60$$
$$-\ 12x + 14y = -114$$
$$-29y = 174$$
$$y = -\frac{174}{29} = -6$$

② $\Rightarrow 6x - 42 = -57$

$$6x = -15$$
$$x = -\frac{15}{6} = -2.5$$

$x =$ -2.5

$y =$ -6

(Total for Question 10 is 4 marks)

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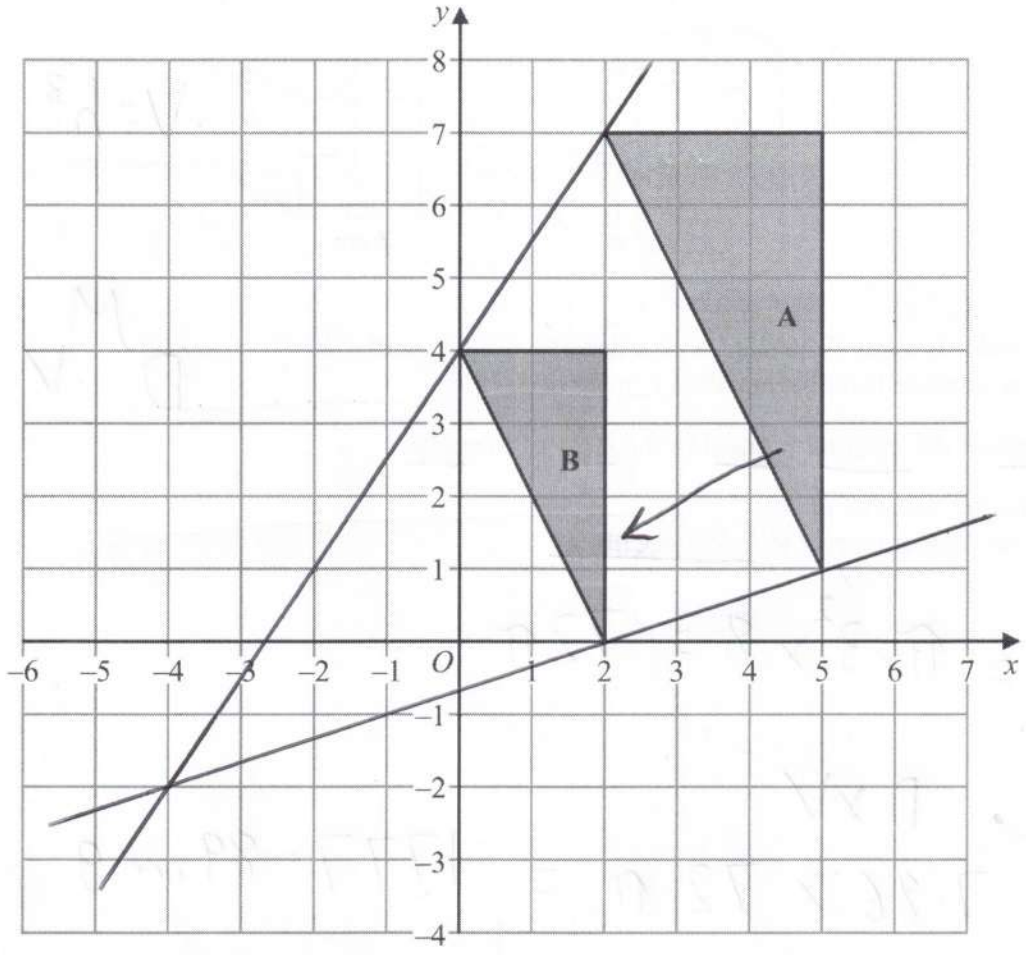
11



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

Enlargement, scale factor = 2/3
centre (-4, -2)

(Total for Question 11 is 2 marks)

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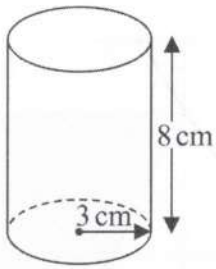
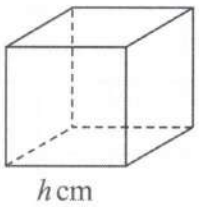
12 The diagram shows a solid cylinder with base radius 3 cm and height 8 cm.
It also shows a solid cube with side length h cm.





$V = h^3$

$D = \frac{M}{V}$

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.

Vol Cyl $= \pi \times 3^2 \times 8 = 72\pi$

$M = D \times V$
$= 7.86 \times 72\pi = 1777.89\ldots$ g

Cube: $h^3 = 1777.89\ldots$

$h = \sqrt[3]{1777.89\ldots}$
$= 12.11\ldots$

$h =$ 12.1 cm

(Total for Question 12 is 5 marks)

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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.

Yes, both are increasing

(1)

w is directly proportional to the square root of t.

$w = 140$ when $t = 64$

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

$w = c \times \sqrt{t}$

$140 = c \times 8$

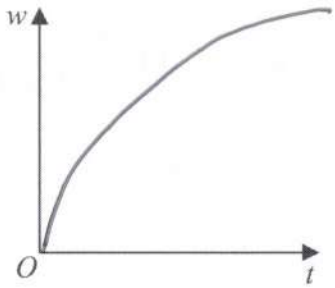
$c = 17.5$

$w = 17.5 \times \sqrt{7.84}$

$w =$ 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.

$4 \times (9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1)$

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 nth term of this sequence.

17 27 37 47

10 10 10

$5n^2 =$ 5 20 45 80 125

$5 - 5n^2 =$ -2 0 2 4 6) -4

$2n =$ 2 4 6 8 10

$5n^2 + 2n - 4$

(3)

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

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

(b) find the value of u_4

$4 = 9K + K = 10K$

$K = \frac{2}{5}$

$U_3 = \frac{2}{5} \times 4 + \frac{2}{5} = 2$

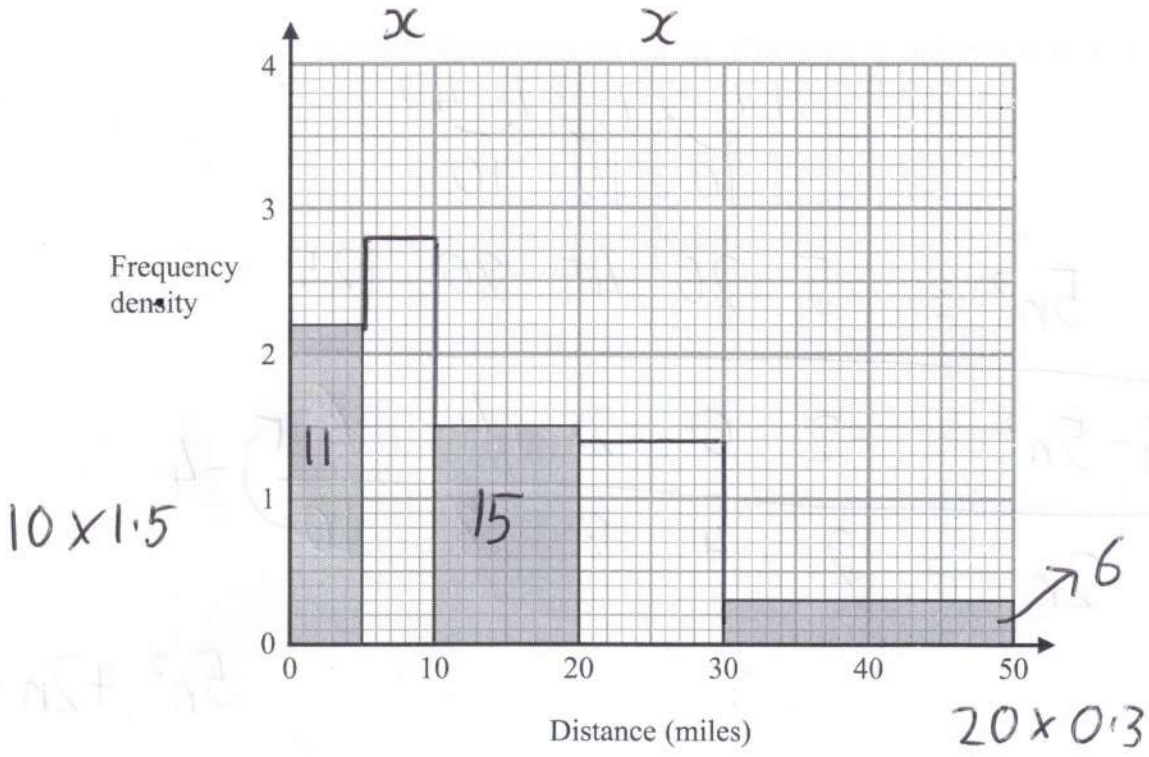
$U_4 = \frac{2}{5} \times 2 + \frac{2}{5}$

$u_4 =$ 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.

$\frac{60-15-11-6}{2} = 14$

$14 \div 5 = 2{\cdot}8$ $\quad$ $14 \div 10 = 1{\cdot}4$

(Total for Question 16 is 4 marks)

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

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

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

$$\frac{20x+0y}{10xy}$$

$$=\frac{2}{y}$$

(Total for Question 17 is 3 marks)

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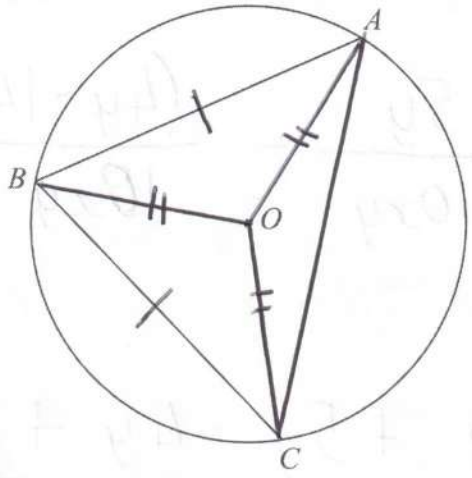
18 A, B and C are three points on a circle, centre O.



$BA = BC$

Prove that OB bisects angle ABC. $= x$

$\angle AOC = 2x$ (angle at centre is twice the angle on the arc)

(Total for Question 18 is 3 marks)

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

$w = 435$ correct to the nearest 5
$a = 9.8$ correct to 2 significant figures.
$c = 2.5$ correct to 2 significant figures.

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.

$w < \begin{matrix} 437.5 \\ 432.5 \end{matrix}$ $\quad a < \begin{matrix} 9.85 \\ 9.75 \end{matrix}$ $\quad c < \begin{matrix} 2.55 \\ 2.45 \end{matrix}$

$T\uparrow = \dfrac{w\uparrow}{a\downarrow - c\uparrow} = \dfrac{437.5}{9.75 - 2.55} = 60.7638\ldots$

$T\downarrow = \dfrac{w\downarrow}{a\uparrow - c\downarrow} = \dfrac{432.5}{9.85 - 2.45} = 58.445\ldots$

Both answers = 60 rounded to 2 significant figures

60 (2sf)

(Total for Question 19 is 5 marks)

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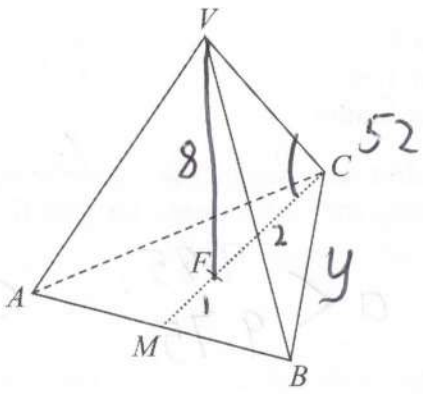
20 *VABC* is a solid pyramid.
ABC is an equilateral triangle.

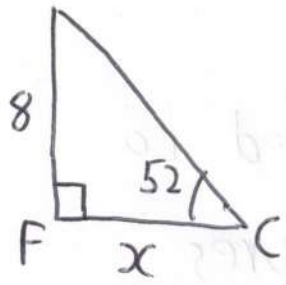


M is the midpoint of *AB*.
F is the point on *MC* such that $MF : FC = 1 : 2$

The vertex *V* is vertically above *F*.
$VA = VB = VC$

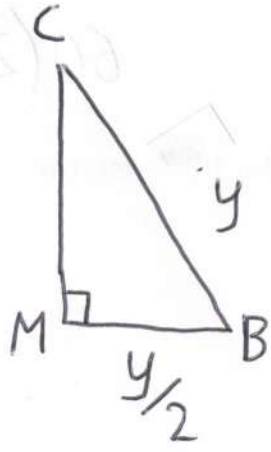
$VF = 8$ cm Angle $VCM = 52°$

Work out the side length of the equilateral triangle *ABC*.
Give your answer correct to 1 decimal place.



TOA $\quad x = \dfrac{8}{\tan 52} = 6.25\ldots$

$CM = 1.5 \times 6.25\ldots = 9.375\ldots$



$\left(\dfrac{y}{2}\right)^2 + 9.375^2 = y^2$

$87.898\ldots = \dfrac{3y^2}{4}$

$y = \sqrt{117.198} = 10.8$

..... cm

(Total for Question 20 is 3 marks)

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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, ∠ is at R

find the possible values of k.
You must show all your working.

$$m_{PR} = \frac{5-(K+3)}{-4-K} = \frac{2-K}{-4-K}$$

$$m_{RQ} = \frac{K+3--6}{K-6} = \frac{K+9}{K-6}$$

[-ve reciprocal and equate] $\Rightarrow \frac{2-K}{-4-K} = \frac{6-K}{K+9}$

$$(2-K)(K+9) = (6-K)(-4-K)$$

$$2K+18-K^2-9K = -24-6K+4K+K^2$$

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

$$0 = (2K-7)(K+6)$$

$K = \frac{7}{2}$ or $K = -6$

(Total for Question 21 is 5 marks)

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.

R	Y
$\frac{3}{5}$	$\frac{2}{5}$

$R = 1.5Y$ *

$P(\text{Same}) = P(RR) + P(YY) = \frac{41}{80}$

$= \left(\frac{R}{R+Y}\right)\times\left(\frac{R-1}{R+Y-1}\right) + \left(\frac{Y}{R+Y}\right)\times\left(\frac{Y-1}{R+Y-1}\right) = \frac{41}{80}$

$= \frac{3}{5}\times\left(\frac{R-1}{R+Y-1}\right) + \frac{2}{5}\left(\frac{Y-1}{R+Y-1}\right) = \frac{41}{80}$

$= \frac{3R-3+2Y-2}{5(R+Y-1)} = \frac{41}{80}$

$240R + 160Y - 400 = 205(R+Y-1)$

$=$

$= 35R - 45Y - 195 = 0$

$\div 5$ * $= 7(1.5Y) - 9Y = 39$

$\frac{3}{2}Y = 39$

$Y = 39 \div \frac{3}{2} = 26$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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