

$F : m : S$

- 1 Frank, Mary and Seth shared some sweets in the ratio $4 : 5 : 7$
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

$$3 \text{ parts} = 18$$

$$1 \text{ part} = 6$$

$$F : m : S$$

$$4 : 5 : 7$$

 $\times 6$

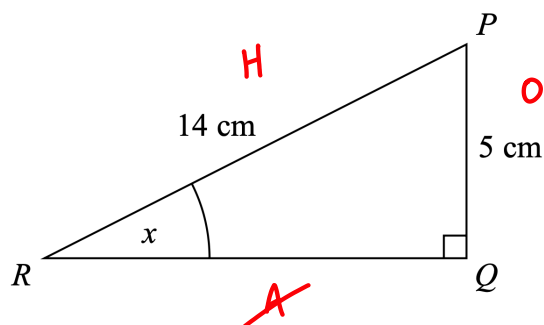
$$24 : 30 : 42$$

$$\begin{array}{r} 24 \\ + 30 \\ \hline 42 \\ + 54 \\ \hline 96 \end{array}$$

 96

(Total for Question 1 is 3 marks)

2 PQR is a right-angled triangle.



Work out the size of the angle marked x .
Give your answer correct to 1 decimal place.

$\sin^{-1} \frac{5}{14}$

$$\sin^{-1}\left(\frac{5}{14}\right) = 20.924..$$

20.9

(Total for Question 2 is 2 marks)

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- 3 Here are the first four terms of an arithmetic sequence.

$\overset{4}{6}$ $\overset{8}{10}$ $\overset{12}{14}$ 18
 $\overset{+4}{\curvearrowright}$ $\overset{+4}{\curvearrowright}$

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

$$4n + 2$$

(2)

The n th term of a different arithmetic sequence is $3n + 5$

- (b) Is 108 a term of this sequence?
Show how you get your answer.

$$\begin{array}{rcl}
 3n + 5 & = & 108 \\
 -5 & & -5 \\
 \hline
 3n & = & 103 \\
 \div 3 & & \div 3 \\
 \hline
 n & = & 34.\bar{3}
 \end{array}$$

NO, n is not
a whole
number

(2)

(Total for Question 3 is 4 marks)

4 Axel and Lethna are driving along a motorway.

They see a road sign.

The road sign shows the distance to Junction 8

It also shows the average time drivers take to get to Junction 8

To Junction 8 30 miles 26 minutes



The speed limit on the motorway is 70 mph.

Lethna says

“We will have to drive faster than the speed limit to drive 30 miles in 26 minutes.”

Is Lethna right?

You must show how you get your answer.

$$S = \frac{D}{T} = \frac{30 \text{ miles}}{26 \text{ mins}} = 69.23 \text{ mph}$$

No, they will be under the
Speed limit

(Total for Question 4 is 3 marks)

- 5 The table shows some information about the foot lengths of 40 adults.

Foot length (f cm)	Number of adults	
$16 \leq f < 18$	17	3
$18 \leq f < 20$	19	6
$20 \leq f < 22$	21	10
$22 \leq f < 24$	23	12
$24 \leq f < 26$	25	9

40

51
114
210
276
225
876

- (a) Write down the modal class interval.

$22 \leq f < 24$
(1)

- (b) Calculate an estimate for the mean foot length.

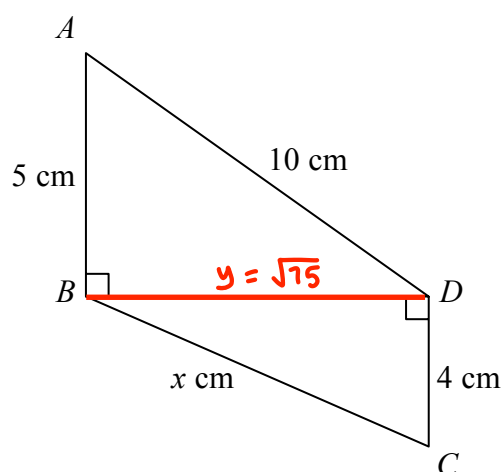
$$876 \div 40 = 21.9$$

21.9 cm
(3)

(Total for Question 5 is 4 marks)



- 6 Triangles ABD and BCD are right-angled triangles.



Work out the value of x .

Give your answer correct to 2 decimal places.

$$\begin{aligned} 10^2 - 5^2 &= y^2 \\ 75 &= y^2 \\ \sqrt{75} &= y \end{aligned}$$

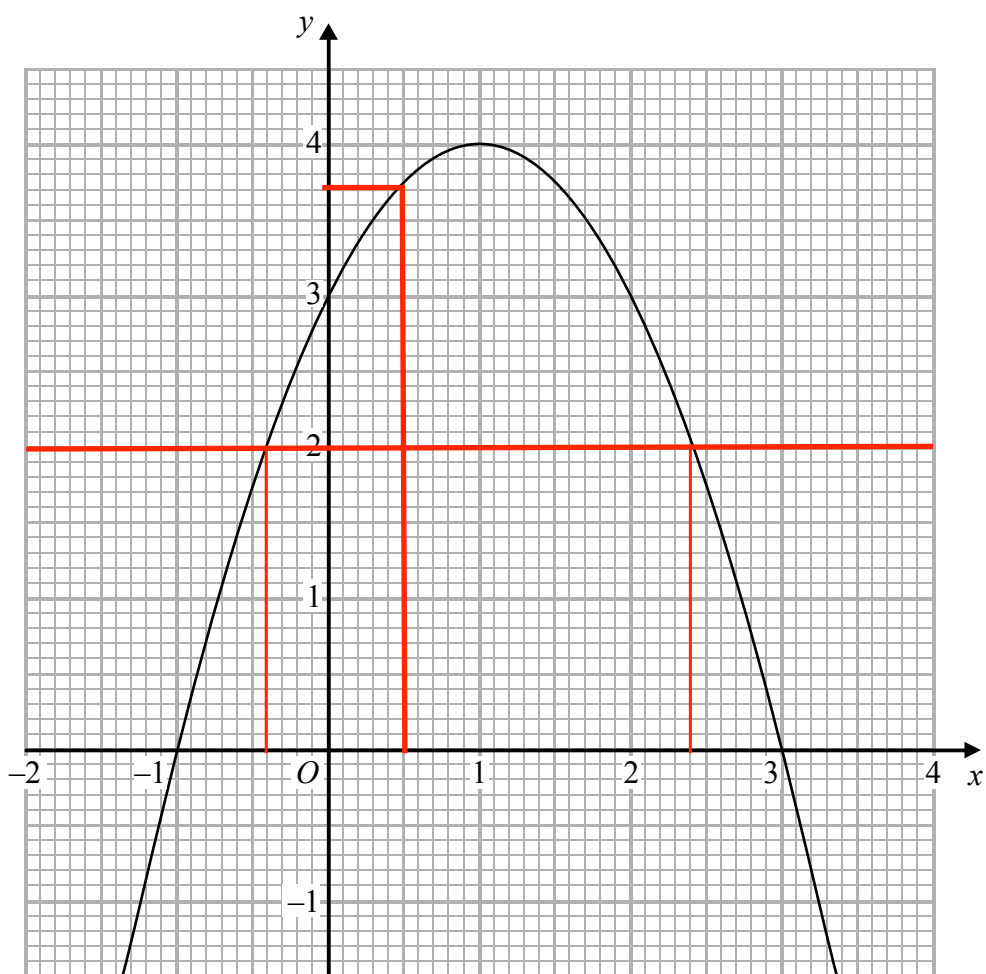
$$\begin{aligned} \sqrt{75}^2 + 4^2 &= x^2 \\ 91 &= x^2 \\ \sqrt{91} &= x \end{aligned}$$

9.54

(Total for Question 6 is 4 marks)



7 The graph of $y = f(x)$ is drawn on the grid.



(a) Write down the coordinates of the turning point of the graph.

(1 , 4)
(1)

(b) Write down the roots of $f(x) = 2$

-0.4, 2.4
(1)

(c) Write down the value of $f(0.5)$

3.7
(3.7 - 3.8) (1)

(Total for Question 7 is 3 marks)

8 In a box of pens, there are

three times as many red pens as green pens
and two times as many green pens as blue pens.

For the pens in the box, write down
the ratio of the number of red pens to the number of green pens to the number of blue pens.

$$\begin{array}{lcl} R : G & G : B \\ \times 2 \quad \downarrow & 3 : 1 & 2 : 1 \\ & 6 : 2 & 2 : 1 \end{array}$$

$$\begin{array}{l} R : G : B \\ 6 : 2 : 1 \end{array}$$

$$6 : 2 : 1$$

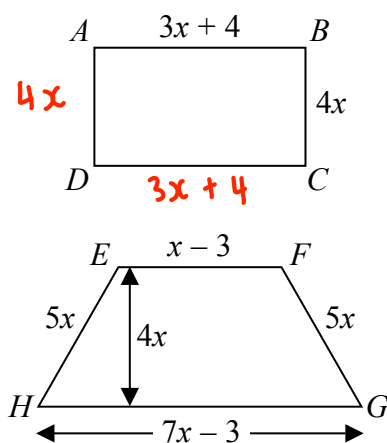
(Total for Question 8 is 2 marks)

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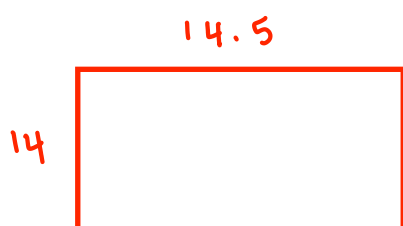
- 9 $ABCD$ is a rectangle.
 $EFGH$ is a trapezium.



All measurements are in centimetres.
 The perimeters of these two shapes are the same.

Work out the area of the rectangle.

$$\begin{array}{rcl}
 4x + 4x + 3x + 4 + 3x + 4 & = & x - 3 + 5x + 5x + 7x - 3 \\
 14x + 8 & = & 18x - 6 \\
 -14x & & -14x \\
 8 & = & 4x - 6 \\
 +6 & & +6 \\
 14 & = & 4x \\
 3.5 & = & x
 \end{array}$$



$$3(3.5) + 4 = 14.5$$

$$4(3.5) = 14$$

$$14.5 \times 14 = 203$$

203 cm²

(Total for Question 9 is 5 marks)

10 Katy invests £2000 in a savings account for 3 years.

The account pays compound interest at an annual rate of

2.5% for the first year

$x\%$ for the second year

$x\%$ for the third year

There is a total amount of £2124.46 in the savings account at the end of 3 years.

(a) Work out the rate of interest in the second year.

$$2000 \times 1.025 = 2050$$

$$\begin{array}{r|l} 2050 \times y^2 & = 2124.46 \\ \div 2050 & \div 2050 \\ y^2 & = 1.0363... \\ \sqrt{} & \sqrt{} \\ y & = 1.01799.. \end{array}$$

$$x = 1.8\%$$

1.8

(4)

Katy goes to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

(b) Work out the cost of her weekly train ticket before this increase.

$$\begin{array}{l} \div 112.5 \quad \downarrow \quad 112.5\% = 225 \\ \quad \quad \quad \downarrow \quad 1\% = 2 \\ \times 100 \quad \downarrow \quad 100\% = 200 \end{array} \quad \begin{array}{l} \div 112.5 \\ \downarrow \\ \times 100 \end{array}$$

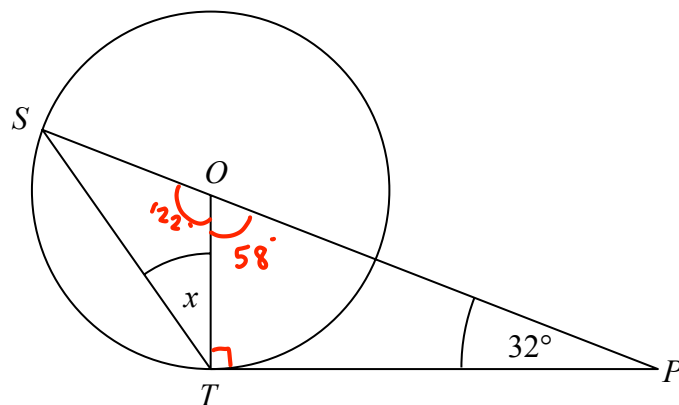
£ 200

(2)

(Total for Question 10 is 6 marks)



11



S and T are points on the circumference of a circle, centre O .

PT is a tangent to the circle.

SOP is a straight line.

Angle $OPT = 32^\circ$

Work out the size of the angle marked x .

You must give a reason for each stage of your working.

$\angle OTP = 90^\circ$ because the radius meets the tangent at 90°

$\angle TOP = 58^\circ$ because angles in triangle add to 180°

$\angle SOT = 122^\circ$ because angles on a straight line add to 180°

$$180 - 22 = 58 \div 2 = 29$$

$x = 29^\circ$ because base angles in an Isosceles triangle are the same

(Total for Question 11 is 4 marks)



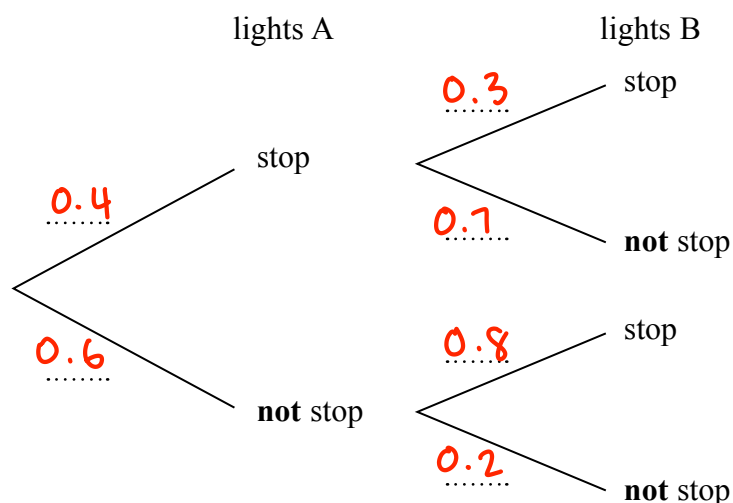
12 A and B are two sets of traffic lights on a road.

The probability that a car is stopped by lights A is 0.4

If a car is stopped by lights A, then the probability that the car is **not** stopped by lights B is 0.7

If a car is **not** stopped by lights A, then the probability that the car is **not** stopped by lights B is 0.2

(a) Complete the probability tree diagram for this information.



(2)

Mark drove along this road.

He was stopped by just one of the sets of traffic lights.

(b) Is it more likely that he was stopped by lights A or by lights B?

You must show your working.

$$P(S, S') = 0.4 \times 0.7 = 0.28$$

$$P(S', S) = 0.6 \times 0.8 = 0.48$$

$$0.48 > 0.28$$

Lights B

(3)

(Total for Question 12 is 5 marks)

13 d is inversely proportional to c

When $c = 280$, $d = 25$

Find the value of d when $c = 350$

$$d \propto \frac{1}{c}$$

$$d = \frac{k}{c}$$

$$25 = \frac{k}{280}$$

$$\times 280 \quad \times 280$$

$$7000 = k$$

$$d = \frac{7000}{c}$$

$$d = \frac{7000}{350} = 20$$

$$d = 20$$

(Total for Question 13 is 3 marks)

14 Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number

for all positive integer values of n .

$$(2n+1)(2n+1) - (2n+1)$$

$$4n^2 + 4n + 1 - (2n + 1)$$

$$= 4n^2 + 2n$$

$$= 2(2n^2 + n)$$

$\therefore$ always even as always a multiple of 2

(Total for Question 14 is 3 marks)

15 Prove algebraically that the recurring decimal $0.2\dot{5}$ has the value $\frac{23}{90}$

$$\begin{array}{r} 10x = 2.5\cancel{5}\cancel{5}\cancel{5}\dots \\ - \quad x = 0.2\cancel{5}\cancel{5}\cancel{5}\dots \\ \hline 9x = 2.3 \\ x = \frac{2.3}{9} = \frac{23}{90} \end{array}$$

(Total for Question 15 is 2 marks)

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16 Show that $\frac{1}{6x^2 + 7x - 5} \div \frac{1}{4x^2 - 1}$ simplifies to $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

$$\frac{1}{(3x+5)(2x-1)} \div \frac{1}{(2x-1)(2x+1)}$$

$$\frac{1}{(3x+5)(2x-1)} \times \frac{(2x-1)(2x+1)}{1}$$

$$= \frac{(\cancel{2x-1})(2x+1)}{(3x+5)(\cancel{2x-1})} = \frac{2x+1}{3x+5}$$

$$\begin{array}{r} 6x^2 + 7x - 5 \\ 3x(2x-1) \overline{) 6x^2 - 3x - 5} \\ \underline{6x^2 - 3x} \\ 10x - 5 \end{array} \quad \begin{array}{l} +1 \quad x-30 \\ 10, -3 \end{array}$$

$$(3x+5)(2x-1)$$

$$\frac{2x+1}{3x+5}$$

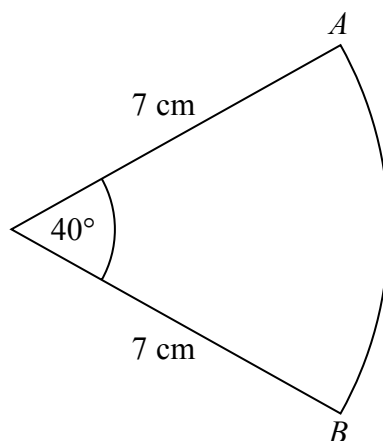
(Total for Question 16 is 3 marks)

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17 The diagram shows a sector of a circle of radius 7 cm.



Work out the length of arc AB .

Give your answer correct to 3 significant figures.

$$\frac{40}{360} \times \pi \times 14 = 4.886..$$

4.89 cm

(Total for Question 17 is 2 marks)

18 $m = \frac{\sqrt{s}}{t}$

$LB = 3.465 \quad UB = 3.475$

$s = 3.47$ correct to 3 significant figures

$t = 8.132$ correct to 4 significant figures

$LB = 8.1315 \quad UB = 8.1325$

By considering bounds, work out the value of m to a suitable degree of accuracy.
Give a reason for your answer.

$$m_L = \frac{\sqrt{s_L}}{t_U} = \frac{\sqrt{3.465}}{8.1325} = 0.22889 \dots$$

$$m_U = \frac{\sqrt{s_U}}{t_L} = \frac{\sqrt{3.475}}{8.1315} = 0.22924 \dots$$

$$m = 0.229$$

Both UB and LB are 0.229 to 3.d.p

(Total for Question 18 is 5 marks)

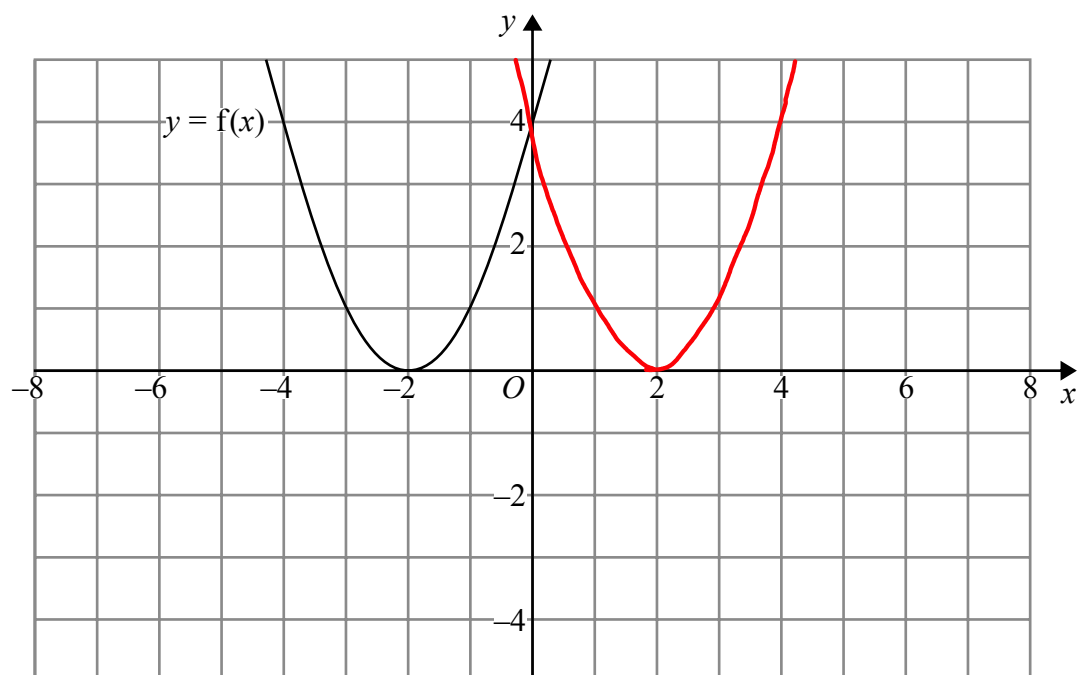
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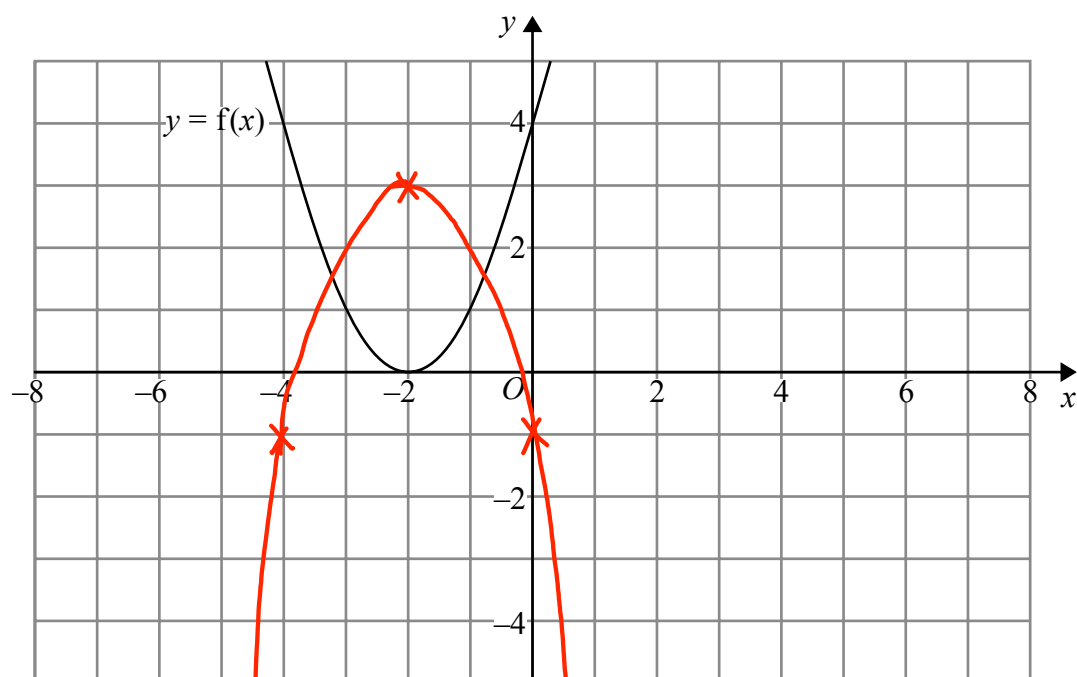


19 The graph of $y = f(x)$ is shown on both grids below.



(a) On the grid above, sketch the graph of $y = f(-x)$

(1)



(b) On this grid, sketch the graph of $y = -f(x) + 3$

(1)

$$\begin{aligned} (-4, 4) &\rightarrow (-4, -1) \\ (-2, 0) &\rightarrow (-2, 3) \\ (0, 4) &\rightarrow (0, -1) \end{aligned}$$

(Total for Question 19 is 2 marks)

20 Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$

$$y - 2x = 5$$

$$\rightarrow y = 5 + 2x$$

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

$$= 4x^2 + 20x + 25$$

$$\begin{array}{r|l} x^2 + 4x^2 + 20x + 25 & = 0 \\ 5x^2 + 20x + 25 & = 0 \\ -25 & -25 \\ 5x^2 + 20x & = 0 \\ 5x(x + 4) & = 0 \end{array}$$

$$x = 0 \text{ or } x = -4$$

$$\begin{aligned} y &= 5 + 2x \\ &= 5 + 2(0) = 5 \end{aligned}$$

$$\text{or } = 5 + 2(-4) = -3$$

$$x = 0, y = 5$$

$$x = -4, y = -3$$

(Total for Question 20 is 5 marks)



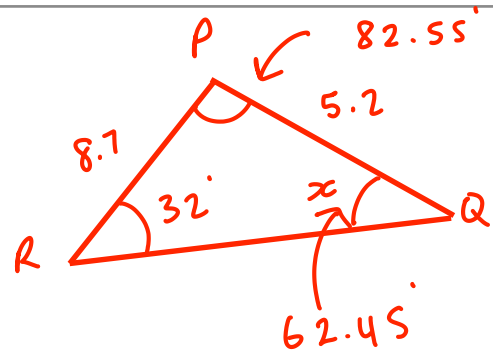
21 In triangle RPQ ,

$$RP = 8.7 \text{ cm}$$

$$PQ = 5.2 \text{ cm}$$

$$\text{Angle } PRQ = 32^\circ$$

- (a) Assuming that angle PQR is an acute angle, calculate the area of triangle RPQ .
Give your answer correct to 3 significant figures.



$$\frac{\sin(x)}{8.7} = \frac{\sin(32)}{5.2}$$

$$\sin(x) = \frac{\sin(32)}{5.2} \times 8.7 = 0.886..$$

$$\sin^{-1}(0.886...) = 62.45$$

$$180 - 32 - 62.45 = 85.55$$

$$\begin{aligned} \frac{1}{2} ab \sin c &= \frac{1}{2} (8.7)(5.2) \times \sin(85.55) \\ &= 22.55.. \end{aligned}$$

$$\underline{22.6} \text{ cm}^2$$

(4)

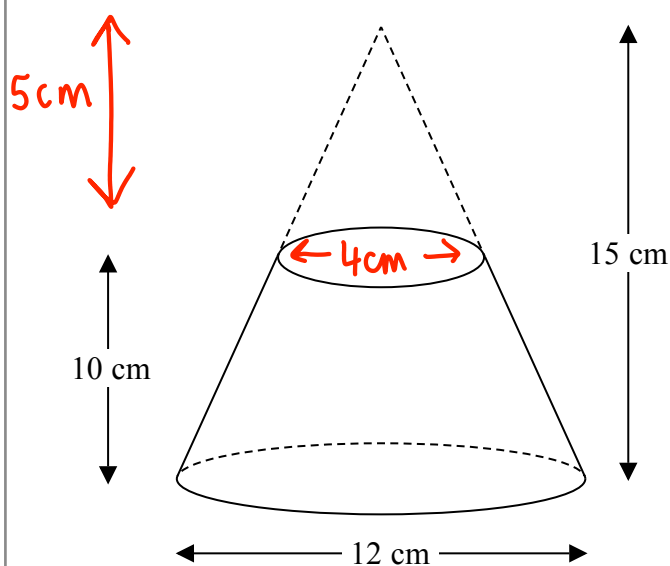
- (b) If you did not know that angle PQR is an acute angle, what effect would this have on your calculation of the area of triangle RPQ ?

There would be two possible values for PQR , and so there would be two possible answers for the area of the triangle

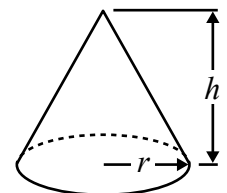
(1)

(Total for Question 21 is 5 marks)

22 A frustum is made by removing a small cone from a large cone as shown in the diagram.



$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$



The frustum is made from glass.

The glass has a density of 2.5 g/cm^3

Work out the mass of the frustum.

Give your answer to an appropriate degree of accuracy.

Volume frustum :

$$\text{Large cone : } \frac{1}{3}\pi(6)^2 \times 15 = 180\pi$$

$$\text{Small cone : } \frac{1}{3}\pi(2)^2 \times 5 = \frac{20}{3}\pi$$

$$180\pi - \frac{20}{3}\pi = 544.543$$

$$M = D \times V$$

$$= 2.5 \times 544.543 = 1361.356 \dots \quad 1361$$

1361 or 1360 or 1400 g

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS