

Write your name here

Surname

Just Maths

Other names

Pearson Edexcel

Level 1/Level 2 GCSE (9 - 1)

Centre Number

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Candidate Number

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# Mathematics

worked solutions

## Paper 2 (Calculator)

Higher Tier

Sample Assessment Materials – Issue 2

Time: 1 hour 30 minutes

Paper Reference

1MA1/2H

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**



### Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

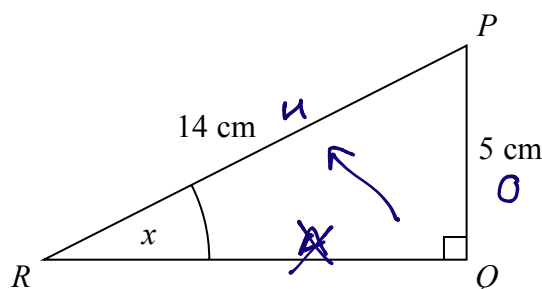
- 1 Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7  
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

$$\begin{array}{ccc} F & : & M & : & S \\ 4 & & 5 & & 7 \\ & & & & \underbrace{\phantom{000}} \\ & & & & 18 \text{ more than} \\ & & & & \text{Frank} \end{array} \quad \begin{array}{l} 3 \text{ "parts" more} \\ 18 \div 3 = 6 \end{array}$$
$$\begin{array}{ccc} 4 \times 6 & 5 \times 6 & 7 \times 6 \\ 24 & : & 30 & : & 42 \end{array}$$
$$24 + 30 + 42 = 96$$

(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.

$$\begin{aligned} \sin x &= \frac{5}{14} \\ x &= \sin^{-1}\left(\frac{5}{14}\right) \\ &= 20.92483243 \end{aligned}$$

20.9

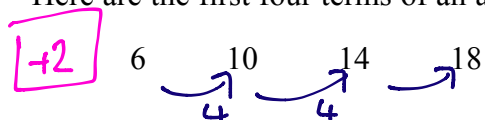
(Total for Question 2 is 2 marks)

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



(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.

$$\begin{aligned} 3n + 5 &= 108 \\ 3n &= 103 \\ n &= \frac{103}{3} = 34.\dot{3} \end{aligned}$$

' $n$ ' is not a whole number so 108 is not in the sequence

(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<br>30 miles<br>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.

30 miles in 26 mins

$$30 \div 26 = 1.153846 \text{ miles per minute} \\ \times 6$$

$$= 69.230769 \text{ miles per hour}$$

Lethna is not right

(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 |
|-----------------------|------------------|
| $16 \leq f < 18$      | 3                |
| $18 \leq f < 20$      | 6                |
| $20 \leq f < 22$      | 10               |
| $22 \leq f < 24$      | 12               |
| $24 \leq f < 26$      | 9                |



| Mid | $F \times M$ |
|-----|--------------|
| 17  | 51           |
| 19  | 114          |
| 21  | 210          |
| 23  | 276          |
| 25  | 225          |
| 40  | 876          |

- (a) Write down the modal class interval.

$$22 \leq f < 24$$

(1)

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

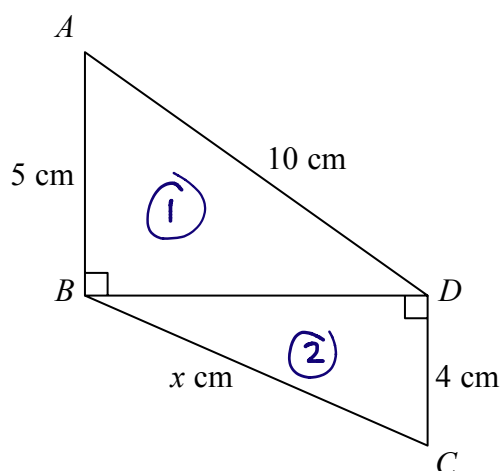
$$876 \div 40$$

$$21.9 \text{ cm}$$

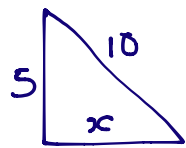
(3)

(Total for Question 5 is 4 marks)

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

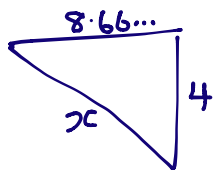


Work out the value of  $x$ .  
Give your answer correct to 2 decimal places.



$$10^2 - 5^2 = 100 - 25$$

$$x = \sqrt{75}$$

$$= 8.660254033$$


$$8.660254033^2 + 4^2$$

$$75 + 16 = 91$$

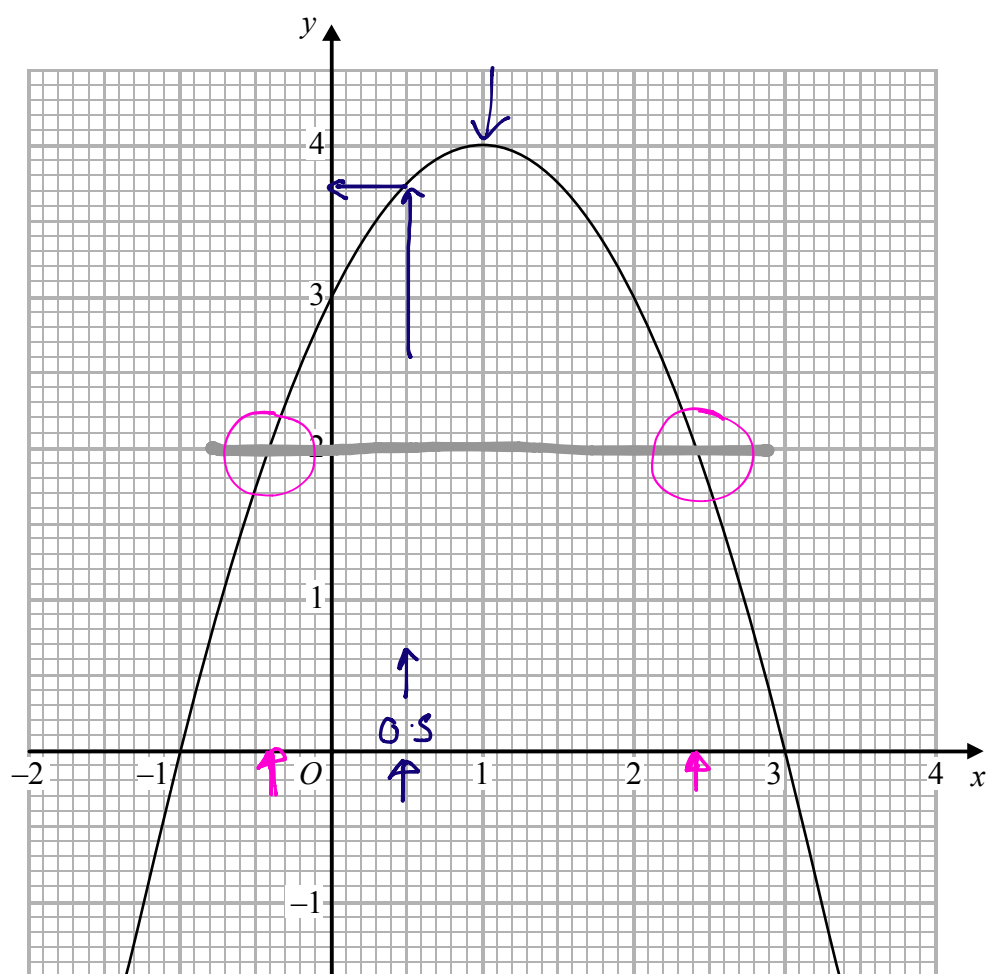
$$x = \sqrt{91}$$

$$= 9.539392014$$

9.54 cm (2dp)

(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

(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.

$$\begin{aligned} \text{Red} &= 3 \times \text{green} = 6x \\ \text{Green} &= 2 \times \text{blue} = 2x \\ \text{Blue} &= x \end{aligned}$$

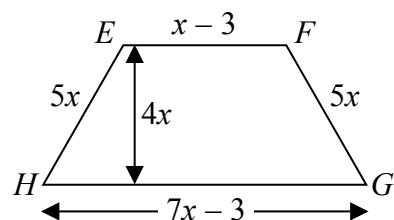
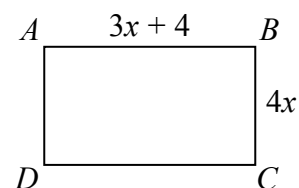
$$\begin{aligned} R : G : B \\ 6 : 2 : 1 \end{aligned}$$

$$6 : 2 : 1$$

(Total for Question 8 is 2 marks)



- 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.

$ABCD$

$EFGH$

$$3x + 4 + 4x + 3x + 4 + 4x = x - 3 + 5x + 7x - 3 + 5x$$

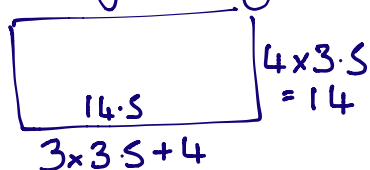
$$14x + 8 = 18x - 6$$

$$14x + 14 = 18x$$

$$4x = 14$$

$$x = 3.5 \text{ cm}$$

area of rectangle



$$14.5 \times 14 = 203 \text{ cm}^2$$

203 cm<sup>2</sup>

(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.

$$2000 \times 1.025 = 2050$$

$$2050 \times \left(1 + \frac{x}{100}\right)^2 = 2124.46$$

$$\left(1 + \frac{x}{100}\right)^2 = \frac{2124.46}{2050}$$

$$1 + \frac{x}{100} = \sqrt{\frac{2124.46}{2050}}$$

$$\frac{x}{100} = 1.017996593 - 1$$

$$x = 0.017996593 \times 100 = 1.799659782\%$$

$$1.799\%$$

(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.

$$\frac{100\%}{112.5\%} = 225$$

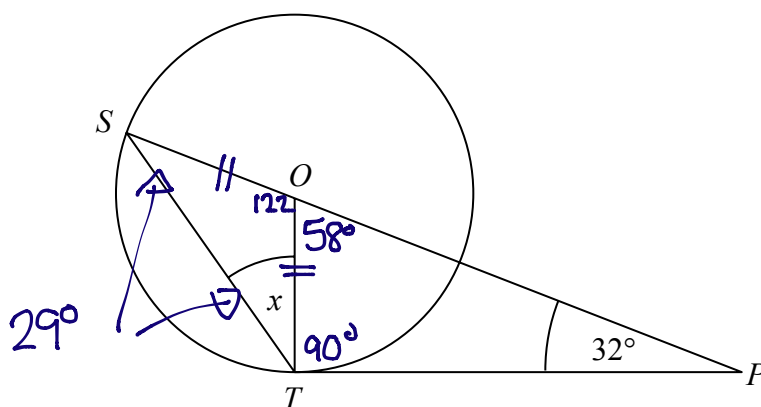
$$\begin{aligned} \div 112.5 \quad 112.5\% &= 225 \quad \div 112.5 \\ 1\% &= 2 \\ 100\% &= \pounds 200 \end{aligned}$$

$$\pounds 200$$

(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.

$\text{OTP} = 90^\circ$  angle between tangent and radius =  $90^\circ$   
 $\text{POT} = 58$  angles in a triangle =  $180^\circ$   
 $\text{TOS} = 180 - 58 = 122$  angles on a straight line =  $180$   
 $\text{SO}$  and  $\text{OT} = \text{equal length}$   
 $180 - 122 = 58 \quad 58 \div 2 = 29^\circ$   
 2 angles in an isosceles triangle are equal

$$x = 29^0$$

**(Total for Question 11 is 4 marks)**

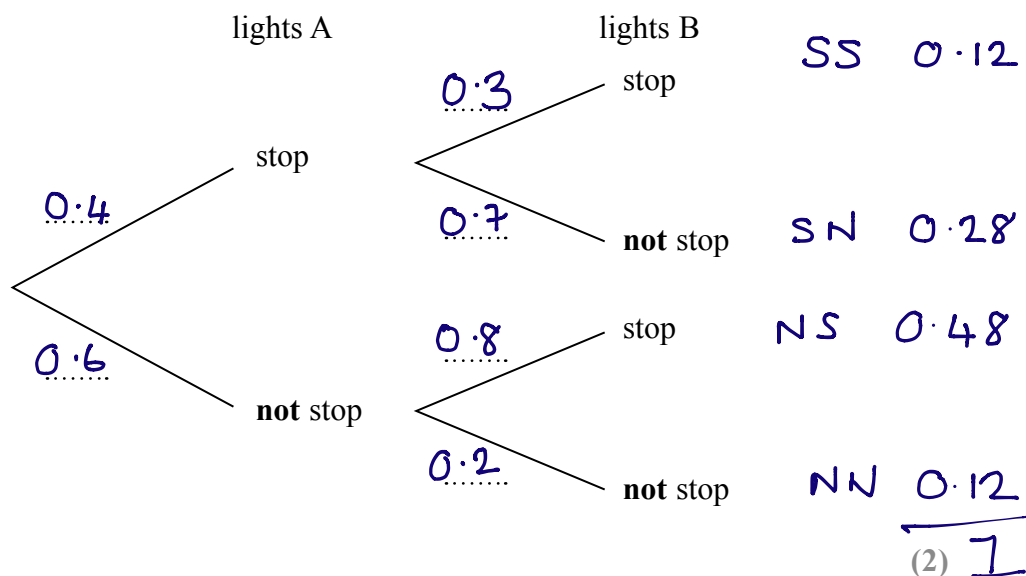
12 A and B are two sets of traffic lights on a road.

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.



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.

$$\begin{array}{l} SN \\ A \quad B \end{array} = 0.28 \qquad \begin{array}{l} NS \\ A \quad B \end{array} = 0.48$$

more likely to be stopped by 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  $c = 350$

$$d \propto \frac{1}{c} \quad d = \frac{k}{c} \quad 25 = \frac{k}{280} \quad k = 7000$$

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

$$d = 20$$

(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  $n$ .

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

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

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

$n+1$  = could be odd or even

But  $2n(n+1)$  will always be even ( $2 \times \text{any whole number is even}$ )

(Total for Question 14 is 3 marks)

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

$$\begin{aligned} x &= 0.25555\ldots \\ 10x &= 2.5555\ldots \\ \hline 9x &= 2.3 \\ x &= \frac{2.3}{9} \times \frac{10}{10} = \frac{23}{90} \text{ as required.} \end{aligned}$$

(Total for Question 15 is 2 marks)

- 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.

$$\begin{aligned} &\frac{1}{6x^2 + 7x - 5} \times \frac{4x^2 - 1}{1} \quad \leftarrow (2x-1)(2x+1) \\ &\begin{array}{l} 6x^2 - 3x + 10x - 5 \\ 3x(2x-1) + 5(2x-1) \\ (3x+5)(2x-1) \end{array} \\ &\begin{array}{l} a \times c = -30 \\ \begin{array}{l} 1, 30 \\ 2, 15 \\ 3, 10 \end{array} \end{array} \quad \begin{array}{l} (2x-1)(2x+1) \\ (3x+5)(2x-1) \\ = \frac{2x+1}{3x+5} \end{array} \\ &\qquad\qquad\qquad \frac{2x+1}{3x+5} \end{aligned}$$

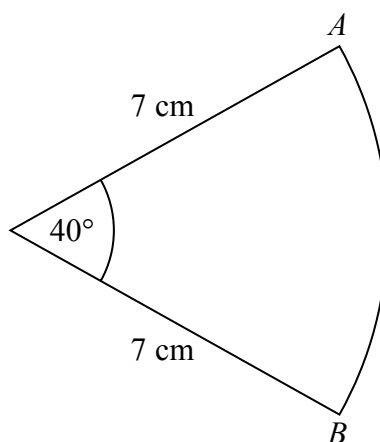
(Total for Question 16 is 3 marks)

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



$$\text{diameter} = 14$$

$$A = \pi r^2 \quad C = \pi \times d$$

Work out the length of arc  $AB$ .

Give your answer correct to 3 significant figures.

$$\frac{40}{360} \times \pi \times 14$$

$$= 4.886921906$$

$$4.89 \text{ cm}$$

(Total for Question 17 is 2 marks)

18  $m = \frac{\sqrt{s}}{t}$   $s = 3.47$  correct to 3 significant figures  
 $t = 8.132$  correct to 4 significant figures

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

$$s = 3.47 \begin{array}{l} \nearrow 3.475 \\ \phantom{\nearrow} 0.005 \\ \searrow 3.465 \end{array}$$

$$t = 8.132 \begin{array}{l} \nearrow 8.1325 \\ \phantom{\nearrow} 0.0005 \\ \searrow 8.1315 \end{array}$$

$$\frac{UB}{LB} \quad m = \frac{\sqrt{3.475}}{8.1315}$$

$$\frac{LB}{UB} \quad m = \frac{\sqrt{3.465}}{8.1325}$$

$$= 0.2292486243$$

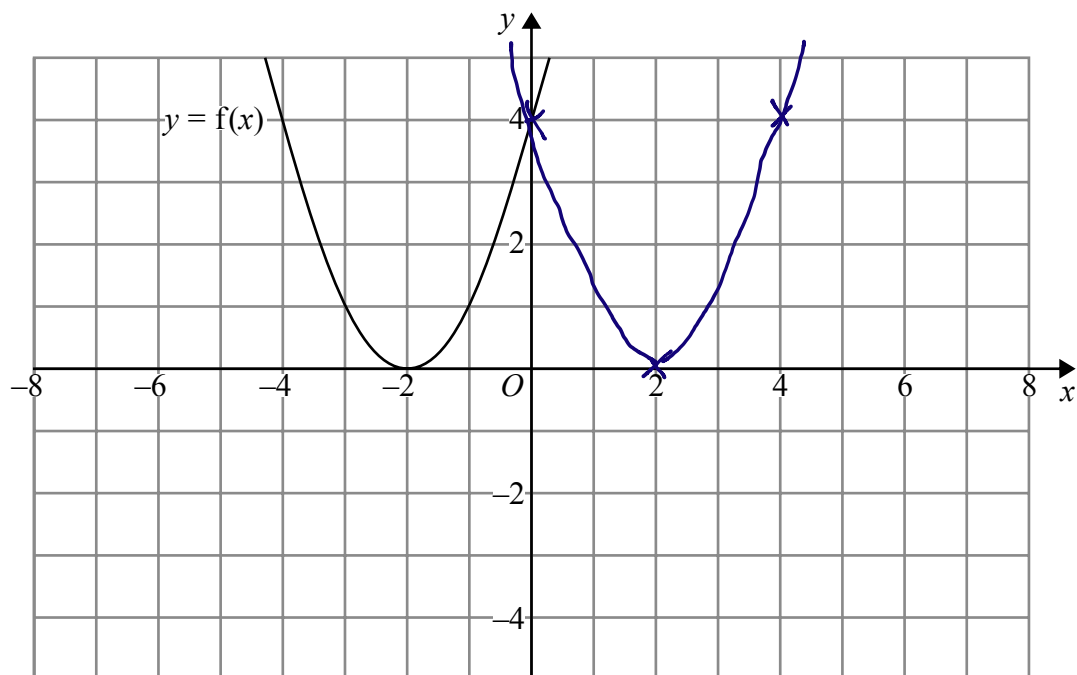
$$= 0.2288903839$$

$m = 0.229$  both UB and LB  
 round to this value

(Total for Question 18 is 5 marks)

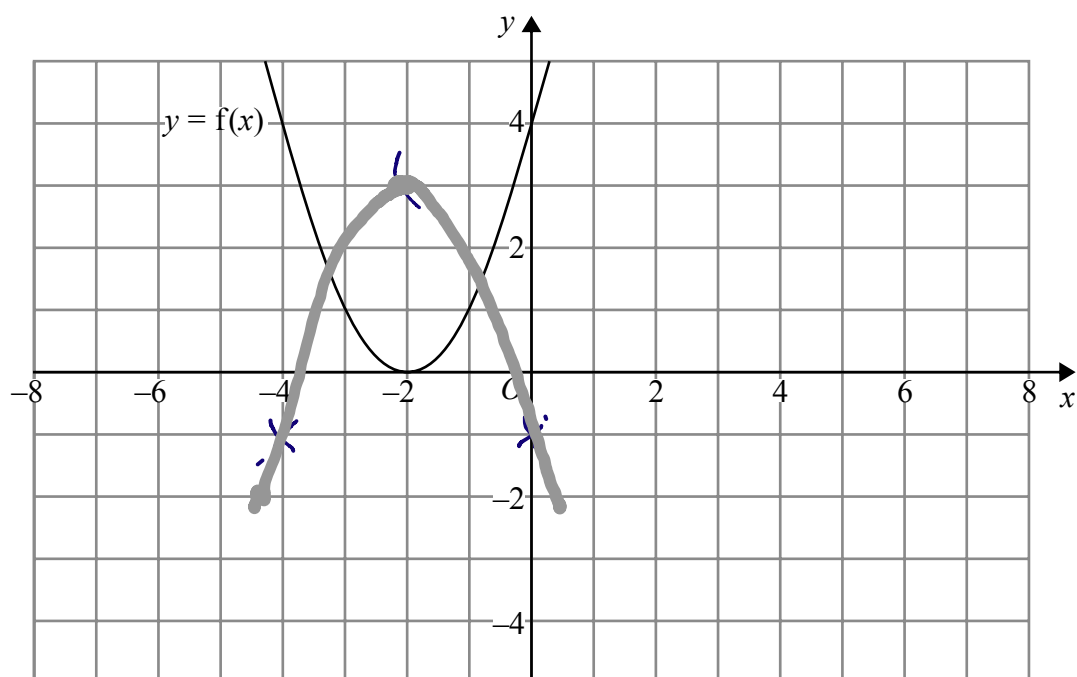


19 The graph of  $y = f(x)$  is shown on both grids below.



(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)

(Total for Question 19 is 2 marks)

20 Solve algebraically the simultaneous equations

$$\begin{aligned}x^2 + y^2 &= 25 & \text{--- (1)} \\y - 2x &= 5 & \text{--- (2)}\end{aligned}$$

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

$$\begin{aligned}y^2 &= (5 + 2x)(5 + 2x) \\&= 25 + 10x + 10x + 4x^2\end{aligned}$$

sub into (1)  $x^2 + 25 + 20x + 4x^2 = 25$

$$5x^2 + 20x = 0$$

$$5x(x + 4) = 0$$

$$x = 0$$

$$x = -4$$

$$\begin{aligned}y &= 5 + 2 \times 0 \\&= 5\end{aligned}$$

$$\begin{aligned}y &= 5 + 2 \times -4 \\&= 5 - 8 = -3\end{aligned}$$

$$(0, 5)$$

$$(-4, -3)$$

$$(0, 5) \quad (-4, -3)$$

(Total for Question 20 is 5 marks)

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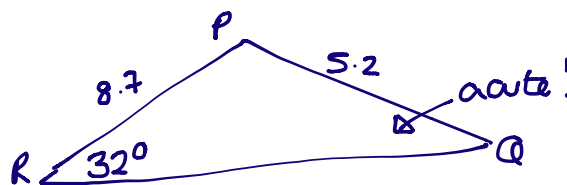
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21 In triangle  $RPQ$ ,

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

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

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



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

$$\boxed{\frac{\sin Q}{8.7} = \frac{\sin P}{p} = \frac{\sin 32}{5.2}}$$

$$\sin Q = \frac{\sin 32}{5.2} \times 8.7$$

$$Q = \sin^{-1}(0.88659\dots)$$

$$= 62.44853\dots$$

$$P = 180 - (32 + 62.44853\dots)$$

$$= 85.55146812^\circ$$

$$\text{Area} = \frac{1}{2} \times 8.7 \times 5.2 \times \sin 85.55$$

$$= 22.55185522$$

$$= \underline{\underline{22.6 \text{ cm}^2}} \text{ (3 s.f.)}$$

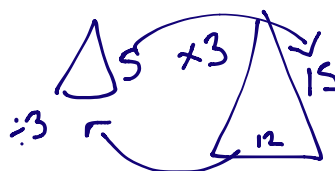
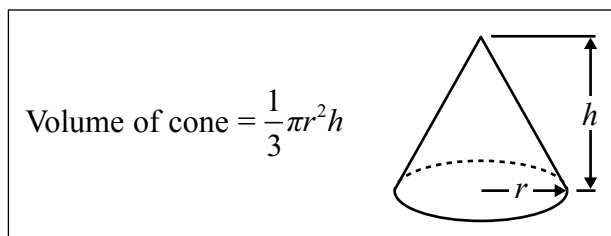
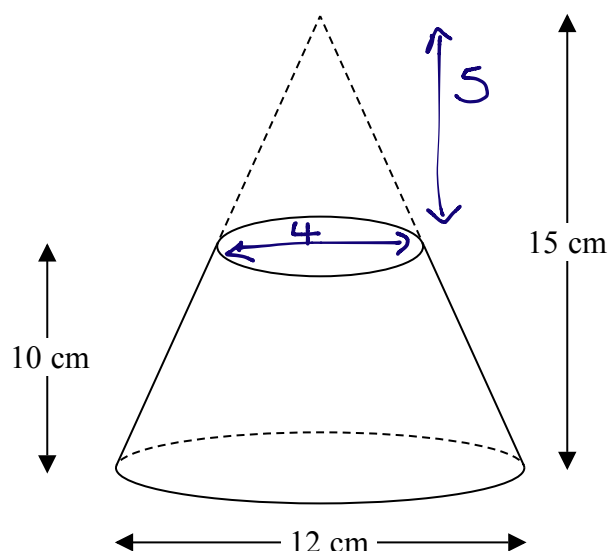
.....cm<sup>2</sup>  
(4)

- (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  $RPQ$ ?

(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.



The frustum is made from glass.

The glass has a density of  $2.5 \text{ g/cm}^3$

Work out the mass of the frustum.

Give your answer to an appropriate degree of accuracy.

$$\begin{aligned} \text{Volume} &= \frac{1}{3} \times \pi \times 6^2 \times 15 \\ \text{large cone} &= 180\pi \end{aligned}$$

$$\begin{aligned} \text{small cone} &= \frac{1}{3} \times \pi \times 2^2 \times 5 \\ &= \frac{20}{3}\pi \end{aligned}$$

$$\text{Volume of frustum} = 180\pi - \frac{20}{3}\pi = 544.5427\dots$$

$$\begin{aligned} \text{Mass} &= 2.5 \times 544.5427\dots \\ &= 1361.356817 \end{aligned}$$

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

$$M = D \times V$$

1361

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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