

Write your name here

Surname

Other names

**Mr. FRANKS**

**Pearson Edexcel**

**Level 1/Level 2 GCSE (9 - 1)**

Centre Number

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Candidate Number

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# Mathematics

## 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.

MW  
106 & 107

Work out the total number of sweets they shared.

$$\begin{array}{l} F : M : S \quad \text{Total} \\ 4 : 5 : 7 \quad 16 \end{array}$$

Mary got  $\frac{5}{16}$  Seth got  $\frac{7}{16} \Rightarrow$  Seth got  $\frac{3}{16}$  more than Frank

Frank got  $\frac{4}{16}$  (P1) so  $\frac{3}{16} \Rightarrow 18$  sweets  $\downarrow \div 3$  (P1)  
 $\frac{1}{16} \Rightarrow 6$  sweets

96 (A1)  
Cao.

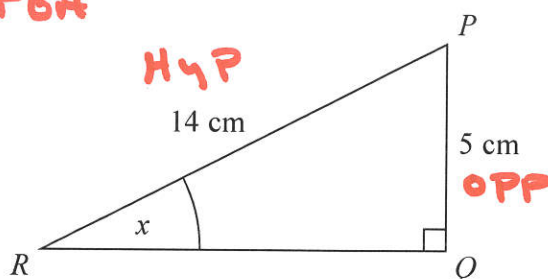
MW 168

$$\text{total no.} = 6 \times 16 = 96$$

(Total for Question 1 is 3 marks)

- 2  $PQR$  is a right-angled triangle.

SOH CAH TOA



Angle =  $x$ ?

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

$$\sin x = \frac{\text{OPP}}{\text{HYP}}$$

(A1)

(M1)

$$\sin x = \frac{5}{14}$$

$$x = 20.9^\circ$$

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

$$x = 20.9^\circ$$

(Total for Question 2 is 2 marks)

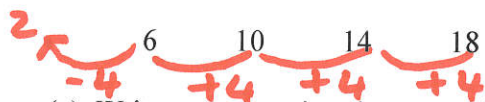
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3 Here are the first four terms of an arithmetic sequence.



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



$$4n + 2$$



(A1) Cao.

(2)

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

MW 102

(b) Is 108 a term of this sequence?

Show how you get your answer.

$$3n + 5 = 108$$

(M1)

(-5)

$$3n = 103$$

(÷3)

$$n = 34 \frac{1}{3}$$

(C1)

$n$  is not a whole number so No

108 is not in the sequence

(2)

Need a justifying statement.

(Total for Question 3 is 4 marks)

eg  $34^{\text{th}}$  term is  $3 \times 34 + 5 = \underline{\underline{107}}$

$35^{\text{th}}$  term is  $3 \times 35 + 5 = \underline{\underline{110}}$

misses out 108, so no

- 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.

$P_1 \quad 30 \div 70 = 0.428 \quad 26 \div 60 = 0.433 \quad 30 \div 26 = 1.153$   
 $P_1 \quad 60 \times 0.428 \dots \quad 70 \times 0.4333 \dots \quad 60 \times 1.153 \dots$   
 $\quad \approx 25.7 \text{ mins} \quad \approx 30.3 \text{ miles} \quad \approx 69.18 \text{ mph}$   
 $C_1 \quad \text{Travels 30 miles in 25.7 minutes} \quad \text{Travels 30.3 miles in 26 minutes} \quad \text{Travels 30 miles at a speed of 69.18 mph}$   
**and Conclusion**

So NO. Lethna is wrong. You need to travel at 69.23 mph. or you can cover 30.3 miles when travelling at 70 mph.

(Total for Question 4 is 3 marks)

OR.  $26 \text{ mins} \Rightarrow 30 \text{ miles}$   
 $1 \text{ min} \Rightarrow \frac{30}{26} \text{ miles}$   
 $60 \text{ mins} \Rightarrow \frac{30 \times 60}{26} \text{ miles} = \underline{\underline{69.23 \text{ mph}}}$   
or  $70 \text{ mph}$   $60 \text{ mins} \Rightarrow 70 \text{ miles}$   
 $1 \text{ min} \Rightarrow \frac{70}{60} \text{ miles}$   
 $26 \text{ mins} \Rightarrow \frac{70 \times 26}{60} \text{ miles} = \underline{\underline{30.3 \text{ miles}}}$



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

MW 130b

Foot length ( $f$ cm)	Number of adults	mp	$\Sigma fx$
$16 \leq f < 18$	3	17	51
$18 \leq f < 20$	6	19	114
$20 \leq f < 22$	10	21	210
$22 \leq f < 24$	12	23	276
$24 \leq f < 26$	9	25	225
	$\Sigma 40$	$\Sigma$	876

mi

- (a) Write down the modal class interval.

(B1)  $22 \leq f < 24$   
(1)

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

mean =  $\frac{876}{40} = 21.9$  ~~22~~

mi

(A1)  $21.9$  cm  
(3)

(Total for Question 5 is 4 marks)

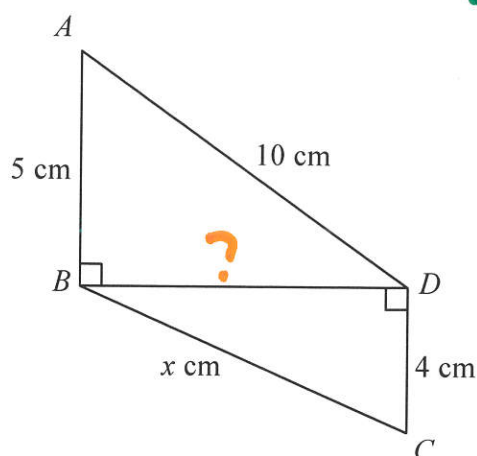
M1 ~ for multiplying midpoint by no. of adults

M1 dep. ft. ~  $876 \div 40$

A1 for 21.9

ONLY allow 22 if workings shown.  
ie NO marks for 22 without workings.

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



MW  
150 a  
or 150 b

Work out the value of  $x$ .

Give your answer correct to 2 decimal places.

$$\begin{aligned} ? &= \sqrt{10^2 - 5^2} = \sqrt{75} \\ &= 5\sqrt{3} \\ &= 8.660254038 \end{aligned}$$

(PI)

or sighting of 75

$$\begin{aligned} x &= \sqrt{8.660^2 + 4^2} \\ &= 9.54 \text{ cm} \end{aligned}$$

(PI)

f.t.

sighting of "75" + 4<sup>2</sup>

$$\begin{aligned} \text{OR } x &= \sqrt{75 + 4^2} \\ &= \sqrt{75 + 16} \\ &= \sqrt{91} \end{aligned}$$

9.54

(Total for Question 6 is 4 marks)

$$= 9.539\dots$$

allow any answer between & including 9.53 and 9.54

[units NOT wanted as  $x$  cm  $\Rightarrow$  but do not drop a

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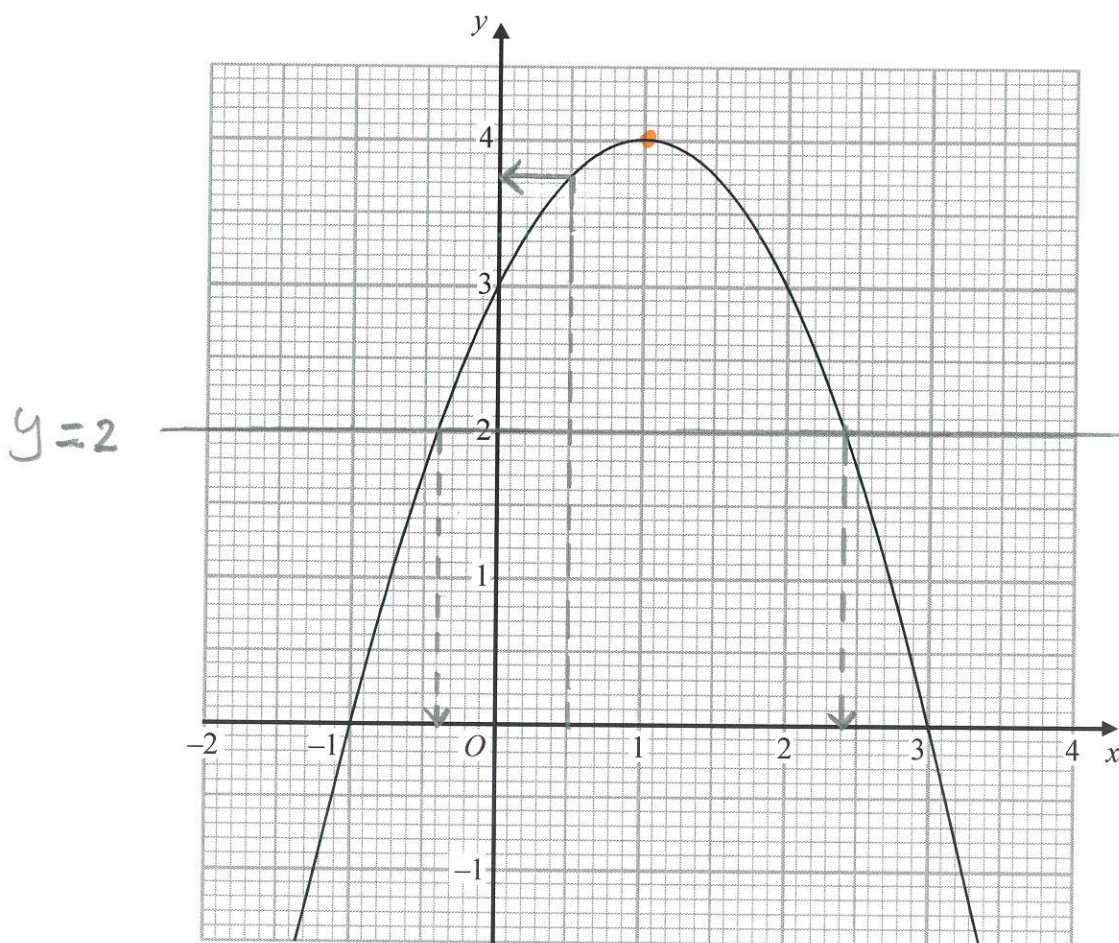
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mark if they have put 9.54 cm]



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

MW 160



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

more than 1 solution

(B1) (1, 4)  
(1)

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

i.e. the solution.

Need both answers

(B1) -0.4, 2.4  
(1)

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

Value of  $x$  is 0.5

Allow 3.7 → 3.8 inclusive

At  $x = 0.5$  the vertical

line meets the curve at 3.75

(B1) 3.75  
(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.

Let blue be one part

Green will be 2 parts

Red will be 6 parts

Red : Green : Blue

6 : 2 : 1 (A1)

(Total for Question 8 is 2 marks)

(M1) for one correct interpretation,

eg 3 : 1

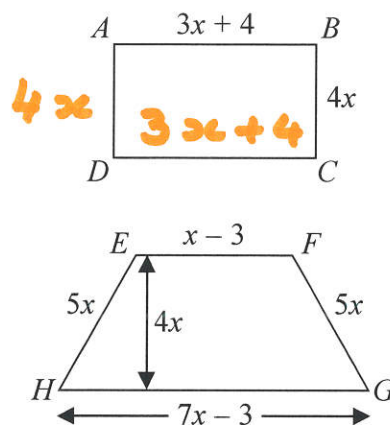
2 : 1

1 : 0.5



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

MW 137  
 & MW 135



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

Work out the area of the rectangle.

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

(P1)  $\Rightarrow$  translate into algebraic expression either for rectangle or trapezium

(P1)  $14x + 8 = 18x - 6$

$-14x$

$-14x$

Forming an equation

$8 = 4x - 6$  (+6)

(+6)

$14 = 4x$

$\frac{14}{4} = x$

$x = 3.5$  (A1) o.e. [eg  $3\frac{1}{2}$ ]

Area of Rectangle =  $4x(3x + 4)$

$l = 14.5$

$w = 14$

$= 4 \times 3.5(3 \times 3.5 + 4)$

(P1)  $14 \times 14.5$  f.to  $= 203 \text{ cm}^2$

(A1)

203  $\text{cm}^2$

cao

(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.

$$\text{1st year} = 2000 \times 1.025 = \pounds 2050$$

(P1)

Next two years

$$\text{(P1)} \quad 2050 \times \left(1 + \frac{x}{100}\right)^2 = 2124.46$$

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

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

$$x = 100 \left( \sqrt{\frac{2124.46}{2050}} - 1 \right) \quad (4)$$

$$x = 1.8\%$$

(A1)

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.

$$\text{Now } x = 100\%$$

$$\pounds 225 = 112.5$$

$$\div 1.125$$

(M1) o.e.

$$x = 225 \div 1.125$$

$$= \pounds 200$$

(A1)

$$\pounds 200 \quad (2)$$

(Total for Question 10 is 6 marks)

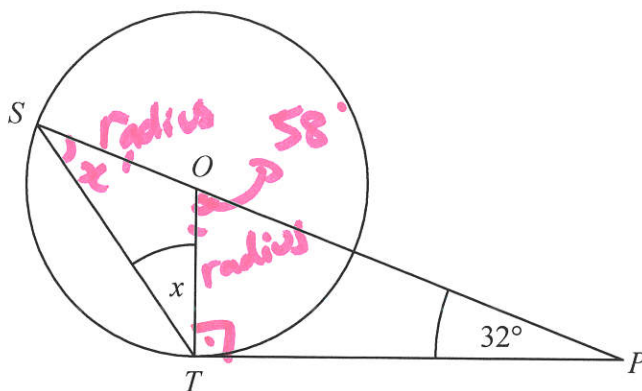
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Mw183



$S$  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  $OPT = 32^\circ$

can annotate diagram.

Work out the size of the angle marked  $x$ .  
 You must give a reason for each stage of your working.

angle  $OTP = 90^\circ$  (C1) the angle between radius and tangent =  $90^\circ$   
 $90 + 32 = 122$   
 $180 - 122 = 58$   
 angle  $TOP = 58^\circ$  (M1) Sum of angles in a triangle =  $180^\circ$   
 \*  $x + x = 58$

$$x + x = 58$$

$$2x = 58$$

$$x = \frac{58}{2} = 29^\circ$$

base angles of isosceles triangle are equal. (M1)

exterior angle of a triangle equal to sum of interior opposite angles. (C1)

\* OR Angle at the centre is twice angle at circumference

so  $x = \frac{58}{2} = 29^\circ$

all reasons needed for final mark.

(Total for Question 11 is 4 marks)

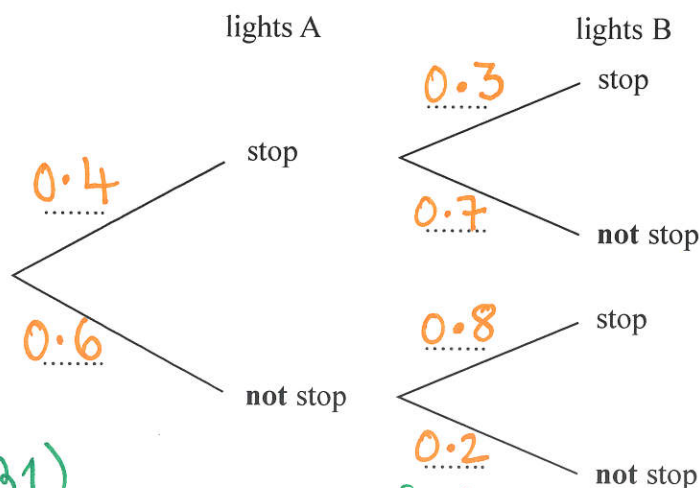
12 A and B are two sets of traffic lights on a road.

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.



(B1)  
for 0.4 & 0.6

(B1)  
for these branches

(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.

No workings, no marks!

$$P(\text{stopped by lights A only}) = 0.4 \times 0.7 = \underline{\underline{0.28}}$$

f.t.

$$P(\text{stopped by lights B only}) = 0.6 \times 0.8 = \underline{\underline{0.48}}$$

f.t.

More likely that he was stopped by lights B

(P1) for one correct multiplication shown

(P1) for the other multiplication shown.

(C1)

No workings  
→ No marks

(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  $c = 350$

$$d \propto \frac{K}{c} \quad d = \frac{K}{c} = 25 = \frac{K}{280}$$

(1M)

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

$$25 \times 280 = K$$

$$7000 = K$$

Substitute  $K = 7000$

$$d = \frac{7000}{350} = \frac{700}{35} = 20$$

(M1)

$d = 20$  (1A)

(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  $n$ .

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

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

$$4n^2 + 2n \leftarrow \textcircled{P1} \text{ or } \rightarrow$$

Factorise  $2n(n+1)$

(M1) Any 3 terms

(C1)  $2n$  is a multiple of two hence  $2n(n+1)$  is also a multiple of 2 which makes it even

(Total for Question 14 is 3 marks)

MW189

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

$$10 \times (x = 0.2\dot{5}) \times 10$$

$$10x = 2.5\dot{5}$$

$$10x = 2.5\dot{5}$$

$$- x = 0.2\dot{5}$$


---


$$9x = 2.3$$

$$x = \frac{2.3 \times 10}{9 \times 10}$$

$$x = \frac{23}{90}$$

correct working must be shown  
as each step needed  
for full marks.

(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.

$$6x^2 + 7x - 5 = (3x + 5)(2x - 1)$$

$$4x^2 - 1 = (2x - 1)(2x + 1)$$

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

$$= \frac{2x + 1}{3x + 5} = \frac{ax + b}{cx + d}$$

this gets  
full  
marks.

$$a = 2$$

$$b = 1$$

$$c = 3$$

$$d = 5$$

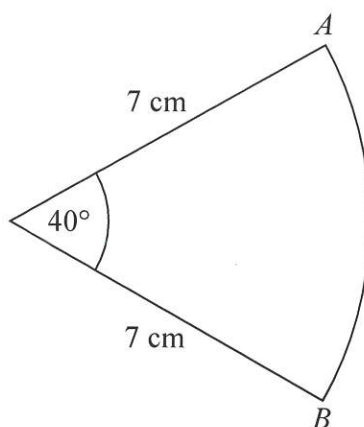
(Total for Question 16 is 3 marks)

first method mark either  $(3x \pm 5)(2x \pm 1) \Rightarrow$  signs need  
OR  $(2x - 1)(2x + 1)$  not be correct for



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

Mark 49  
162



Work out the length of arc  $AB$ .

Give your answer correct to 3 significant figures.

$$C = 2\pi \times 7$$

$$\frac{40}{360} \times 2 \times \pi \times 7$$

$$= 4.89$$

(M1)

(A1)

..... cm

(Total for Question 17 is 2 marks)

X Allow my answer

between 4.8 → 4.9 inclusive.

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

$s = 3.47$  correct to 3 significant figures

$t = 8.132$  correct to 4 significant figures

MW 206

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

minimum value of  $m = \frac{\sqrt{s_{\min}}}{t_{\max}}$  (P1)

(B1) for either

3.465 or 3.475  
(or 3.474999999)

$= \frac{\sqrt{3.465}}{8.1325}$  (P1)

or 8.1315 or  
8.1325 (or 8.132499999)

$= 0.2288903839$

maximum value of  $m = \frac{\sqrt{s_{\max}}}{t_{\min}}$

$= \frac{\sqrt{3.475}}{8.1315}$

$= 0.2292486243$

Both needed

To 3 sig. figs both are 0.229 (C1) with appropriate comment.

(Total for Question 18 is 5 marks)

for the two ~~process~~ process marks, can have in  
either  $M_{\min}$  or  $M_{\max}$

\* N.B. No workings  $\Rightarrow$  NO marks at all.  
ie No marks for doing  $\frac{\sqrt{3.47}}{8.132}$

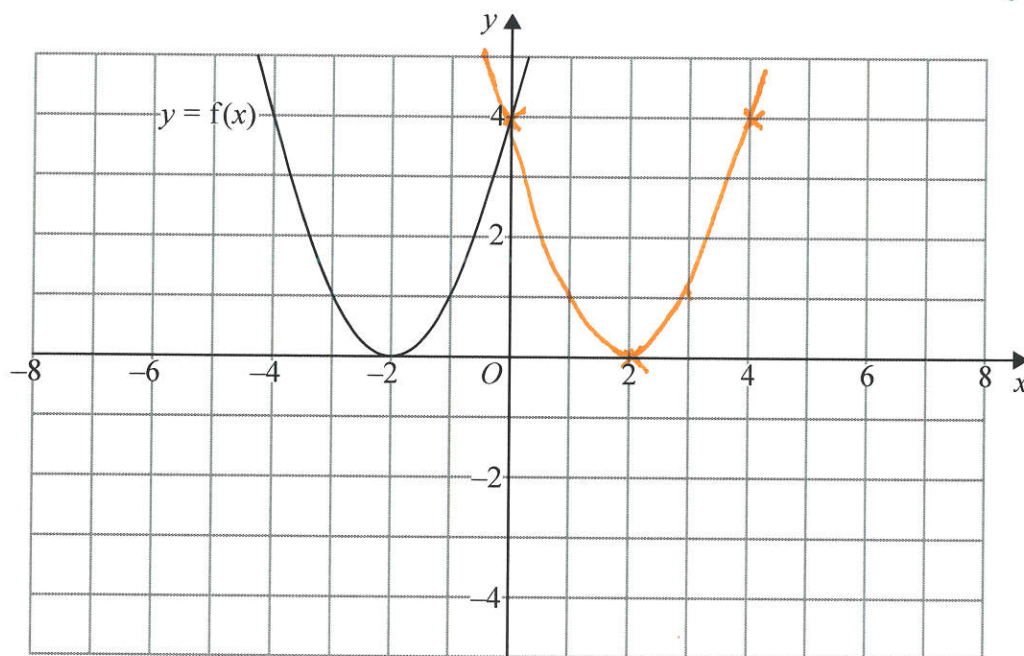
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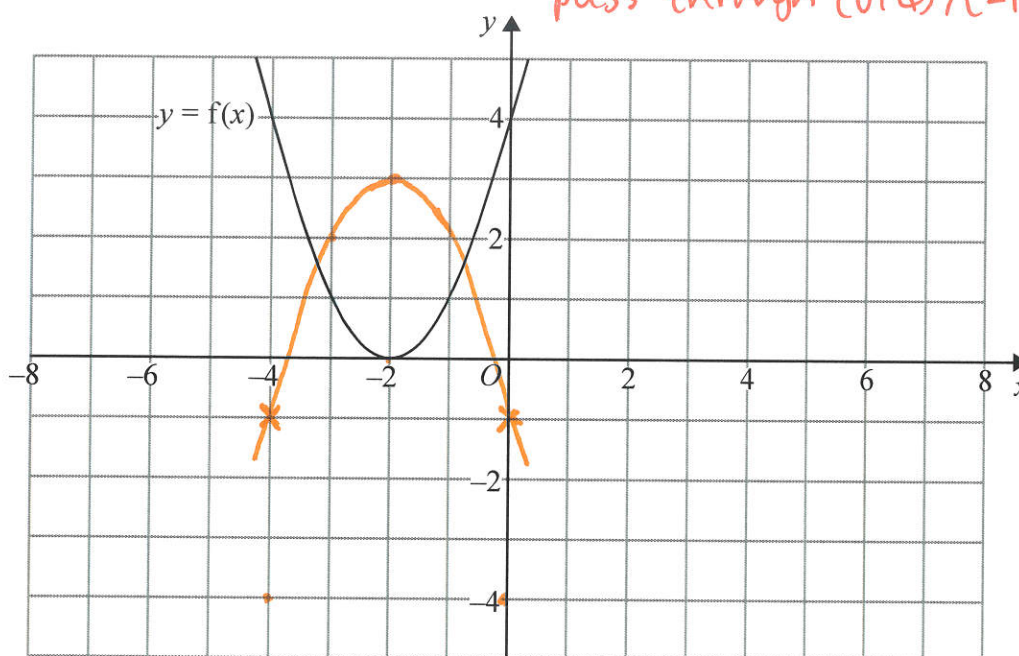


19 The graph of  $y = f(x)$  is shown on both grids below.



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

Parabola reflected in y axis.  
Must be correct shape and  
pass through  $(0, 4)$ ,  $(2, 0)$  &  
 $(4, 4)$



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

parabola passing through  $(-4, -1)$ ,  $(-2, 3)$ ,  $(0, -1)$

(Total for Question 19 is 2 marks)

20 Solve algebraically the simultaneous equations

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

~~14/20/15~~  
MW 211

$$y = 2x + 5$$

$$x^2 + (2x + 5)^2 = 25 \quad (M1)$$

$$x^2 + 4x^2 + 20x + 25 = 25 \quad (M1)$$

$$5x^2 + 20x + 25 = 25$$
$$\phantom{5x^2 + 20x} - 25 \quad - 25$$

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

$$5x(x + 4) = 0 \quad (M1)$$

$$x = 0 \quad x = -4 \quad (A1)$$

Substitution  $\rightarrow$

$$y = 2x + 5$$

$$y = 2 \times 0 + 5$$

$$y = 5$$

$$y = 2x + 5$$

$$y = 2 \times (-4) + 5$$

$$y = -8 + 5$$

$$y = -3$$

$$x = 0$$

$$y = 5$$

$$x = -4$$

$$y = -3 \quad (C1)$$

(Total for Question 20 is 5 marks)

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21 In triangle  $RPQ$ ,

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

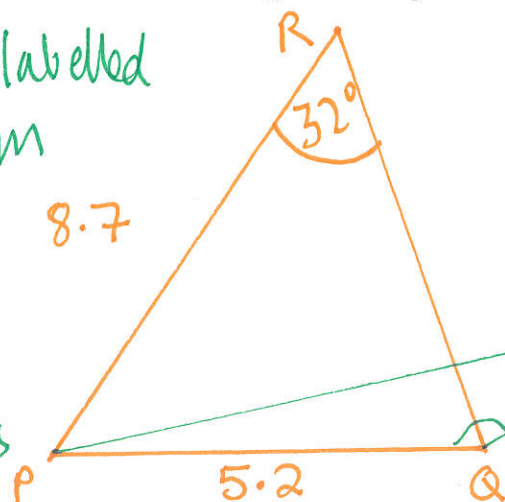
$$PQ = 5.2 \text{ cm}$$

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

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

(P1) either labelled diagram

OR  
sine rule  
with  
correct  
substitutions



Sine Rule  $\frac{\sin Q}{8.7} = \frac{\sin 32^\circ}{5.2}$

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

(P1)

$$\sin Q = 0.88659 \dots$$

$$Q = 62.4^\circ$$

Do not need to give the answer,  
as it asks for the effect.

- (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  $RPQ$ ?

$$\text{Then } \hat{Q} = 180^\circ - 62.4^\circ = 117.55^\circ$$

$$\text{so } \hat{P} = 180^\circ - (32^\circ + 117.55^\circ) = 30.44^\circ$$

$$\text{so Area} = \frac{1}{2} \times 5.2 \times 8.7 \times \sin 30.44^\circ < \frac{1}{2} \times 5.2 \times 8.7 \times \sin 85.55^\circ$$

The angle at P is smaller, so it is reduced.

(Total for Question 21 is 5 marks)

(C1)

$$\hat{P} = 180^\circ - (32^\circ + 62.4^\circ)$$

$$\hat{P} = 85.55^\circ$$

$$\text{Area} = \frac{1}{2} ab \sin C$$

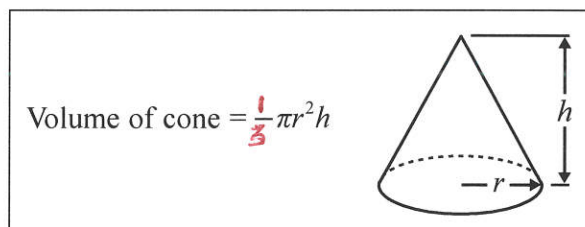
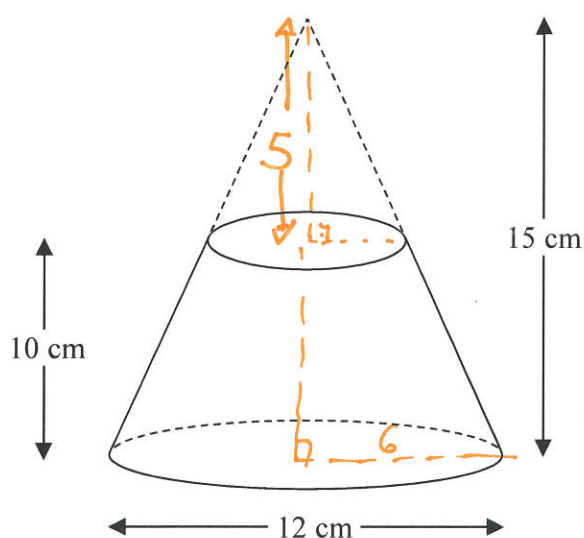
$$= \frac{1}{2} \times 5.2 \times 8.7 \times \sin 85.55^\circ$$

$$= 22.55$$

Allow any  
answer between  
22.5 → 22.6 inclusive

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

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



$$D = \frac{M}{V} \quad \text{so } \underline{M = D \times V}$$

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.

Volume of Large Cone or  
Small Cone

$$\text{Volume of Large Cone} = \frac{1}{3} \times \pi \times 6^2 \times 15 = 180\pi \quad (\text{P1})$$

$$\text{radius of small Cone} = \frac{1}{3} \text{ of } 6 = \underline{2\text{ cm}} \quad [\text{similar } \Delta\text{'s}] \quad (\text{P1})$$

$$\text{Volume of Small Cone} = \frac{1}{3} \times \pi \times 2^2 \times 5 = \frac{20}{3} \pi$$

$$[\text{OR can use volume factor } \frac{180}{27} \pi = \frac{20}{3} \pi] \quad (\text{P1})$$

$$\text{Volume of frustum} = 180\pi - \frac{20}{3}\pi = \frac{520}{3} \pi = \underline{544.54}$$

$$\text{Mass} = 2.5 \times 544.54 = \underline{1361.9} \quad (\text{P1}) \quad \underline{1360} \quad (\text{A1}) \text{ g}$$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

for final mark  $\Rightarrow$  appropriate degree of accuracy  
so 1361 or 1360 or 1400

[withhold final mark if answer given to 5 or more sig. figs]  
Final process mark allow 1360  $\rightarrow$  1362 inclusive.