Write your name here

Surname

Other names

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

Centre Number

Candidate Number

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 π button, take the value of π 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 ▶

S 4 8 5 7 4 A 0 1 2 0

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. ← *'The difference between Seth and Frank'*

    Work out the total number of sweets they shared.

F   M   S
4 : 5 : 7

7 − 4 = 3 ← *'Ratio difference'*
         }×6 ①
18 ← *'Real life difference'*

4 + 5 + 7 = 16 ← *'Ratio total'*

① 16 × 6 = 96 ← *'Real life total'*

3x = 18
$\frac{3x}{3} = \frac{18}{3}$
x = 6

96 ①

(Total for Question 1 is 3 marks)

2   *PQR* is a right-angled triangle.

H

14 cm

P

5 cm
O

x

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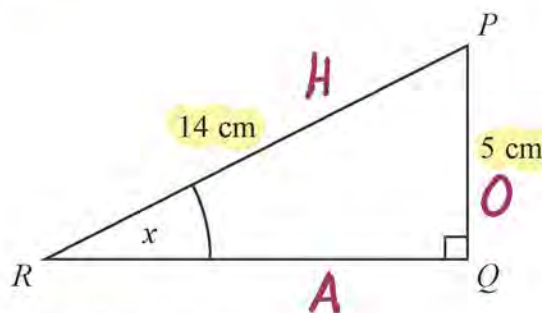
Work out the size of the angle marked *x*.
Give your answer correct to 1 decimal place.

SOHCAHTOA

$Sin\theta = \frac{O}{H}$

$Sin\,x = \frac{5}{14}$ ①

$x = Sin^{-1}\left(\frac{5}{14}\right)$ } *using calculator*

$x = 20.92483...$
$= 20.9°\,(1dp)$
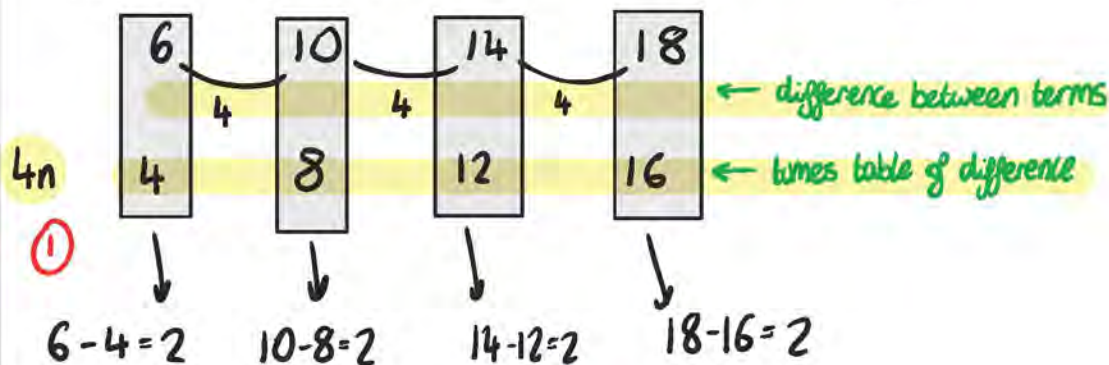
20.9° ①

(Total for Question 2 is 2 marks)

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

6   10   14   18

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

$4n$ ①

| 6 | 10 | 14 | 18 |

4   4   4   ← difference between terms

| 4 | 8 | 12 | 16 | ← times table of difference

$6 - 4 = 2$ $10 - 8 = 2$ $14 - 12 = 2$ $18 - 16 = 2$

So nth term is $4n + 2$ ①

$\underline{\hspace{1cm} 4n + 2 \hspace{1cm}}$

(2)

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

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

$3n + 5 = 108$ ①

$3n = 108 - 5$

$3n = 103$

$n = \dfrac{103}{3}$

$n = 34.\dot{3}$

So NO because $34.\dot{3}$ isn't an integer ①

Alternative Method

$3n + 5$ ①

try $n = 30$

$3(30) + 5 = 95$

try $n = 34$

$3(34) + 5 = 107$

try $n = 35$

$3(35) + 5 = 110$

Since 34th term is 107 and 35th term is 110 NO 108 isn't a term in the sequence ①

(2)

(Total for Question 3 is 4 marks)

(because n can only be integers because n refers to terms of a sequence, can't be a $34.\dot{3}$th term only 1st, 2nd, 3rd, ...)

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.

70 mph means 70 miles in 60 minutes

30 miles in 26 minutes ← we want to work out what speed in mph this represents

$60 \div 26 = \frac{30}{13}$ ① ← working out what to multiply 26 by to get 60

$26 \times \frac{30}{13} = 60$ ← minutes

$30 \times \frac{30}{13} = \frac{900}{13} = 69.23 \, (2dp)$ ← miles ①

69.23 miles in 60 minutes which is 69.23 mph

69.23 mph is less than 70 mph so NO
Lethna is wrong ①

(Total for Question 4 is 3 marks)

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

frequency (f)   *midpoints*

Foot length (f cm)	Number of adults	x	fx ①
$16 \leqslant f < 18$	3	17	$3 \times 17 = 51$
$18 \leqslant f < 20$	6	19	$6 \times 19 = 114$
$20 \leqslant f < 22$	10	21	$10 \times 21 = 210$
$22 \leqslant f < 24$	12	23	$12 \times 23 = 276$
$24 \leqslant f < 26$	9	25	$9 \times 25 = 225$

working out midpoint

$$\frac{16+18}{2} = \frac{34}{2} = 17$$

use same method to find midpoint for rest of the class intervals

Total :   40

876

add up all of fx

(a) Write down the modal class interval.

The highest frequency

total number of adults

$22 \leqslant f < 24$ ①

(1)
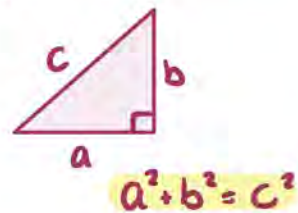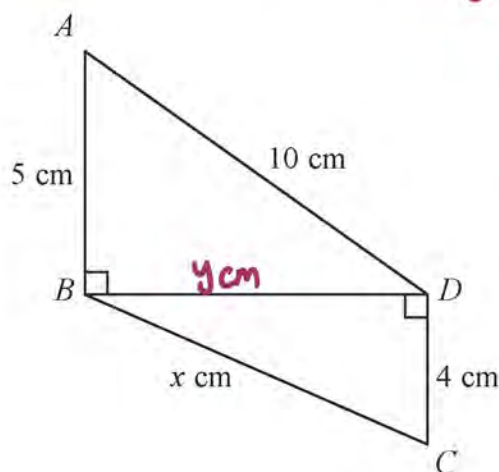
(b) Calculate an estimate for the mean foot length. ①

estimate mean $= \dfrac{total\ fx}{total\ f} = \dfrac{876}{40} = 21.9$

21.9 ①

........21.9........ cm

(3)

(Total for Question 5 is 4 marks)

6 Triangles *ABD* and *BCD* are right-angled triangles. → Pythagoras' theorem

$a^2 + b^2 = c^2$

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

For triangle ABD

$$y^2 + 5^2 = 10^2$$
$$y^2 = 10^2 - 5^2$$
$$y^2 = 75 \quad ①$$

For triangle BCD

$$y^2 + 4^2 = x^2$$
use $y^2 = 75$
$$75 + 4^2 = x^2$$
$$75 + 16 = x^2$$
$$x^2 = 91 \quad ①$$
$$x = \pm\sqrt{91} \quad ①$$
x is a length so reject $-\sqrt{91}$
$$x = \sqrt{91} = 9.54 \ (2dp)$$

$x = 9.54$ ①

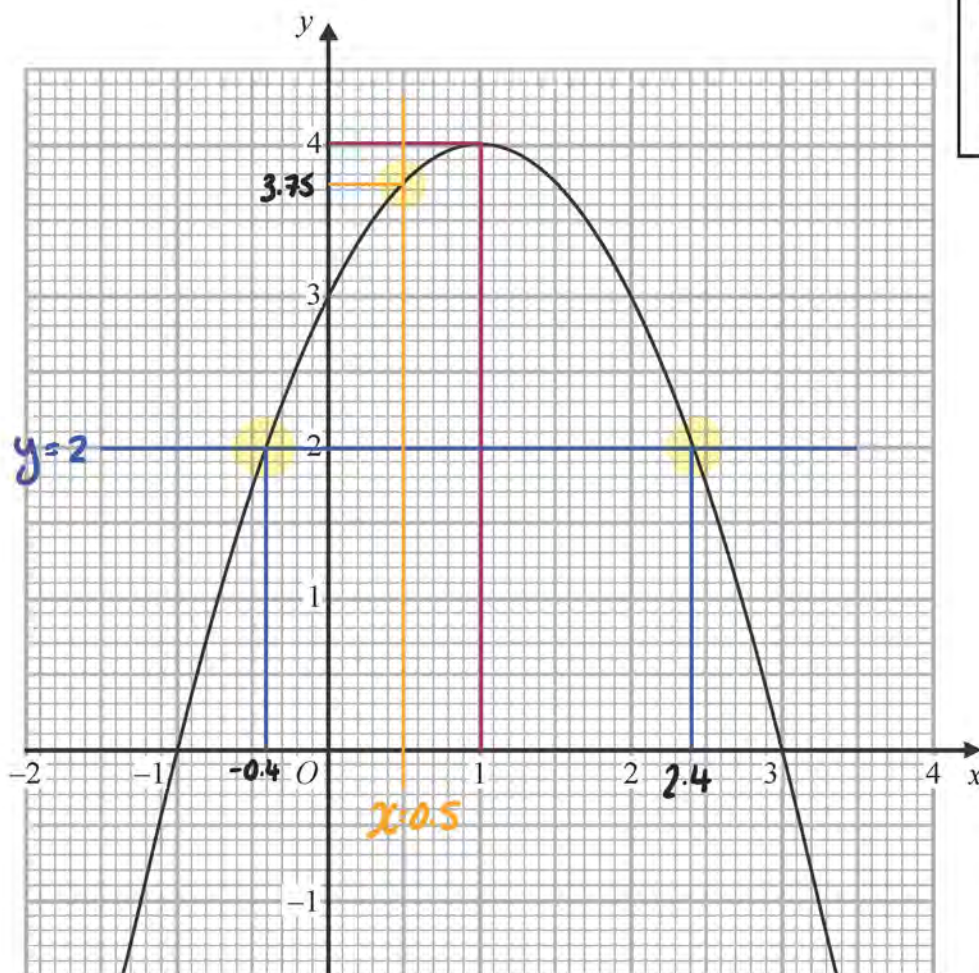**(Total for Question 6 is 4 marks)**

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

working for
part...
a) 🟥
b) 🟦
c) 🟧

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

① (....1...., ...4....)
(1)

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

① Draw line $y = 2$
② Roots are the x coordinates of where
   the line $y = 2$ intersects $y = f(x)$

① 2.4, -0.4 ....
(1)

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

① Draw line $x = 0.5$
② Write down y coordinate of intersection

3.75 ....
① (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.

R   G   G   B
3 : 1   2 : 1

×2

need these
numbers to
be the same

R   G   G   B
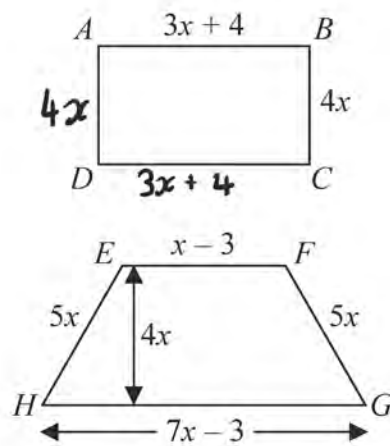6 : 2   2 : 1

6 : 2 : 1

(Total for Question 8 is 2 marks)

R   G   B
6 : 2 : 1

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

A $3x + 4$ B

$4x$ $4x$

D $3x + 4$ C

E $x - 3$ F

$5x$ $4x$ $5x$

H   G

$7x - 3$

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

Work out the area of the rectangle.

Perimeters

Trapezium: $x - 3 + 5x + 7x - 3 + 5x = 18x - 6$ ①

Rectangle: $3x + 4 + 4x + 3x + 4 + 4x = 14x + 8$ ①

two shapes have same perimeter

$18x - 6 = 14x + 8$ ①
$ +6 +6$
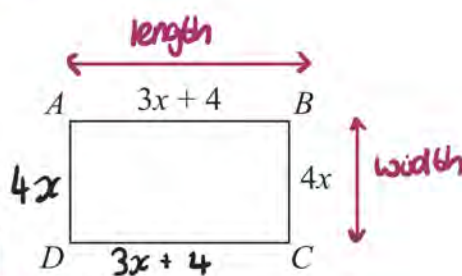$18x = 14x + 14$
$-14x -14x$
$4x = 14$
$\div 4 \div 4$
$x = \dfrac{14}{4} = 3.5$ ①

Area of rectangle

length

A $3x + 4$ B

$4x$ $4x$ width

D $3x + 4$ C

Area = length × width

Area $= [3(3.5) + 4] \times [4(3.5)]$
$= [10.5 + 4] \times [14]$ ①
$= 14.5 \times 14$
$= 203 \text{ cm}^2$

203 ① 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.

Compound interest: You earn interest on both the money you have saved and the interest you earn

Year 1: £2000 × 1.025 = £2050 ①

$\left[1 + \frac{2.5}{100}\right]$

Year 2: £2050 × $\left[1 + \frac{x}{100}\right]$

Year 3: £2050 × $\left[1 + \frac{x}{100}\right]$ × $\left[1 + \frac{x}{100}\right]$

create equation using info from question

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

$\left(1 + \frac{x}{100}\right)^2 = 1.0363...$

$1 + \frac{x}{100} = \sqrt{1.0363...}$

$1 + \frac{x}{100} = 1.01799...$ ①

$\frac{x}{100} = 0.01799...$

$x = 1.799... = 1.8 (1dp)$

1.8% ①

(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.

let C be the cost before the increase

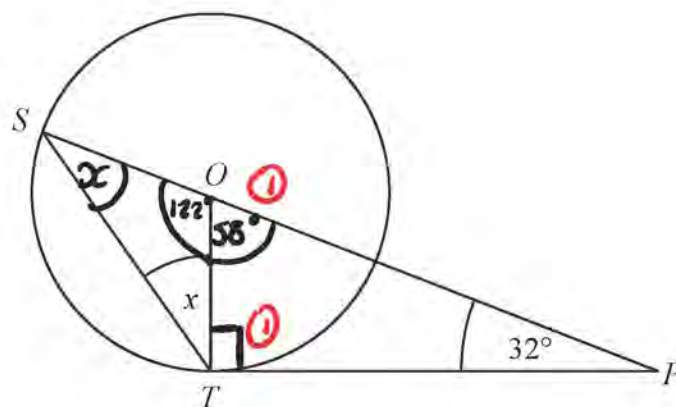$C \times \left(1 + \frac{12.5}{100}\right) = 225$

$C \times 1.125 = 225$

$C = \frac{225}{1.125}$ ①

$C = 200$

£ 200 ①

(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 $OPT = 32°$

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

Tangents and radius meet at 90° so angle PTO is 90°
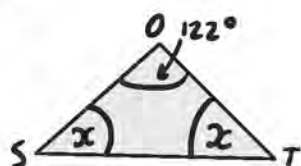
Interior angles of triangle add to 180°

$\qquad$ 180 - 32 - 90 = 58 So angle POT is 58°

Angles at a point on a straight line add to 180°

$\qquad$ 180 - 58 = 122 so angle SOT is 122°

OS and OT are both the radius so are the same length
meaning triangle SOT must be isosceles
∴ angle TSO is x

(1) Reasoning

(Total for Question 11 is 4 marks)

Interior angles of triangle add to 180°

$\qquad$ $x + x + 122 = 180$
$\qquad$ $2x + 122 = 180$
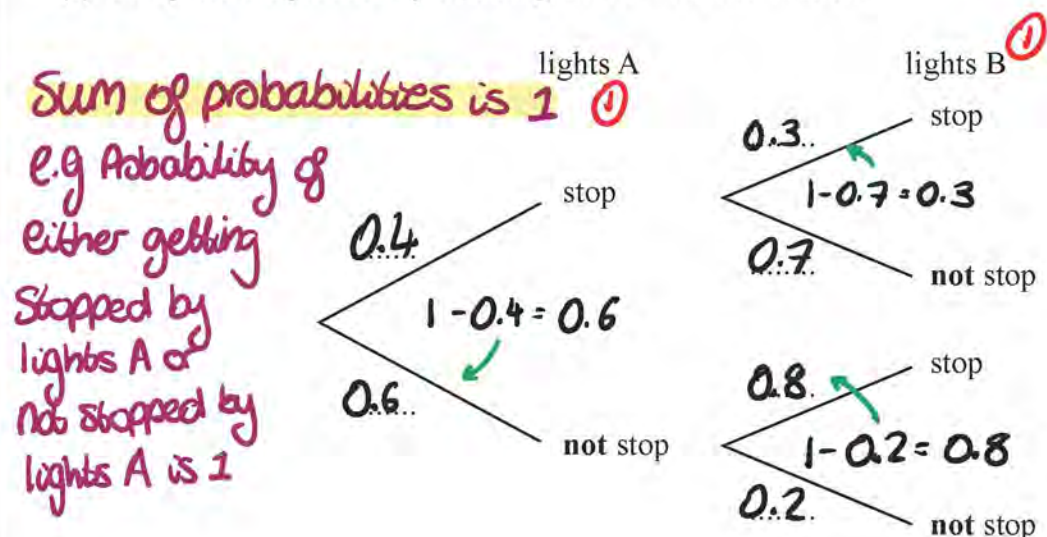$\qquad$ $2x = 58$
$\qquad$ $x = 29°$

PMT

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.

Sum of probabilities is 1 ①

e.g Probability of either getting stopped by lights A or not stopped by lights A is 1

lights A ①

lights B ①

0.4

stop

1 − 0.4 = 0.6

0.6

not stop

0.3

stop

1 − 0.7 = 0.3

0.7

not stop

0.8

stop

1 − 0.2 = 0.8

0.2

not stop

(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.

For AND we multiply

Probability of stopped lights A
and not stopped lights B
= 0.4 × 0.7 = 0.28 ①

Probability of not stopped A
and stopped lights B
= 0.6 × 0.8 = 0.48 ①

0.48 > 0.28 so stopped by lights B
is more likely ①

(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 is inversely proportional to c'

$$d = k \times \frac{1}{c}$$ → sub info from question

$$25 = k \times \frac{1}{280} \quad ①$$

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

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

$$k = 7000$$

create equation

$$d = \frac{7000}{c} \quad ①$$

Sub $c = 350$

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

$d =$ 20 ①

(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.

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

$$= (2n+1)(2n+1) - (2n+1) \quad ①$$

$$= (2n \times 2n) + (2n \times 1) + (1 \times 2n) + (1 \times 1) - (2n+1)$$

$$= 4n^2 + 4n + 1 + [-1 \times (2n+1)]$$

$$= 4n^2 + 4n + 1 + [-2n - 1]$$

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

$$= 4n^2 + 2n \quad ①$$

FOIL — outside, Last, Front, Inside

$2 = 2 \times 1$
$4 = 2 \times 2$
$6 = 2 \times 3$
$8 = 2 \times 4$
$10 = 2 \times 5$

All even numbers have a factor of 2

(Total for Question 14 is 3 marks)

$$4n^2 + 2n = 2(2n^2 + n) \quad ①$$

Since 2 is a factor of $4n^2 + 2$ it is even for all positive integer values of n

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

$x = 0.255555\dot{5}$

$10x = 2.55555\dot{5}$ ← Here we ×10 because we want there to only be the recurring part of the decimal to the right of the decimal point

$10x - x = 9x$ ①

$\begin{array}{r} 2.5555\dot{5} \\ - \ 0.255\dot{5} \\ \hline 2.3000 \end{array}$ → $9x = 2.3$ ①

Subtracting x from $10x$ eliminates the recurring decimals

$x = \dfrac{2.3}{9} \xrightarrow{\times 10} = \dfrac{23}{90}$ ×10

(Total for Question 15 is 2 marks)

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

$6x^2 + 7x - 5$

① $6 \times (-5) = -30$

② Find two numbers that multiply to make −30 and add to make 7

$10 \times (-3) = -30$
$10 + (-3) = 7$
Our numbers 10, −3

$(6x + 10)(6x - 3)$ by 60

$(3x + 5)(2x - 1)$ Simplify each bracket

$4x^2 - 1$ ← called difference of two squares

$a^2 - b^2 = (a+b)(a-b)$

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

Factorising quadratics

$6x^2 + 7x - 5 = (3x+5)(2x-1)$
$4x^2 - 1 = (2x+1)(2x-1)$ ①

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

$\dfrac{a}{b} \div \dfrac{c}{d} = \dfrac{a}{b} \times \dfrac{d}{c} = \dfrac{ad}{bc}$ use rule

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

$\dfrac{2x+1}{3x+5}$ ①

(Total for Question 16 is 3 marks)

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

7 cm

40°

7 cm
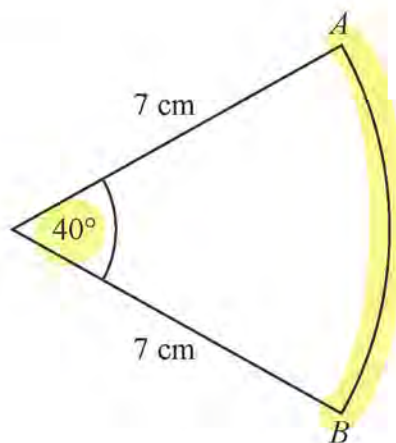
Work out the length of arc AB.
Give your answer correct to 3 significant figures.

7cm

Circumference = π × diameter

diameter = 2 × radius = 2 × 7cm = 14 cm

Circumference = π × 14 = 14π

$\dfrac{40}{360}$ × 14π = 4.886921906 = 4.89 (3sf)

............................4.89............................ cm

(Total for Question 17 is 2 marks)

18 $m = \dfrac{\sqrt{s}}{t}$ $s = 3.47$ 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.

working out bounds ↘

$3.465 \leqslant S < 3.475$ ①
$8.1315 \leqslant t < 8.1325$

LB $m = \dfrac{\sqrt{3.465}}{8.1325} = 0.2288903839$
② ①

UB $m = \dfrac{\sqrt{3.475}}{8.1315} = 0.2292486243$

$x = \dfrac{\text{big number}}{\text{small number}}$
x will be a big number

$x = \dfrac{\text{small number}}{\text{big number}}$
x will be a small number

Highest degree of accuracy
where UB and LB round to
same number

Here round to 3dp so $m = 0.229$ ①
Since both the LB and UB round to 0.229

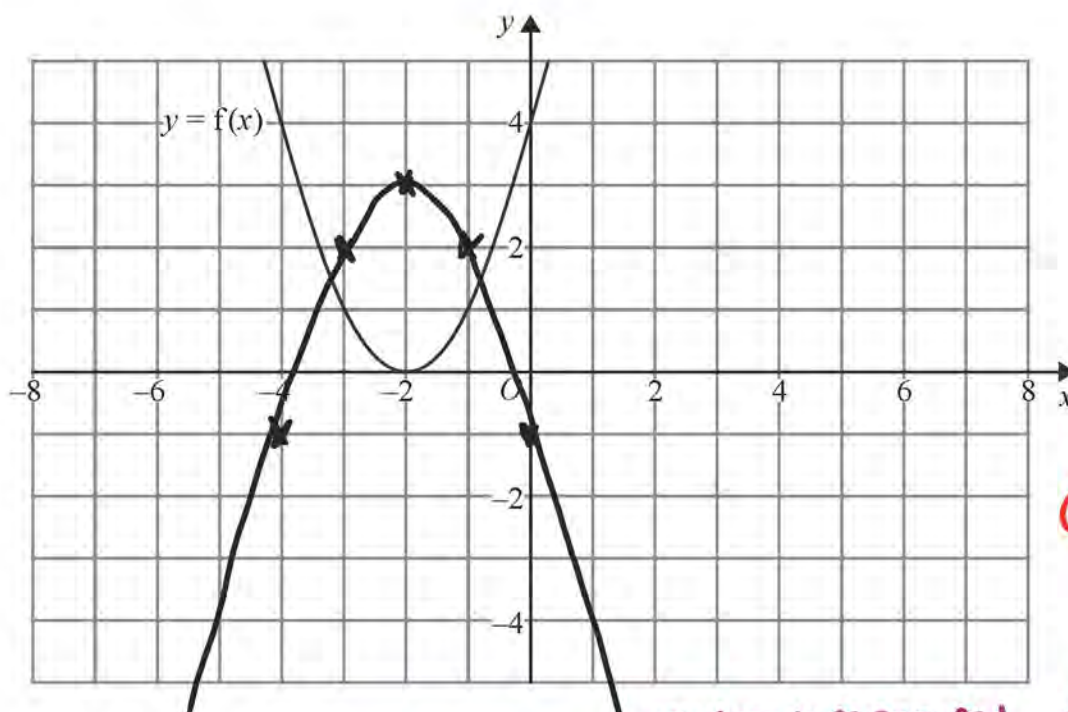(Total for Question 18 is 5 marks)

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

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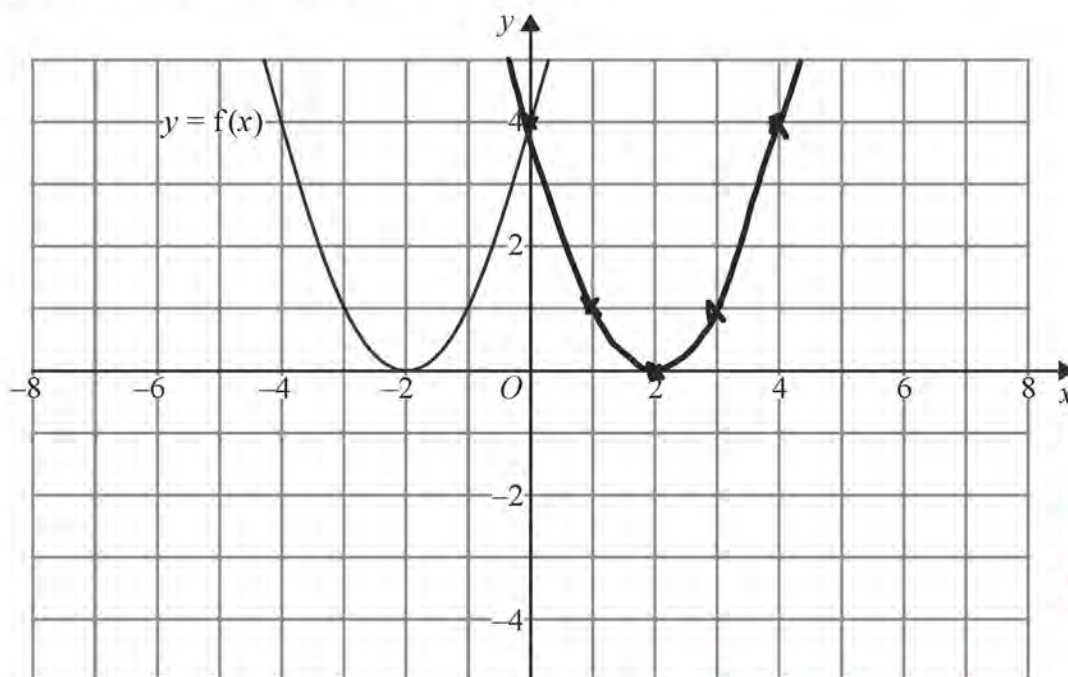
(a) On the grid above, sketch the graph of $y = f(-x)$ ← reflection in y axis

(1)

$y = f(x)$

(b) On this grid, sketch the graph of $y = -f(x) + 3$ ← reflection in x axis and translation by vector $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$ $\begin{pmatrix} \leftrightarrow \\ \updownarrow \end{pmatrix}$ ∴ translate 'up' by 3

(1)

(Total for Question 19 is 2 marks)

20 Solve algebraically the simultaneous equations

$$x^2 + y^2 = 25$$
$$y - 2x = 5$$

$x^2 + y^2 = 25$,) Sub
$y = 2x + 5$ ①

$y - 2x = 5$ $\searrow$ $y = 2x + 5$

$x^2 + (2x+5)^2 = 25$

$x^2 + (2x+5)(2x+5) = 25$

$x^2 + 4x^2 + 10x + 10x + 25 = 25$

$5x^2 + 20x + 25 = 25$

$5x^2 + 20x = 0$

$x^2 + 4x = 0$ ①

$x(x+4) = 0$ ①

$x = 0$ $x + 4 = 0$
                $x = -4$
①

$y - 2z = 5$

Sub $x = 0$ Sub $x = -4$

$y - 2(0) = 5$ $y - 2(-4) = 5$

$y = 5$ $y + 8 = 5$

                    $y = -3$

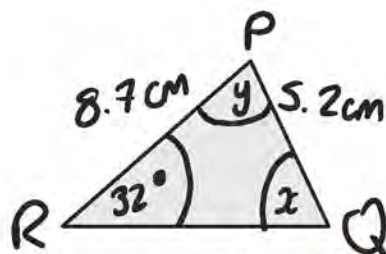$x = 0, y = 5$ and $x = -4, y = -3$ ①

(Total for Question 20 is 5 marks)

21 In triangle RPQ,

$RP = 8.7$ cm
$PQ = 5.2$ cm
Angle $PRQ = 32°$

angle < 90°

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

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

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

$$x = \sin^{-1}\left[8.7 \times \frac{\sin 32}{5.2}\right]$$

$$x = 62.44853188°$$

Sine rule:
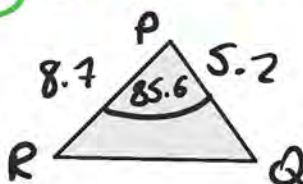$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

① work out angle Q

② work out angle P

$$y = 180 - 32 - 62.448...$$
$$= 85.55146812°$$

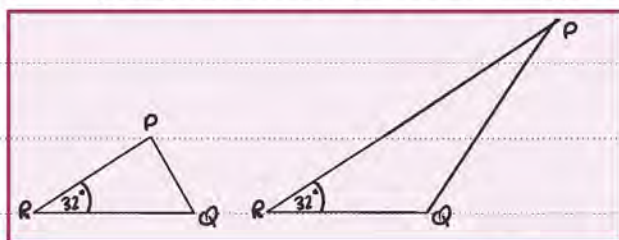③ Calculate area

Don't round when you type into calculator

Area of triangle = $\frac{1}{2} ab \sin(C)$

$$Area = \frac{1}{2} \times 5.2 \times 8.7 \times \sin(85.6)$$
$$= 22.55185522$$
$$= 22.6 \ (3sf)$$

................ 22.6 .... cm²

(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?

We would need to work out the area of two triangles (one when Q is acute and one when obtuse) Since areas could differ (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.

5 cm

4 cm

15 cm

10 cm

12 cm

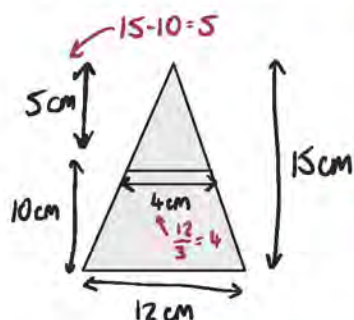Volume of cone $= \frac{1}{3}\pi r^2 h$

h

r
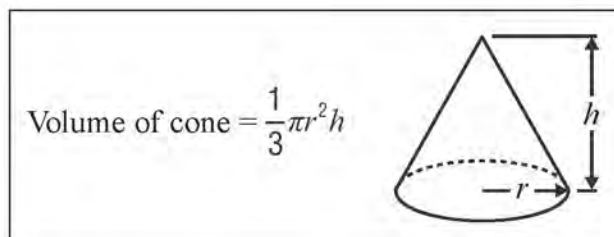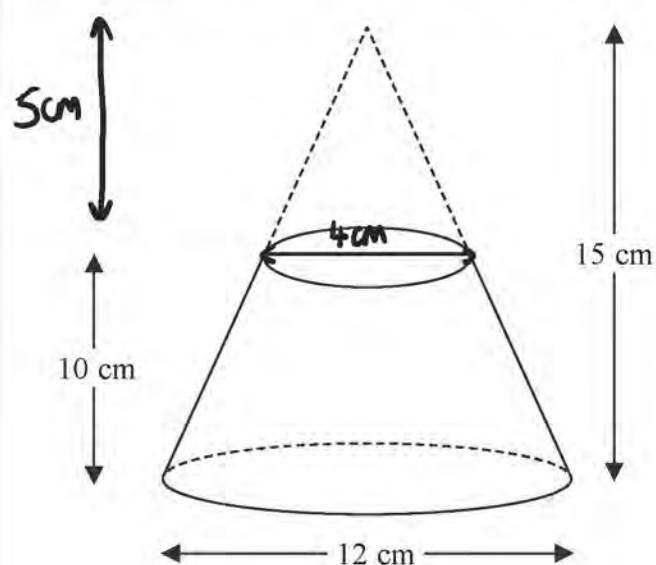
The frustum is made from glass.
The glass has a density of 2.5 g / cm³

Work out the mass of the frustum.
Give your answer to an appropriate degree of accuracy.

15-10=5

5 cm

10 cm

15 cm

4 cm

$\frac{12}{3} = 4$

12 cm

$\frac{15}{5} = 3$ ∴ The big triangle is 3 times the size of the small triangle

use this to work out width of small triangle

①

Can now work out volume of cones

large cone volume
$= \frac{1}{3}\pi(6)^2(15) = 180\pi$ cm³   ①

small cone volume
$= \frac{1}{3}\pi(2)^2(5) = \frac{20}{3}\pi$ cm³

Volume of the frustum
$= 180\pi - \frac{20}{3}\pi = \frac{520}{3}\pi$ cm³   ①

density = $\frac{mass}{volume}$

$2.5 = \frac{mass}{\left(\frac{520}{3}\pi\right)}$ ⟹ mass $= 2.5 \times \left(\frac{520}{3}\pi\right) = 1361.36$ g (2dp)   ①

.... 1361 .... g

TOTAL FOR PAPER IS 80 MARKS