Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number	Candidate Number

2016 Predicted Paper 2

SOLUTIONS

Higher Tier

Time: 1 hour 45 minutes

Paper Reference
1MA0/2H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

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.

Information

- The total mark for this paper is 100
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed.

Advice

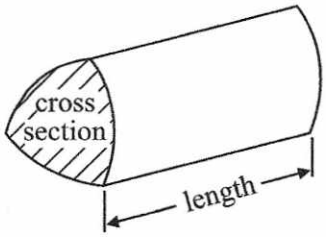
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

GCSE Mathematics 1MA0

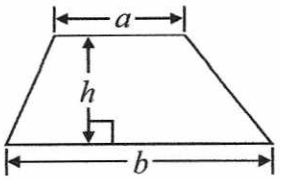
Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

Volume of prism = area of cross section × length

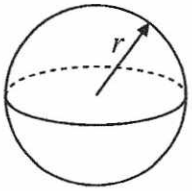


Area of trapezium $= \frac{1}{2}(a + b)h$



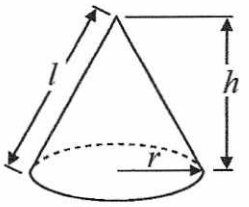
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

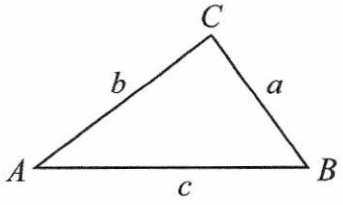


Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



In any triangle *ABC*



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

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

Answer ALL TWENTY EIGHT questions. Write your answers in the spaces provided. You must write down all the stages in your working.

1 (a) Work out the value of $\dfrac{\sqrt{4.6}}{8.1 - 3.7}$

Give your answer as a decimal.
Write down all the figures on your calculator display.

0.487445 6952

(2)

(b) Write your answer to part (a) correct to 3 significant figures.

0.487

(1)

(Total for Question 1 is 3 marks)

2 $D = 3e^2 + 4e$

Work out the value of D when $e = -5$

$D = 3(-5)^2 + 4(-5)$

$D =$ 55

(Total for Question 2 is 2 marks)

3 Stephen plays in a basketball team.

The list shows the numbers of points Stephen scored in 15 games of basketball this year.

26 14 33 8 21 18 20 9 17 22 21 18 22 30 25

(a) Show this information in an ordered stem and leaf diagram.

key
0 | 8 = 8 points

0	8, 9
1	4, 7, 8, 8
2	0, 1, 1, 2, 2, 5, 6
3	0, 3

(3)

Last year the ratio of the number of games Stephen's team won to the number of games Stephen's team did **not** win was 5 : 4

Last year Stephen's team played 36 games. 9 parts

(b) Work out the number of games Stephen's team won last year.

$\frac{36}{9} = 4$ (games per part)

5 × 4 : 4 × 4

20 : 16

20

(2)

(Total for Question 3 is 5 marks)

***4** A shop sells coffee in 3 different sizes of jar.

£4.39 £6.39 £7.95

A 150 g jar of coffee costs £4.39
A 200 g jar of coffee costs £6.39
A 275 g jar of coffee costs £7.95

Which size of jar is the best value for money?
You must show all your working.

150 g

$\frac{439}{150} = 2.926$ p/gram

200g

$\frac{639}{200} = 3.195$p/gram

275g

$\frac{795}{275} = 2.890$ p/gram

The 275g jar is the best value for money.

[Lowest price per gram]

(Total for Question 4 is 4 marks)

5 Harry has a cable.
The cable has a length of 16 metres.

Harry cuts the cable into two parts, part *A* and part *B*.

The length of part *A* is 5 metres.
The weight of part *A* is 8 kg.

Work out the weight of part *B*.

Length of part B = 16 − 5
= 11 metres.

5 metres weighs 8kg
÷5 ÷5
1 metre weighs 1.6kg
×11 ×11
11 metres weighs 17.6kg

17.6 kg

(Total for Question 5 is 3 marks)

***6** The nth term of sequence A is $3n - 2$
The nth term of sequence B is $10 - 2n$

Sally says there is only one number that is in both sequence A and sequence B.

Is Sally right?
You must explain your answer.

Sequence A:

$3(1) - 2 = 1$
$3(2) - 2 = 4$
$3(3) - 2 = 7$
$3(4) - 2 = 10$

Sequence B:

$10 - 2(1) = 8$
$10 - 2(2) = 6$
$10 - 2(3) = 4$
$10 - 2(4) = 2$
$10 - 2(5) = 0$

Yes Sally is right. Both sequences have 4 in them.
Sequence A is getting bigger. Sequence B is getting smaller (so they will not have any more the same)

(Total for Question 6 is 2 marks)

7 Tom and Amy set the alarms on their phones to sound at 6.45 am.

Both alarms sound together at 6.45 am.
Tom's alarm then sounds every 9 minutes.
Amy's alarm then sounds every 12 minutes.

At what time will both alarms next sound together?

9, 18, 27, 36

12, 24, 36

LCM of 9 and 12 is 36

36 minutes after 6.45

7:21 am

(Total for Question 7 is 3 marks)

8 The table shows information about the number of years 41 teachers have each taught at a school.

Number of years (n)	**Number of teachers**	m.p	m.p × f
$0 < n \leqslant 10$	14	5	70
$10 < n \leqslant 20$	13	15	195
$20 < n \leqslant 30$	8	25	200
$30 < n \leqslant 40$	4	35	140
$40 < n \leqslant 50$	2	45	90
	41		

(a) Write down the class interval that contains the median.

21st number

$10 < n \leqslant 20$

(2)

(b) Calculate an estimate for the mean number of years.
You must show all your working.

$\frac{695}{41} = 16.95121951$ years

16.95 years (2dp)

(4)

(Total for Question 8 is 6 marks)

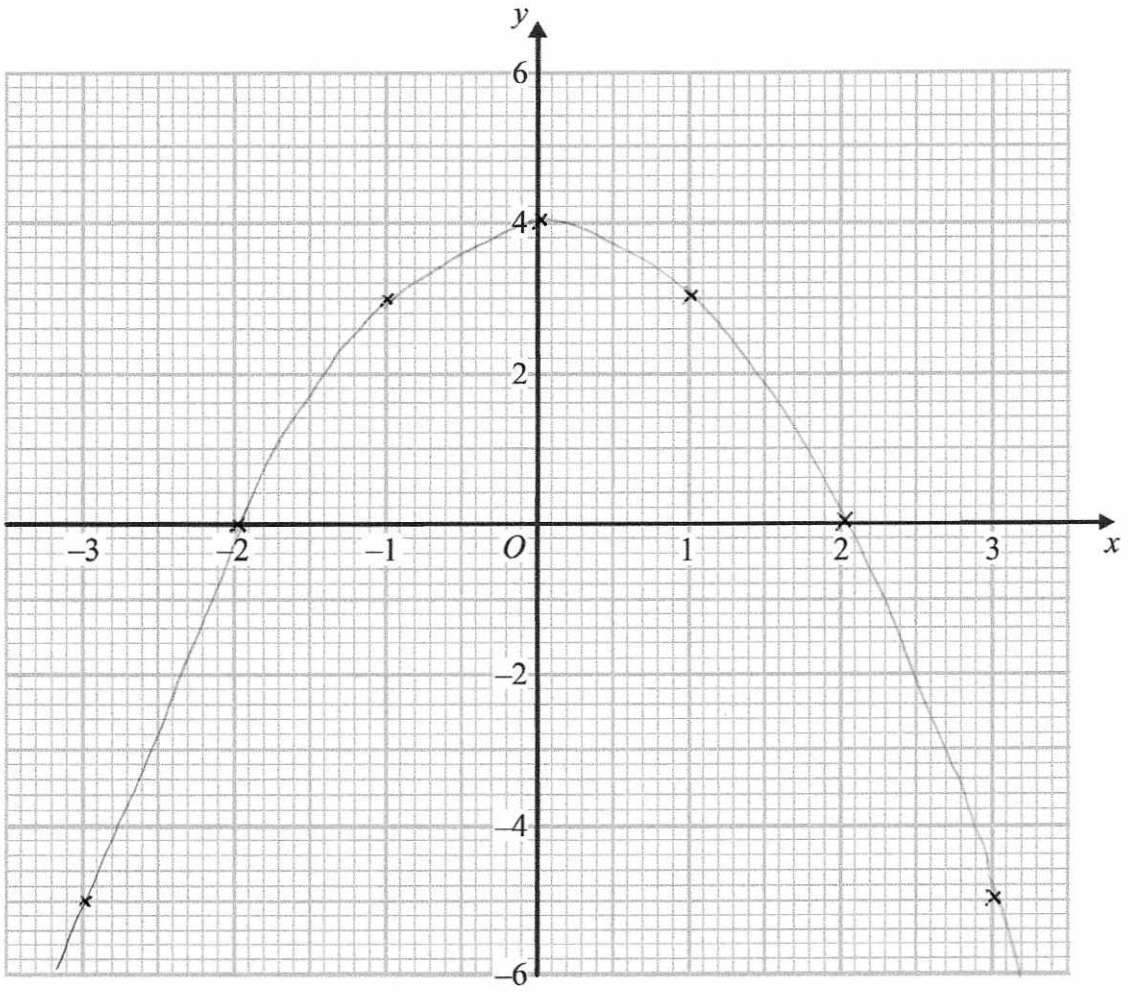
9 (a) Complete the table of values for $y = 4 - x^2$

x	−3	−2	−1	0	1	2	3
y	−5	0	3	4	3	0	−5

$4-(-2)^2$ $4-(0)^2$ $4-(1)^2$ $4-(3)^2$

(2)

(b) On the grid, draw the graph of $y = 4 - x^2$ for values of x from –3 to 3



(2)

(Total for Question 9 is 4 marks)

***10**

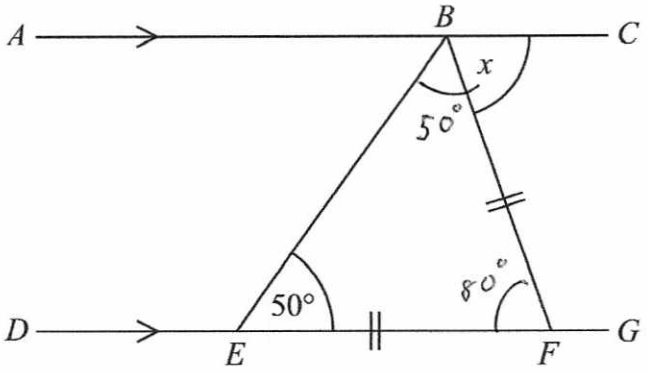


Diagram **NOT** accurately drawn

ABC is a straight line.
DEFG is a straight line.
AC is parallel to *DG*.
EF = *BF*.
Angle *BEF* = 50°.

Work out the size of the angle marked *x*.
Give reasons for your answer.

$E\hat{B}F = 50^\circ$ Angles at the base of an isosceles triangle are equal

$B\hat{F}E = 80^\circ$ Angles in a triangle sum to 180°

$x = 80^\circ$ Alternate angles are equal

80° °

(Total for Question 10 is 4 marks)

11 A clothes shop has a sale.

In the sale, normal prices are reduced by 12%
The normal price of a shirt is £30

(a) Work out the sale price of the shirt.

10% = £3
1% = 30p
2% = 60p

12% = £3.60

£30 − £3.60 = £26.40

OR

0.88 × 30
= £26.40

£ 26.40

(3)

The price of a coat is reduced by £9 in the sale.

(b) Work out the normal price of the coat.

£9 = 12%
÷12 ÷12

£0.75 = 1%
×100 ×100
£75 = 100%

£ 75

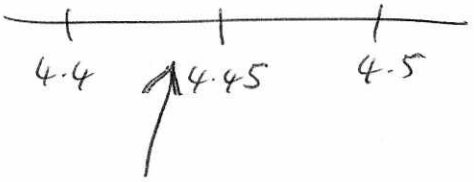
(3)

(Total for Question 11 is 6 marks)

12 The equation $x^3 - 9x = 48$
has a solution between 4 and 5

Use a trial and improvement method to find the solution.
Give your answer correct to one decimal place.
You must show **all** your working.

x	$(x)^3 - 9(x)$	Comment
4.5	$(4.5)^3 - 9(4.5)$ $= 50.625$	too big
4.4	$(4.4)^3 - 9(4.4)$ $= 45.584$	too small
4.45	$(4.45)^3 - 9(4.45)$ $= 48.071125$	too big



[anything between 4.4 and 4.45 rounds to 4.4 to 1dp]

$x =$ 4.4

(Total for Question 12 is 4 marks)

13 Here is a regular 10-sided polygon.

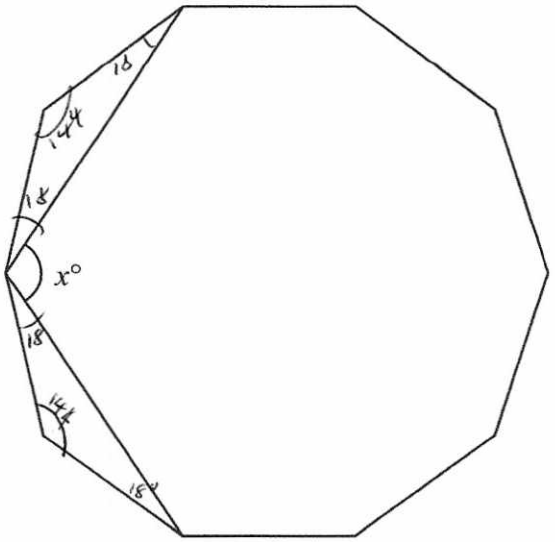


Diagram **NOT** accurately drawn

Work out the value of x.
Show your working clearly.

10 sided reg polygon

Exterior angle $= \frac{360}{10} = 36°$

Interior angle $= 180 - 36 = 144°$

Angles at the base of an isosceles triangle are equal $= \frac{180 - 144}{2} = 18°$

$x = 144 - 18 - 18$

$= 108°$

$x =$ 108°

(Total for Question 13 is 4 marks)

14

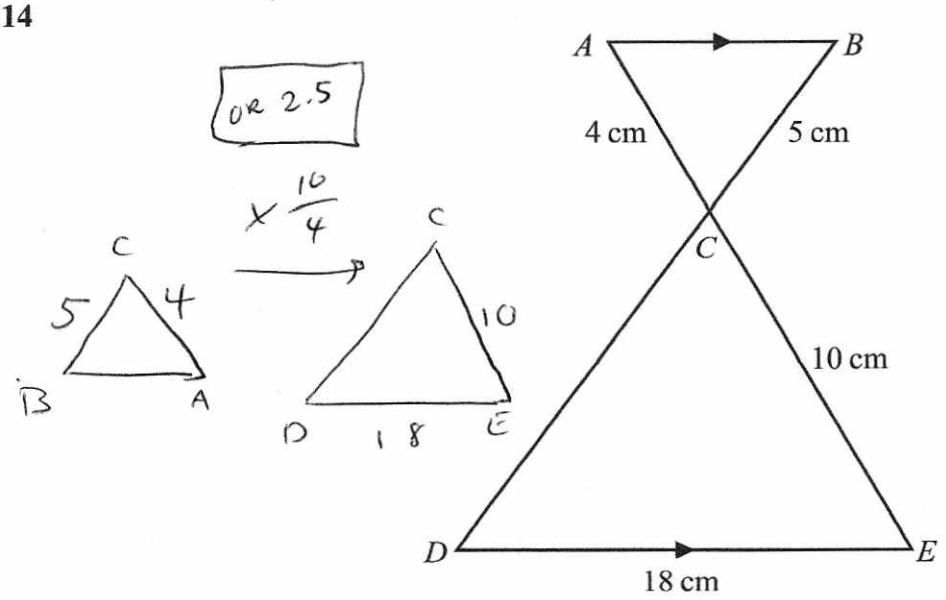


Diagram **NOT** accurately drawn

ACE and *BCD* are straight lines.
AB is parallel to *DE*.

Similar shapes

(a) Calculate the length of *CD*.

scale factor × 10/4

5 × 10/4

12.5 cm

(2)

(b) Calculate the length of *AB*.

18 ÷ 10/4

7.2 cm

(2)

(Total for Question 14 is 4 marks)

15 Jade makes an orange drink by mixing orange concentrate with water.

She mixes 15 cm^3 of orange concentrate with 250 cm^3 of water.

The density of orange concentrate is 1.20 g/cm^3.
The density of water is 1.00 g/cm^3.

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

Work out the density of Jade's orange drink.
Give your answer correct to 2 decimal places.

Total volume = 15 + 250
= 265 cm^3

Mass of orange
mass = density × volume
= 1.2 × 15
= 18

Mass of water
mass = density × volume
= 1 × 250
= 250

Total mass = 250 + 18
= 268

density = $\frac{268}{265}$ = 1.01 g/cm^3 (2dp)

1.01 ..... g/cm^3

(Total for Question 15 is 3 marks)

16 *GHJ* is a right-angled triangle.

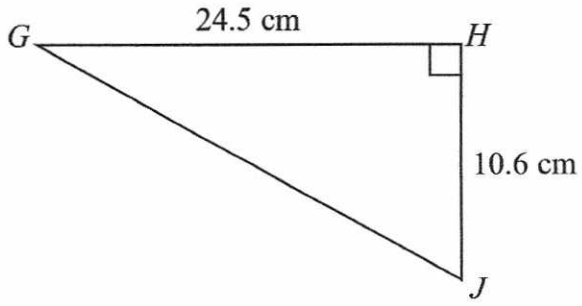


Diagram **NOT** accurately drawn

(a) Calculate the length of *GJ*.
Give your answer correct to one decimal place.

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

$(24.5)^2 + (10.6)^2 = c^2$

$712.61 = c^2$

$c = \sqrt{712.61}$

$= 26.7$ cm 1dp

26.7 cm

(3)

LMN is a different right-angled triangle.

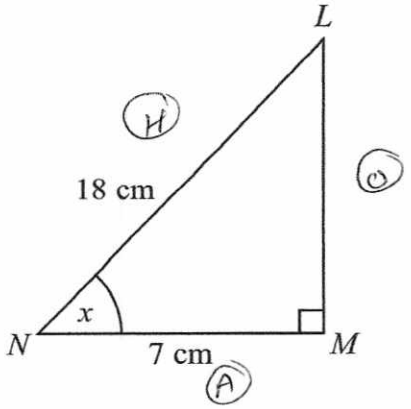


Diagram **NOT** accurately drawn

~~SOH~~ CAH ~~TOA~~

(b) Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

$\cos x = \frac{7}{18}$

$x = \cos^{-1}\left(\frac{7}{18}\right)$

$= 67.1^\circ$ (1dp)

67.1 °

(3)

(Total for Question 16 is 6 marks)

17 Solve the simultaneous equations

$3x + 10y = 7$
$x - 4y = 6$ $\times 3$

$3x + 10y = 7$
$3x - 12y = 18$

$22y = -11$
$y = -0.5$

$3x + 10(-0.5) = 7$
$3x - 5 = 7$
$3x = 12$
$x = 4$

$x =$ 4

$y =$ -0.5

(Total for Question 17 is 3 marks)

18 Simplify fully $\dfrac{3x^2 - 6x}{x^2 + 2x - 8}$

$$\frac{3x(x-2)}{(x+4)(x-2)}$$

$$\frac{3x}{x+4}$$

(Total for Question 18 is 3 marks)

$x_1\ y_1$

19 A is the point with coordinates $(1, 3)$
B is the point with coordinates $(-2, -1)$
$x_2\ y_2$
The line **L** has equation $3y = 4 - 2x$

Is line **L** parallel to AB?
Show your working clearly.

parallel if they have the same gradient.

L: $3y = 4 - 2x$

$3y = -2x + 4$

$y = \frac{-2}{3}x + \frac{4}{3}$

$y = mx + c$

$m = \frac{-2}{3}$

AB: $m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{-1 - 3}{-2 - 1}$

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

$= \frac{4}{3}$

$\frac{-2}{3} \neq \frac{4}{3}$ ∴ They are not parallel

(Total for Question 19 is 3 marks)

20 Solve $5x^2 + 6x - 2 = 0$

Give your solutions correct to 2 decimal places.

$a = 5 \quad b = 6 \quad c = -2$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(6) \pm \sqrt{(6)^2 - 4(5)(-2)}}{2(5)}$$

$= 0.27$ and -1.47 (2dp)

(Total for Question 20 is 3 marks)

21 A ball fell 2 metres onto horizontal ground.
The ball hit the ground and bounced up and down 3 times.

The first time the ball bounced, it rose to 75% of the height it fell from.
The second time the ball bounced, it rose to 75% of the height it reached after the first bounce.
The third time the ball bounced, it rose to 75% of the height it reached after the second bounce.

Work out the height the ball reached after the third bounce.
Give your answer correct to 2 decimal places.

~~1st bounce~~

$2 \times 0.75^3 = 0.84\text{m}$ (2dp)

Or//

1st bounce = 0.75×2
$= 1.5$

2nd bounce = 0.75×1.5
$= 1.125$

3rd bounce = 0.75×1.125
$= 0.84$ (2dp)

..... m

(Total for Question 21is 3 marks)

22 Make x the subject of the formula $y = \dfrac{3x}{x+5}$

$y(x+5) = 3x$
$xy + 5y = 3x$
$xy - 3x = -5y$
$x(y-3) = -5y$
$x = \dfrac{-5y}{y-3}$

$x = \dfrac{-5y}{y-3}$

(Total for Question 22 is 3 marks)

23 (a) Explain what is meant by a stratified sample.

The sample is taken in proportion to characteristics of the population

(1)

The table gives some information about the number of people at a fitness centre one day.

	Gender	
Age (years)	**Male**	**Female**
Under 40	45	78
40 and over	73	25

Mr Ellory wants to give a questionnaire to some of these people.
He takes a sample of 60 people stratified by age and gender.

(b) Work out the number of males aged 40 and over that should be in the sample.

$\frac{73}{221} \times 60 = 19.81900...$

20

(2)

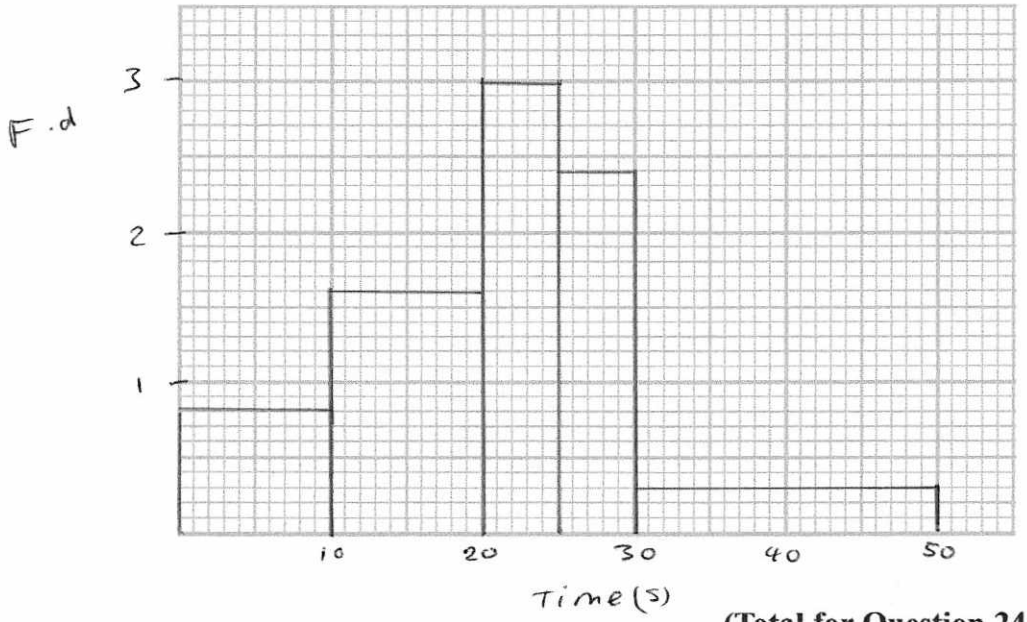
(Total for Question 23 is 3 marks)

F.d = $\frac{F}{\text{class width}}$

24 The table shows some information about the length of time some birds were on a bird table.

Time (t seconds)	Frequency	F.d
$0 < t \leqslant 10$	8	0.8
$10 < t \leqslant 20$	16	1.6
$20 < t \leqslant 25$	15	3
$25 < t \leqslant 30$	12	2.4
$30 < t \leqslant 50$	6	0.3

Draw a histogram for the information in the table.



(Total for Question 24 is 3 marks)

25

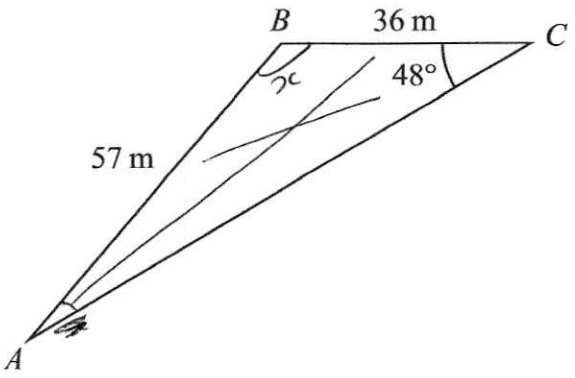


Diagram **NOT** accurately drawn

Work out the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\frac{\sin A}{36} = \frac{\sin 48}{57}$$

$$\sin A = \frac{\sin 48}{57} \times 36$$

$$A = \sin^{-1}\left(\frac{\sin 48}{57} \times 36\right)$$

$$= 27.992412^{\circ}$$

Angle $x = 180 - 48 - 27.992412^{\circ}$

$$= 104.007588^{\circ}$$

Area $= \frac{1}{2} a b \sin C$

$$= \frac{1}{2}(36)(57)\sin(104.007588)$$

$$= 995 \text{ m}^2 \quad 3sf$$

995 m²

(Total for Question 25 is 4 marks)

26 The diagram shows a sphere and a cone.

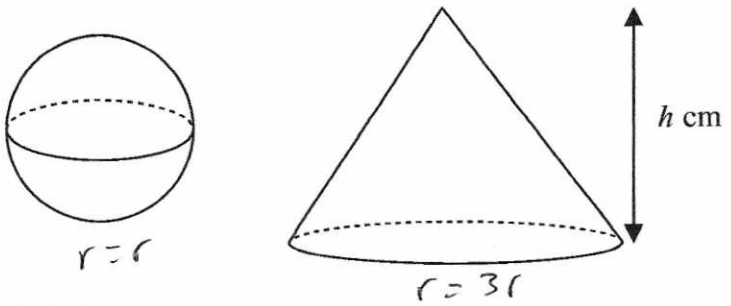


Diagram **NOT** accurately drawn

The cone has height h cm.
The radius of the base of the cone is 3 times the radius of the sphere.

Given that the volume of the sphere is equal to the volume of the cone, find an expression for the radius of the sphere in terms of h.
Give your expression in its simplest form.

volume of sphere $= \frac{4}{3}\pi r^3$

volume of cone $= \frac{1}{3}\pi (3r)^2 h$

$$\frac{4}{3}\pi r^3 = \frac{1}{3}\pi (3r)^2 h$$

$$\frac{4}{3}\pi r^2 = \frac{1}{3}\pi (9r^2) h$$

$$4r = 9h$$

$$r = \frac{9h}{4}$$

$r = \frac{9}{4}h$

(Total for Question 26 is 3 marks)

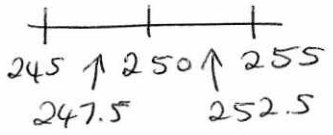
27 $I = \dfrac{V}{R}$

$V = 250$ correct to the nearest 5

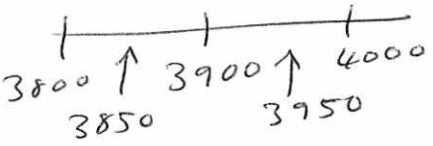
$R = 3900$ correct to the nearest 100

Work out the lower bound for the value of I.
Give your answer correct to 3 decimal places.
You must show your working.

✓



R



$$\text{lower } I = \frac{\text{lower } V}{\text{upper } R}$$

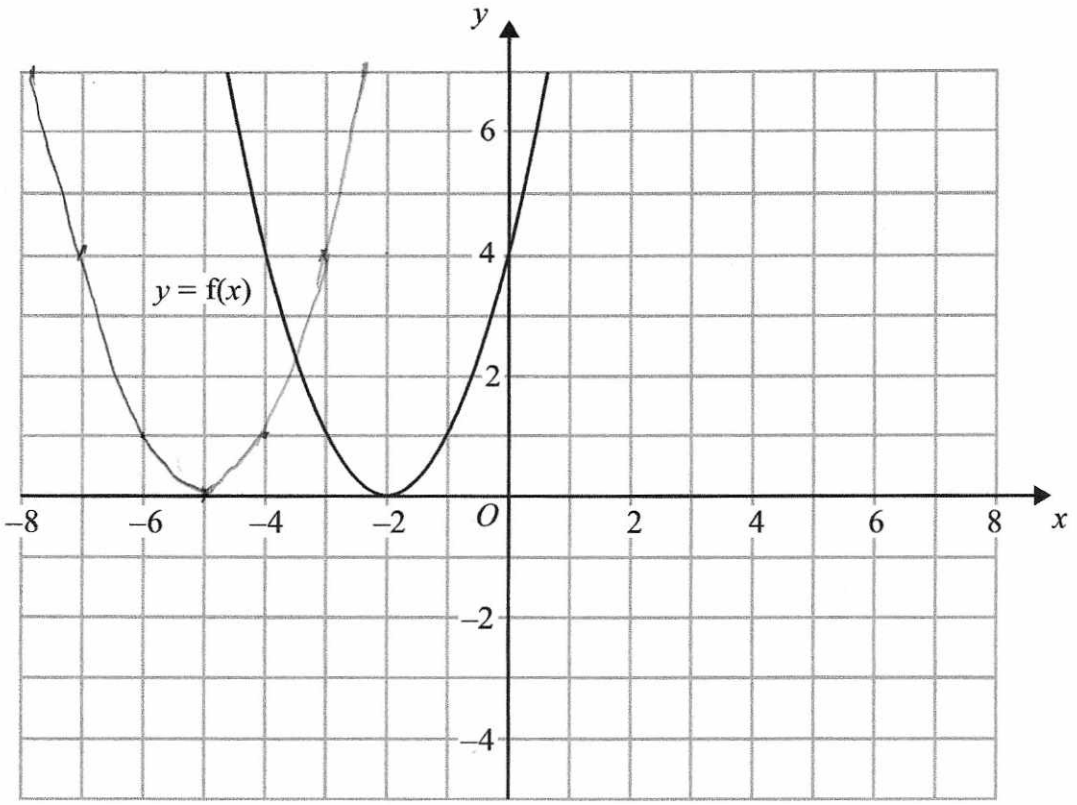
$$= \frac{247.5}{3950}$$

$$= 0.063 \quad (3\text{dp})$$

0.063

(Total for Question 27 is 3 marks)

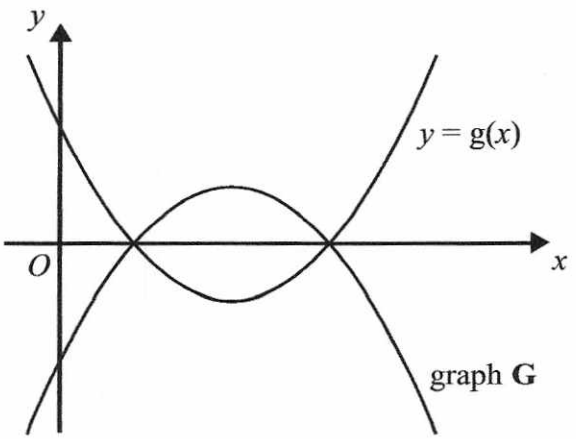
28 The graph of $y = f(x)$ is shown on the grid.



(a) On the grid above, sketch the graph of $y = f(x + 3)$

(2)

The graph of $y = g(x)$ is shown below.



The graph **G** is the reflection of $y = g(x)$ in the x-axis.

(b) Write down an equation of graph **G**.

$y = -g(x)$

(1)

(Total for Question 28 is 3 marks)

TOTAL FOR PAPER 100 MARKS