

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 30 minutes

Paper
reference

1MA1/1H

Mathematics

PAPER 1 (Non-Calculator)

Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, Formulae Sheet (enclosed). 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.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used.**



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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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P 6 8 7 2 1 A 0 1 2 8

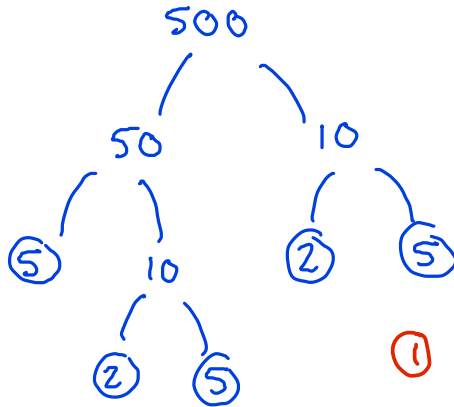

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 Write 500 as a product of powers of its prime factors.



$$\begin{aligned} 500 &= 2 \times 2 \times 5 \times 5 \times 5 \quad \textcircled{1} \\ &= 2^2 \times 5^3 \quad \textcircled{1} \end{aligned}$$

$$2^2 \times 5^3$$

(Total for Question 1 is 3 marks)



2 (a) Work out $1\frac{3}{5} + 2\frac{1}{4}$

Give your answer as a mixed number.

$$1\frac{3}{5} + 2\frac{1}{4} = 1 + \frac{3}{5} + 2 + \frac{1}{4} = 3 + \frac{17}{20}$$

adding fractions:

$$\frac{3}{5} + \frac{1}{4}$$

$$\frac{12}{20} + \frac{5}{20} = \frac{17}{20}$$

$$3\frac{17}{20} \text{ (1)}$$

(2)

(b) Show that $2\frac{2}{3} \div 6 = \frac{4}{9}$

$$2\frac{2}{3} = \frac{2 \times 3 + 2}{3} = \frac{8}{3}$$

$$\frac{8}{3} \div 6 = \frac{8}{3} \times \frac{1}{6} = \frac{8}{18} = \frac{4}{9} \text{ as required}$$

(2)

(Total for Question 2 is 4 marks)



3 Simplify $(2^{-5} \times 2^8)^2$

Give your answer as a power of 2

$$\begin{aligned}
 & (2^{-5} \times 2^8)^2 \\
 &= (2^{-5+8})^2 \quad \leftarrow a^b \times a^c = a^{b+c} \\
 &= (2^3)^2 \quad \textcircled{1} \\
 &= 2^6 \quad \textcircled{1} \quad \leftarrow (a^b)^c = a^{bc}
 \end{aligned}$$

$$2^6$$

(Total for Question 3 is 2 marks)

4 Work out 0.004×0.32

$$\begin{array}{r}
 32 \\
 \times 4 \\
 \hline
 128 \quad \textcircled{1}
 \end{array}$$

$$\begin{aligned}
 & 0.004 \times 0.32 \\
 &= 4 \times 32 \times 0.001 \times 0.01 \\
 &= 128 \times 0.00001 \\
 &= 0.00128 \quad \textcircled{1}
 \end{aligned}$$

figure out
4 x 32, then move
the decimal point
5 places to the left.

$$\begin{array}{cc}
 0.004 & 0.32 \\
 \underbrace{\quad\quad\quad}_3 & \underbrace{\quad\quad}_2
 \end{array}$$

$$0.00128$$

(Total for Question 4 is 2 marks)



- 5 A car factory is going to make four different car models **A**, **B**, **C** and **D**.

80 people are asked which of the four models they would be most likely to buy.

The table shows information about the results.

Car model	Number of people
A	23
B	15
C	30
D	12

The factory is going to make 40 000 cars next year.

Work out how many model **B** cars the factory should make next year.

Proportion of people who chose B

$$= \frac{15}{80} = \frac{3}{16}$$

$$\frac{3}{16} \times 40,000 \text{ ①}$$

$$\begin{array}{r} 02500 \\ 16 \overline{) 40000} \end{array}$$

$$= 3 \times 2500$$

$$= 7500 \text{ ①}$$

7500

(Total for Question 5 is 2 marks)



- 6 Rizwan writes down three numbers a , b and c

$$a:b = 1:3$$

$$b:c = 6:5$$

to combine any two ratios, make the common entry (like b) the same in both ratios

- (a) (i) Find $a:b:c$

$$\begin{array}{l} a:b \quad b:c \\ 1:3 \quad 6:5 \\ \times 2 \quad \downarrow \times 2 \\ 2:6 \quad ① \end{array}$$

since b is the same for both ratios, they can be combined.

$$\begin{array}{l} a:b:c \\ 2:6:5 \end{array}$$

$$\begin{array}{l} 2:6:5 \quad ① \\ \hline (2) \end{array}$$

- (ii) Express a as a fraction of the total of the three numbers a , b and c

$$\text{want } \frac{a}{a+b+c} = \frac{2 \quad ①}{2+6+5} = \frac{2 \quad ①}{13}$$

$$\frac{2}{13}$$

(2)

Emma writes down three numbers m , n and p

$$n = 2m$$

$$p = 5n$$

- (b) Find $m:p$

$$n = 2m$$

$$p = 5n \Rightarrow n = \frac{p}{5}$$

since $n = 2m$ and $n = \frac{p}{5}$, can equate:

$$2m = \frac{p}{5} \quad ①$$

$$10m = p$$

$$m:p$$

$$1:10 \quad ①$$

p is ten times m , so p is bigger.

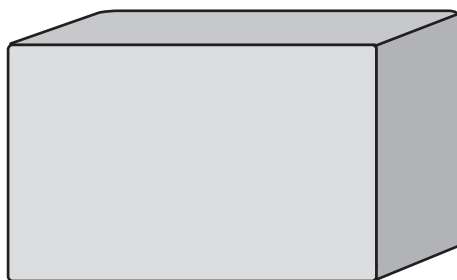
$$1:10$$

(2)

(Total for Question 6 is 6 marks)



7



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

A storage tank exerts a force of 10 000 newtons on the ground.

The base of the tank in contact with the ground is a 4 m by 2 m rectangle.

Work out the pressure on the ground due to the tank.

$$\text{area} = 4 \times 2 = 8 \text{ m}^2$$

$$\text{pressure} = \frac{\text{force}}{\text{area}} = \frac{10,000}{8} = \frac{2,500}{2} = 1250$$

Handwritten calculation showing the steps: 10,000 divided by 8 equals 2,500, which is then divided by 2 to get 1250. Red circled numbers 1 and 2 indicate marks for each step.

.....1250..... newtons/m²

(Total for Question 7 is 2 marks)



- 8 Two numbers m and n are such that
 m is a multiple of 5
 n is an even number
the highest common factor (HCF) of m and n is 7

Write down a possible value for m and a possible value for n .

HCF of m and n is 7, so both m and n
have a factor 7

m is a multiple of 5 so let $m = 7 \times 5$

n is even so let $n = 7 \times 2$

$$\therefore m = 35 \text{ (1)}$$

$$n = 14 \text{ (1)}$$

$$m = 35$$

$$n = 14$$

(Total for Question 8 is 2 marks)

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- 9 (a) Complete the table of values for $y = 6x - x^3$

$$\begin{aligned} x &= -2: \\ y &= 6(-2) - (-2)^3 \\ &= -12 + 8 \\ &= -4 \end{aligned}$$

$$\begin{aligned} x &= -1: \\ y &= 6(-1) - (-1)^3 \\ &= -6 + 1 \\ &= -5 \end{aligned}$$

$$\begin{aligned} x &= 0: \\ y &= 6(0) - 0^3 \\ y &= 0 \end{aligned}$$

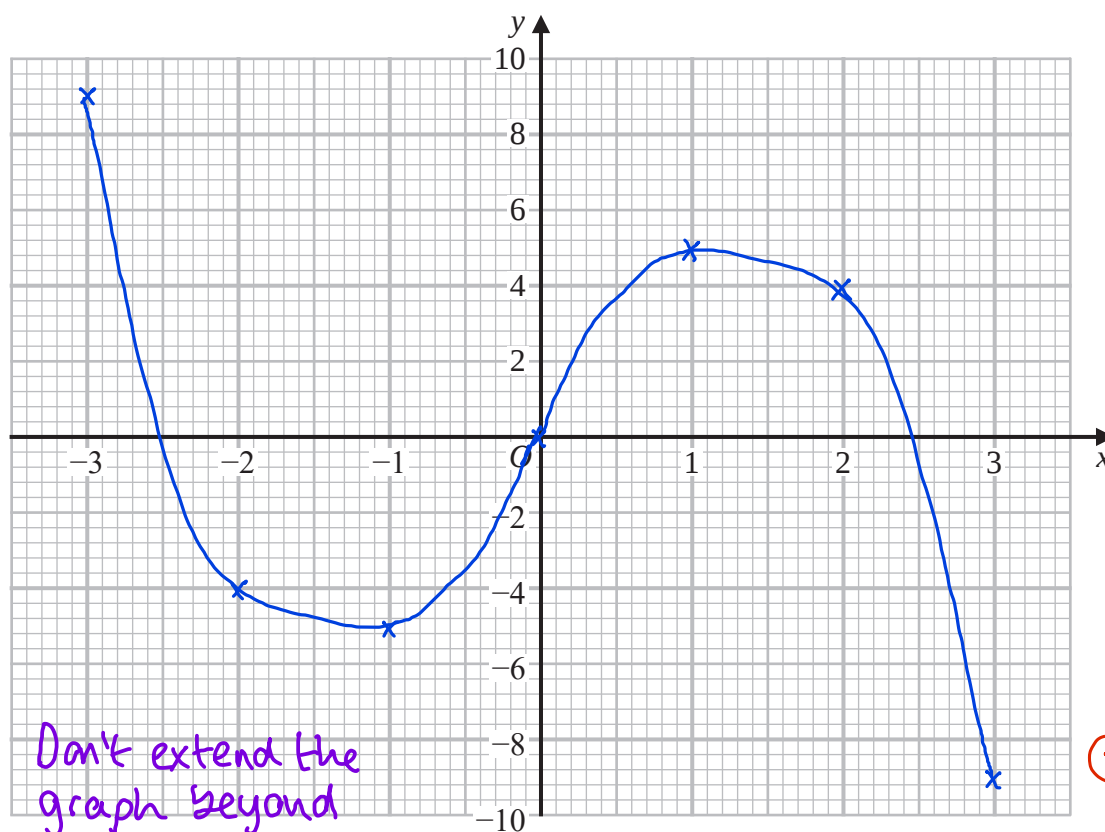
$$\begin{aligned} x &= 1: \\ y &= 6(1) - (1)^3 \\ &= 6 - 1 \\ &= 5 \end{aligned}$$

x	-3	-2	-1	0	1	2	3
y	9	-4	-5	0	5	4	-9

②

(2)

- (b) On the grid, draw the graph of $y = 6x - x^3$ for values of x from -3 to 3



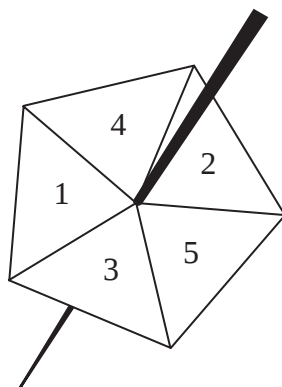
Don't extend the graph beyond the range given.

②

(2)

(Total for Question 9 is 4 marks)

10 Lina spins a biased 5-sided spinner 40 times.



Here are her results.

Score	1	2	3	4	5
Frequency	6	8	9	7	10

Lina is now going to spin the spinner another two times.

(a) Work out an estimate for the probability that she gets a score of 5 both times.

estimated probability of
getting a score of 5:

$$\frac{10}{6+8+9+7+10} = \frac{10}{40} = \frac{1}{4} \text{ (1)}$$

getting 5 both times
 $= \frac{1}{4} \times \frac{1}{4} = \frac{1}{16} \text{ (1)}$

$$\frac{1}{16}$$

(2)

Derek is going to spin the spinner a large number of times.

(b) Work out an estimate for the percentage of times Derek can expect to get a score of 1

estimated probability of
getting a 1:

$$\frac{6}{6+8+9+7+10} = \frac{6}{40} \text{ (1)}$$

$$\frac{6}{40} \xrightarrow{\div 2} \frac{3}{20} \xrightarrow{\times 5} \frac{15}{100} = 15\% \text{ (1)}$$

% means out of 100

$$\frac{15}{100}$$

(2)

(Total for Question 10 is 4 marks)

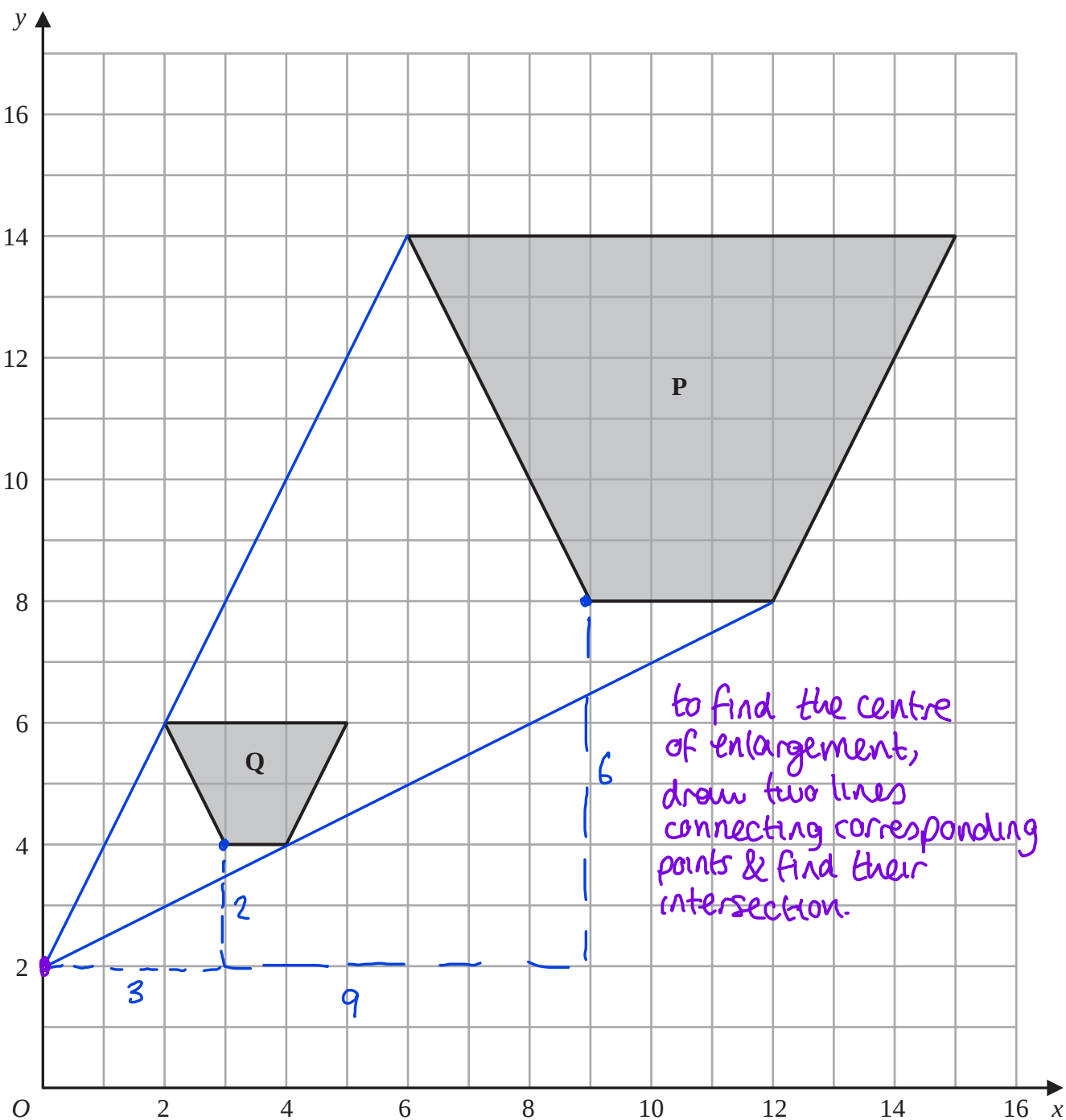
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11



Describe fully the single transformation that maps shape **P** onto shape **Q**.

Enlargement centre $(0, 2)$ scale factor $\frac{1}{3}$

Remember it's $P \rightarrow Q$, not $Q \rightarrow P$

(Total for Question 11 is 2 marks)



P 6 8 7 2 1 A 0 1 1 2 8

12 Solve the simultaneous equations

$$5x + 2y = 11$$

$$4x + 3y = 6$$

$$5x + 2y = 11 \quad (1)$$

$$4x + 3y = 6 \quad (2)$$

plan to eliminate y by making
 y coefficients the same, then
subtracting.

$$(1) \times 3: 15x + 6y = 33$$

$$(2) \times 2: 8x + 6y = 12$$

$$\begin{array}{r} 15x + 6y = 33 \\ - (8x + 6y = 12) \\ \hline 7x + 0y = 21 \end{array} \quad (1)$$

$$\begin{array}{r} 33 \\ - 12 \\ \hline 21 \end{array}$$

$$7x = 21$$

$$x = \frac{21}{7} = 3 \quad (1)$$

substitute $x=3$ into (1)

$$5(3) + 2y = 11 \quad (1)$$

$$2y = 11 - 15$$

$$2y = -4$$

$$y = -2 \quad (1)$$

$$x = 3$$

$$y = -2$$

(Total for Question 12 is 4 marks)

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13 p is inversely proportional to t

Complete the table of values.

t	100	25	20	2
p	1	4	5	50

p is inversely proportional to t

$$p = \frac{k}{t}$$

sub $p=1, t=100$
to find k

$$1 = \frac{k}{100}$$

$$k = 100$$

$$p = \frac{100}{t} \quad \textcircled{1}$$

$$t=25: p = \frac{100}{25} = 4 \quad \textcircled{1}$$

$$p=5: 5 = \frac{100}{t} \Rightarrow t = 20 \quad \textcircled{1}$$

$$t=2: p = \frac{100}{2} = 50$$

(Total for Question 13 is 3 marks)



14 The table shows information about the weights, in grams, of some potatoes.

class width

20

10

10

20

Weight (w grams)	Number of potatoes
$50 < w \leq 70$	20
$70 < w \leq 80$	50
$80 < w \leq 90$	60
$90 < w \leq 110$	30

frequency density

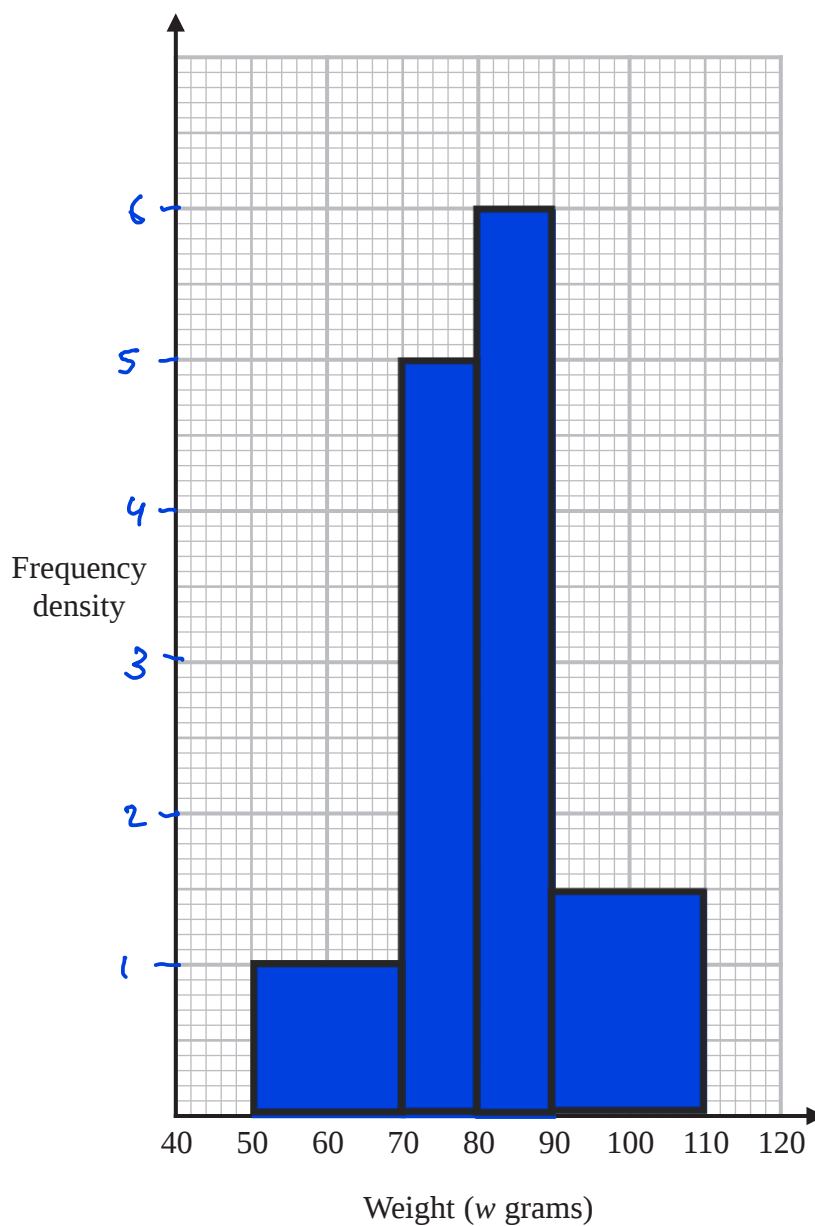
$$20 \div 20 = 1$$

$$50 \div 10 = 5$$

$$60 \div 10 = 6$$

$$30 \div 20 = 1.5$$

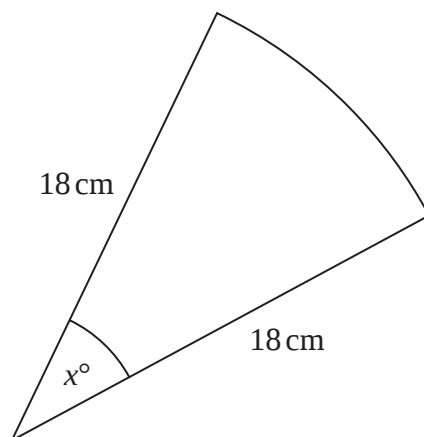
On the grid, draw a histogram for this information.



(Total for Question 14 is 3 marks)



15 The diagram shows a sector of a circle of radius 18 cm.



The length of the arc is 4π cm.

Work out the value of x .

arc length formula = $\frac{\theta}{360^\circ} \times 2\pi r$

we have

$$\theta = x$$

$$r = 18$$



$$\frac{x}{360} \times 2 \times \pi \times 18 = 4\pi \quad (1)$$

$$\frac{x\pi}{10} = 4\pi \quad \downarrow \div \pi$$

$$\frac{x}{10} = 4 \quad \downarrow \times 10$$

$$x = 40 \quad (2)$$

$$x = 40$$

(Total for Question 15 is 3 marks)

16 (a) Prove that

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

$$\text{LHS: } (2m+1)^2 - (2n-1)^2 \quad \downarrow \text{ difference of two squares}$$

$$= (2m+1 + [2n-1])(2m+1 - [2n-1]) \quad \textcircled{1}$$

$$= (2m+2n)(2m-2n+2) \quad \textcircled{1}$$

factor out 2
from both brackets

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

$$= 4(m+n)(m-n+1)$$

$$= \text{RHS} \quad \textcircled{1}$$

(3)

Sophia says that the result in part (a) shows that the difference of the squares of any two odd numbers must be a multiple of 4

(b) Is Sophia correct?

You must give reasons for your answer.

Yes, because $2m+1$ and $2n-1$ are both odd numbers and the right-hand side is divisible by 4. $\textcircled{1}$

(1)

(Total for Question 16 is 4 marks)



17 Work out the value of $\left(\frac{8}{27}\right)^{\frac{4}{3}}$

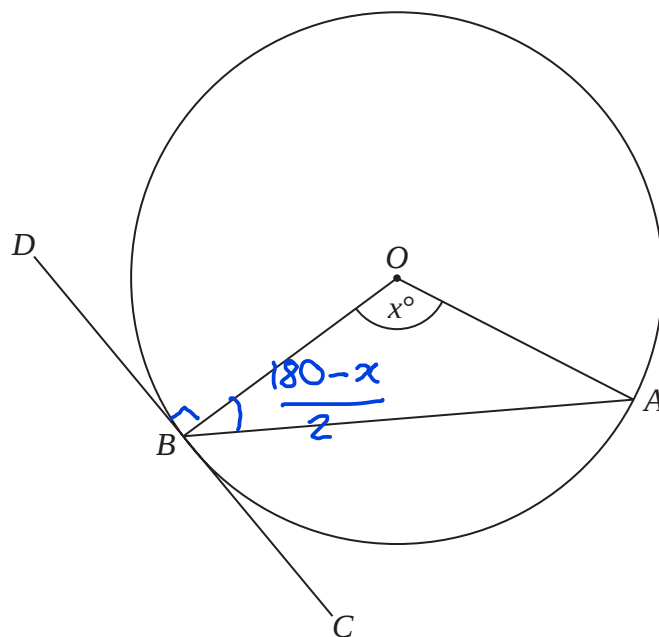
$$\left(\frac{8}{27}\right)^{4/3} = \left(\frac{8^{1/3}}{27^{1/3}}\right)^4 = \left(\frac{2}{3}\right)^4 = \frac{16}{81}$$

$$\frac{16}{81}$$

(Total for Question 17 is 2 marks)



18



A and B are points on a circle, centre O.
 DBC is the tangent to the circle at B.
 Angle $AOB = x^\circ$

Show that angle $ABC = \frac{1}{2}x^\circ$

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

$\angle OBD = 90^\circ$ ① the tangent to a circle is perpendicular to the radius

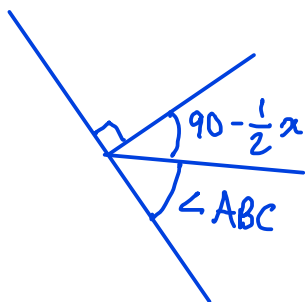
$\triangle OAB$ is isosceles so base angles = $\frac{180-x}{2} = 90 - \frac{1}{2}x$ ①

DBC is a straight line so angles add up to 180°

$$90 + 90 - \frac{1}{2}x + \angle ABC = 180$$

$$-\frac{1}{2}x + \angle ABC = 0$$

$$\angle ABC = \frac{1}{2}x \quad \text{①}$$



(Total for Question 18 is 3 marks)



19 Solve $\frac{1}{x} - \frac{1}{x+1} = 4$

Give your answer in the form $a \pm b\sqrt{2}$ where a and b are fractions.

$$\frac{1}{x} - \frac{1}{x+1} = 4$$

$$\frac{x+1}{x(x+1)} - \frac{x}{x(x+1)} = 4$$

$$\frac{x+1-x}{x(x+1)} = 4 \quad (1)$$

$$\frac{1}{x(x+1)} = 4$$

$$1 = 4x(x+1)$$

$$1 = 4x^2 + 4x$$

$$4x^2 + 4x - 1 = 0 \quad (1)$$

$$4x^2 + 4x - 1 = 0$$

quadratic formula:

$$x = \frac{-4 \pm \sqrt{16 - 4 \times 4 \times -1}}{2 \times 4} \quad (1)$$

$$x = \frac{-4 \pm \sqrt{32}}{8}$$

$$\begin{aligned} \sqrt{32} &= \sqrt{2 \times 16} \\ &= \sqrt{2} \times \sqrt{16} \\ &= 4\sqrt{2} \end{aligned}$$

$$x = \frac{-4 \pm 4\sqrt{2}}{8} \quad (1)$$

$$x = -\frac{1}{2} \pm \frac{1}{2}\sqrt{2} \quad (1)$$

$$x = -\frac{1}{2} \pm \frac{1}{2}\sqrt{2}$$

(Total for Question 19 is 5 marks)



20 Alfie has 11 cards.

He has

3 blue cards
7 green cards
and 1 white card.

Alfie takes at random 2 of these cards.

Work out the probability that he takes cards of different colours.

Alfie can either take cards of different colours or take cards of the same colour.

Hence $P(\text{takes different colours}) = 1 - P(\text{takes same colour})$
Since probabilities add to 1.

$$P(\text{takes two blue cards}) = \frac{3}{11} \times \frac{2}{10} = \frac{6}{110}$$

$$P(\text{takes two green cards}) = \frac{7}{11} \times \frac{6}{10} = \frac{42}{110}$$

$$P(\text{takes two white cards}) = \frac{1}{11} \times \frac{0}{10} = 0 \quad (1)$$

Add all together:

$$P(\text{takes same colour}) = \frac{6}{110} + \frac{42}{110} + 0 = \frac{48}{110} \quad (1)$$

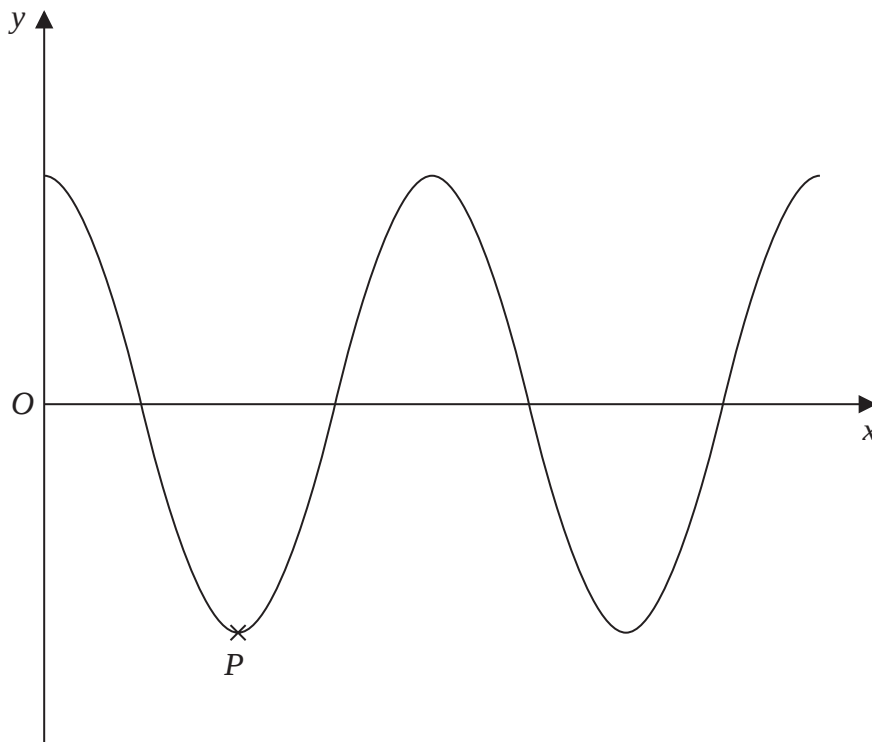
$$P(\text{takes different colours}) = 1 - \frac{48}{110} = \frac{62}{110} \quad (1)$$

$$\frac{62}{110}$$

(Total for Question 20 is 3 marks)



21



The diagram shows a sketch of part of the curve with equation $y = \cos x^\circ$

P is a minimum point on the curve.

Write down the coordinates of P .

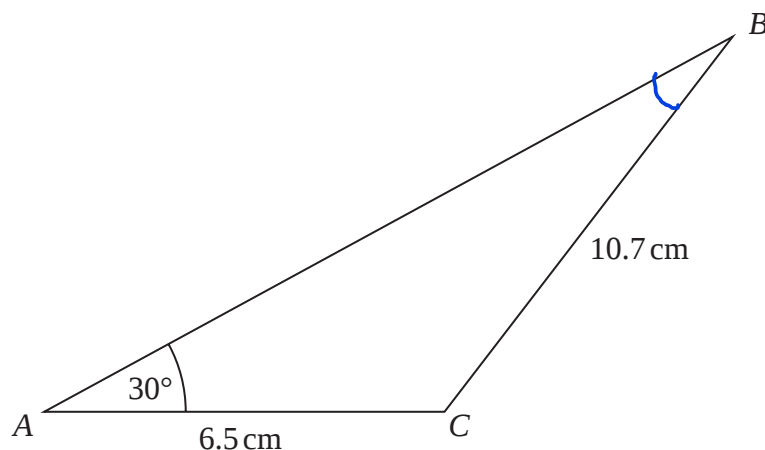
The first minimum point on
 $y = \cos x$ is $(180, -1)$.

(180^① , -1^①)

(Total for Question 21 is 2 marks)



22 Here is a triangle ABC .



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Work out the value of $\sin ABC$

Give your answer in the form $\frac{m}{n}$ where m and n are integers.

using sine rule:

$$\frac{\sin ABC}{6.5} = \frac{\sin 30}{10.7} \quad (1)$$

$$\sin ABC = \frac{\frac{1}{2} \times 6.5}{10.7} \quad (1)$$

$$\text{as } \sin 30 = \frac{1}{2} \quad (1)$$

$$10.7 = \frac{107}{10}$$

$$6.5 = \frac{13}{2}$$

multiplying by
reciprocal
↓

$$\sin ABC = \frac{1}{2} \times \frac{13}{2} \times \frac{10}{107}$$

$$= \frac{1}{2} \times 13 \times \frac{5}{107}$$

$$= \frac{65}{214} \quad (1)$$

$$\frac{65}{214}$$

(Total for Question 22 is 4 marks)



23 Here are the first five terms of a geometric sequence.

$$\sqrt{5} \quad 10 \quad 20\sqrt{5} \quad 200 \quad 400\sqrt{5}$$

(a) Work out the next term of the sequence.

finding the common ratio:

$$r = \frac{10}{\sqrt{5}} = \frac{10\sqrt{5}}{\sqrt{5}\sqrt{5}} = \frac{10}{5}\sqrt{5} = 2\sqrt{5} \text{ (1)}$$

so next term is

$$\begin{aligned} &400\sqrt{5} \times 2\sqrt{5} \\ &= 400 \times 2 \times 5 \\ &= 400 \times 10 \\ &= 4000 \text{ (1)} \end{aligned}$$

$$4000$$

(2)

The 4th term of a different geometric sequence is $\frac{5\sqrt{2}}{4}$

The 6th term of this sequence is $\frac{5\sqrt{2}}{8}$

Given that the terms of this sequence are all positive,

(b) work out the first term of this sequence.
You must show all your working.

If first term is a ,
4th term is ar^3

so we can do

4th term $\div r^3$ to get a .

let the common ratio be r .

$$\frac{5\sqrt{2}}{4} \times r \times r = \frac{5\sqrt{2}}{8}$$

$$r^2 = \frac{5\sqrt{2}}{8} \div \frac{5\sqrt{2}}{4}$$

$$= \frac{5\sqrt{2}}{8} \times \frac{4}{5\sqrt{2}}$$

$$r^2 = \frac{1}{2} \text{ (1)}$$

$$r^2 = \frac{1}{2}$$

$$r = \pm \frac{1}{\sqrt{2}}$$

$$r = \frac{1}{\sqrt{2}}$$

ignore $r = -\frac{1}{\sqrt{2}}$

as all terms
are positive

first term is

$$\frac{5\sqrt{2}}{4} \div \left[\frac{1}{\sqrt{2}} \right]^3 \text{ (1)}$$

$$= \frac{5\sqrt{2}}{4} \times 2\sqrt{2}$$

$$= \frac{10}{4} \times 2$$

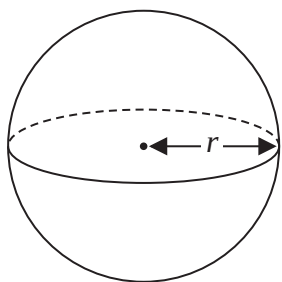
$$= 5 \text{ (1)}$$

$$5$$

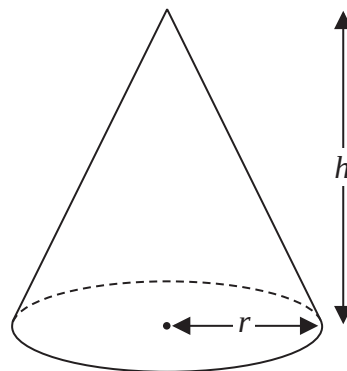
(3)

(Total for Question 23 is 5 marks)

24 Here is a solid sphere and a solid cone.



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



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

All measurements are in cm.

The volume of the sphere is equal to the volume of the cone.

(a) Find $r:h$

Give your answer in its simplest form.

volumes equal:

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

$$\begin{aligned} 4\pi r^3 &= \pi r^2 h && \downarrow \times 3 \\ 4r^3 &= r^2 h && \downarrow \div \pi \\ 4r &= h && \downarrow \div r^2 \end{aligned}$$

$$r:h$$

$$1:4 \quad (1)$$

h is four times r
so h is bigger

$$1:4$$

(2)

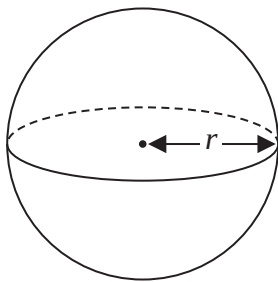
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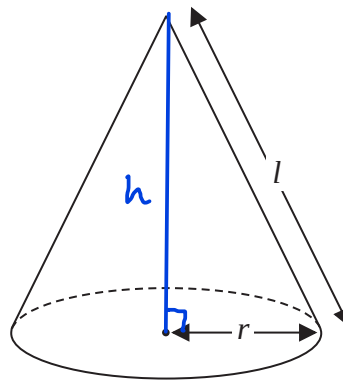
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Here is a different solid sphere and a different solid cone.



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



$$\text{Curved area of cone} = \pi r l$$

All measurements are in cm.

The surface area of the sphere is equal to the **total** surface area of the cone.

(b) Find $r:h$

Give your answer in the form $1:\sqrt{n}$ where n is an integer.

surface area = SA

$$\text{SA of sphere} = 4\pi r^2$$

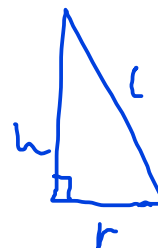
$$\text{SA of cone} = \pi r l + \pi r^2$$

$$4\pi r^2 = \pi r l + \pi r^2 \quad (1)$$

$$4r = l + r$$

$$l = 3r$$

from right angled triangle:



$$\begin{aligned} h &= \sqrt{l^2 - r^2} \\ \text{sub in } l &= 3r \quad \rightarrow \quad h = \sqrt{(3r)^2 - r^2} \quad (1) \end{aligned}$$

$$h = \sqrt{8r^2}$$

$$h = \sqrt{8} r \quad (1)$$

$$\begin{aligned} r:h \\ 1:\sqrt{8} \quad (1) \end{aligned}$$

(4)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS

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