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.
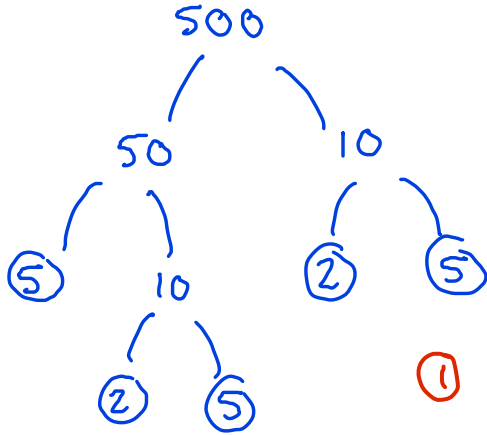- Check your answers if you have time at the end.

Turn over ▶

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.

500

50   10

5   10   2   5

2   5   ①

$$500 = 2 \times 2 \times 5 \times 5 \times 5 \ ①$$
$$= 2^2 \times 5^3 \ ①$$

$2^2 \times 5^3$

(Total for Question 1 is 3 marks)

2

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

Give your answer as a mixed number.

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

adding fractions:

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

$\frac{12}{20} + \frac{5}{20} = \frac{17}{20}$ ①

$3\frac{17}{20}$ ①

(2)

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

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

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

$\div 2$

$\div 2$

(2)

(Total for Question 2 is 4 marks)

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

Give your answer as a power of 2

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

$a^b \times a^c = a^{b+c}$

$= (2^{-5+8})^2$ ①

$= (2^3)^2$

$(a^b)^c = a^{bc}$

$= 2^6$ ①

2^6

(Total for Question 3 is 2 marks)

4 Work out 0.004×0.32

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

0.004×0.32

$= 4 \times 32 \times 0.001 \times 0.01$

$= 128 \times 0.00001$

$= 0.00128$ ①

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

0.004 0.32
  3   2

0.00128

(Total for Question 4 is 2 marks)

4

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

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

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

$$\begin{array}{r} 0\,2\,5\,0\,0 \\ 16\,\overline{)40{,}000} \end{array}$$

$$= 3 \times 2500$$
$$= 7500 \quad ①$$

7500

(Total for Question 5 is 2 marks)

5

6 Rizwan writes down three numbers a, b and c

$$a:b = 1:3$$
$$b:c = 6:5$$

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

$a:b$ $b:c$
$1:3$ $6:5$
$\times 2$ ⌐ $1:3$ ⌐ $\times 2$
$2:6$ ①

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

$a:b:c$
$2:6:5$

$2:6:5$ ①

(2)

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

want $\dfrac{a}{a+b+c} = \dfrac{2}{2+6+5}$ ① $= \dfrac{2}{13}$ ①

$\dfrac{2}{13}$

(2)

Emma writes down three numbers m, n and p

$$n = 2m$$
$$p = 5n$$

(b) Find $m:p$

$n = 2m$
$p = 5n \Rightarrow n = \dfrac{p}{5}$

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

$2m = \dfrac{p}{5}$ ①

$10m = p$ ⌐ p is ten times m,
$m:p$ ⌐ so p is bigger.
$1:10$ ①

$1:10$

(2)

(Total for Question 6 is 6 marks)

7

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

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.

area = 4 × 2 = 8m²

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

÷4 ... ÷4

..................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 × 5

n is even so let n = 7 × 2

∴ m = 35 ①

    n = 14 ①

$m =$ 35

$n =$ 14

(Total for Question 8 is 2 marks)

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

$x = -2$:
$y = 6(-2) - (-2)^3$
$= -12 + 8$
$= -4$

$x = -1$:
$y = 6(-1) - (-1)^3$
$= -6 + 1$
$= -5$

$x = 0$:
$y = 6(0) - 0^3$
$y = 0$

$x = 1$:
$y = 6(1) - (1)^3$
$= 6 - 1$
$= 5$

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

②

(2)

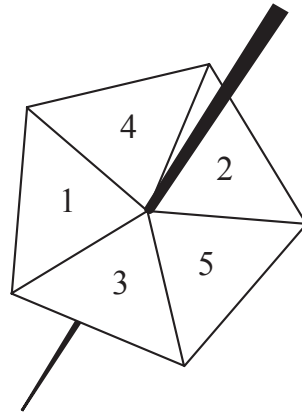(b) On the grid, draw the graph of $y = 6x - x^3$ for values of x from -3 to 3
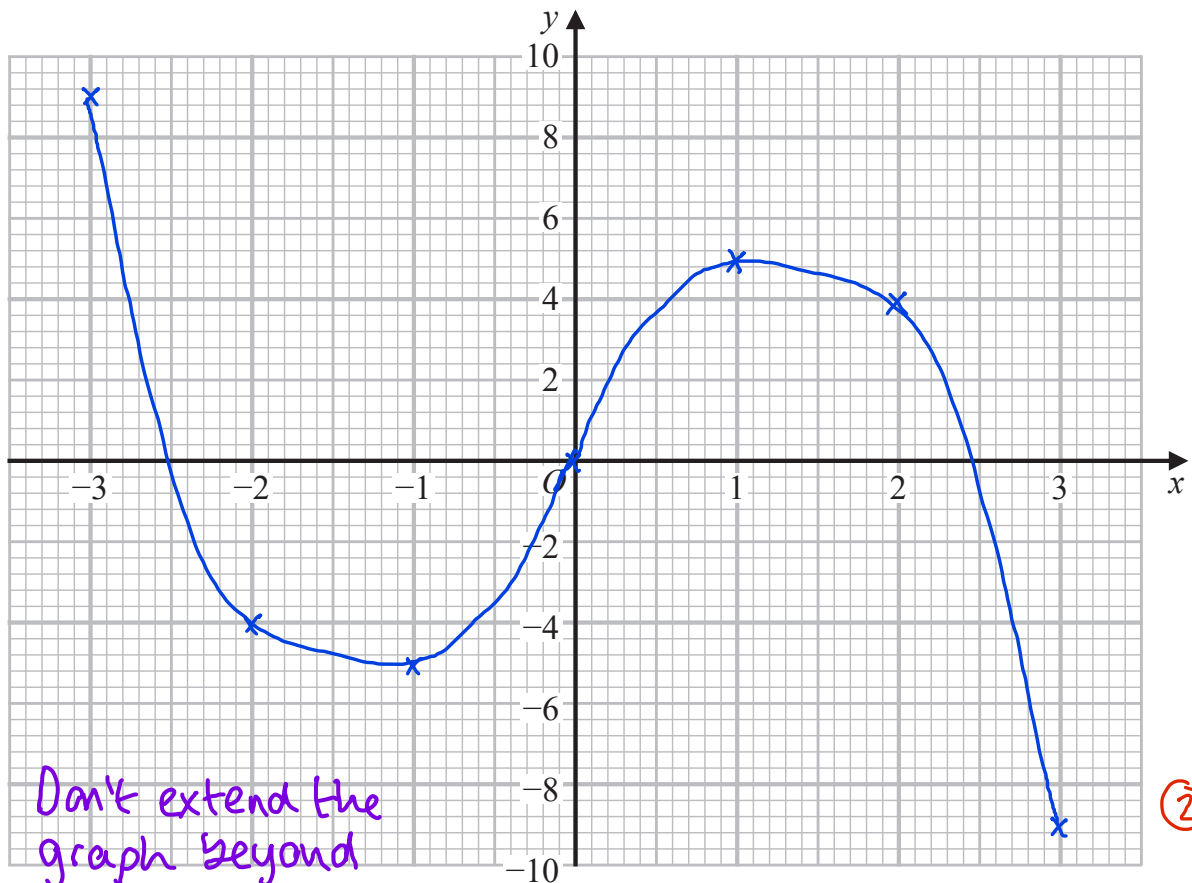
Don't extend the graph beyond the range given.

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:

$$\frac{10}{6+8+9+7+10} = \frac{10}{40} = \frac{1}{4} \;①$$

getting 5 **both** times

$$= \frac{1}{4} \times \frac{1}{4} = \frac{1}{16} \;①$$

$\frac{1}{16}$

(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:

$$\frac{6}{6+8+9+7+10} = \frac{6}{40} \;①$$

$\div 2$ $\times 5$ % means out of 100

$$\frac{6}{40} = \frac{3}{20} = \frac{15}{100} = 15\% \;①$$

$\div 2$ $\times 5$

15 %

(2)

(Total for Question 10 is 4 marks)

10

11
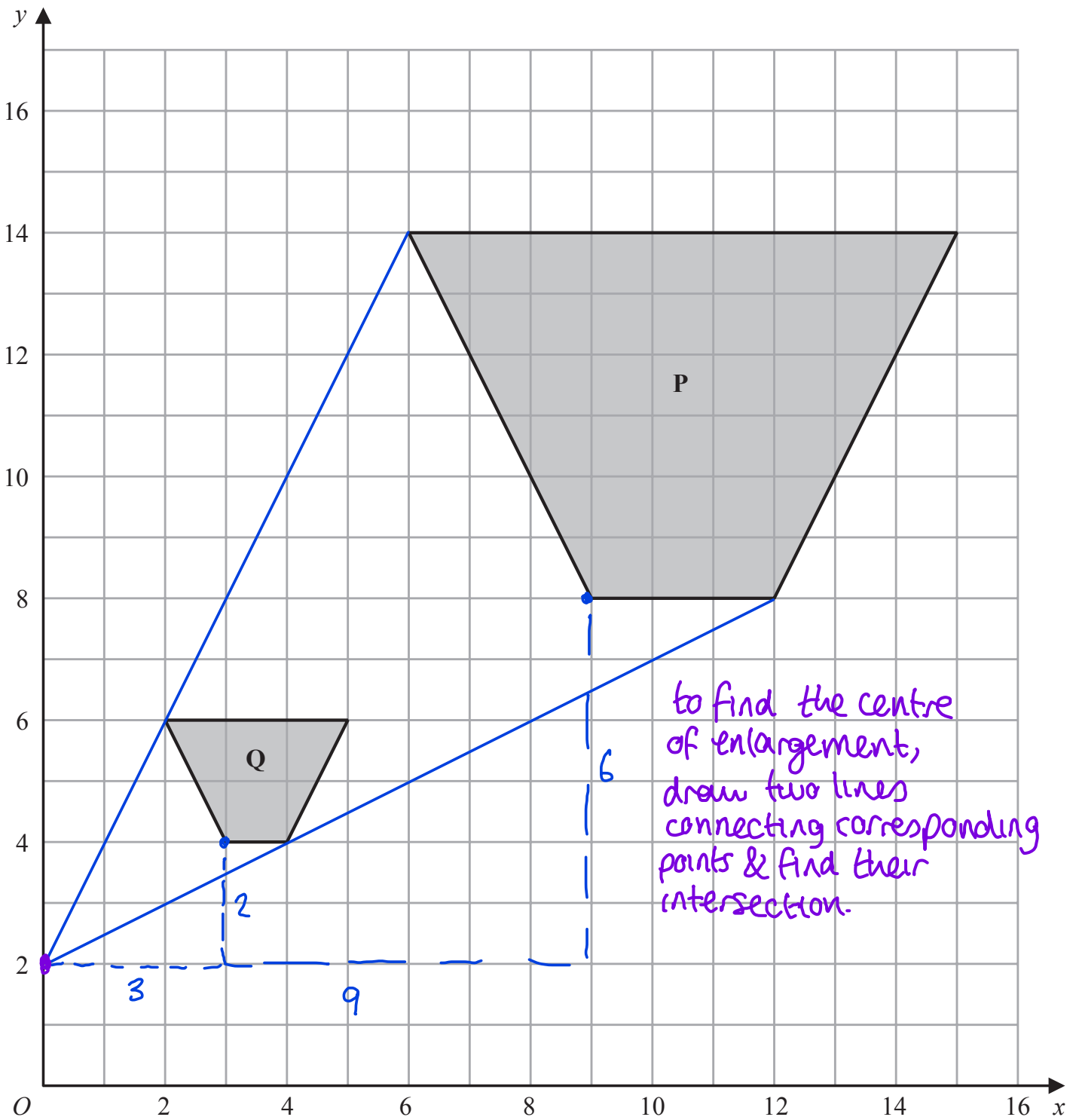
Describe fully the single transformation that maps shape **P** onto shape **Q**.

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

Remember it's P → Q, not Q → P

(Total for Question 11 is 2 marks)

12 Solve the simultaneous equations

$$5x + 2y = 11$$
$$4x + 3y = 6$$

$5x + 2y = 11$ ①
$4x + 3y = 6$ ②

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

① × 3: $15x + 6y = 33$
② × 2: $8x + 6y = 12$
‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾
         $7x + 0y = 21$ ①

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

$7x = 21$
$x = \dfrac{21}{7} = 3$ ①

substitute $x = 3$ into ①

$5(3) + 2y = 11$ ①
$2y = 11 - 15$
$2y = -4$
$y = -2$ ①

$x = \underline{\ 3\ }$

$y = \underline{\ -2\ }$

(Total for Question 12 is 4 marks)

12

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 $\longrightarrow$ $p = \dfrac{100}{t}$ ①

$p = \dfrac{k}{t}$ $\left.\begin{array}{l} \text{sub } p=1, t=100 \\ \text{to find } k \end{array}\right.$

$t=25:$ $p = \dfrac{100}{25} = 4$ ①

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

$p=5:$ $5 = \dfrac{100}{t} \Rightarrow t = 20$ ①

$k = 100$

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

(Total for Question 13 is 3 marks)

13

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

[handwritten annotations: class width — 20, 10, 10, 20]

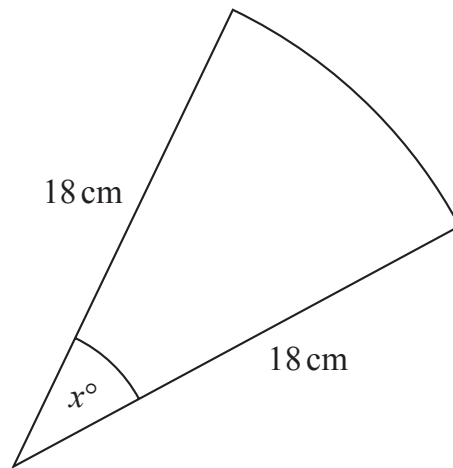| Weight (*w* grams)	Number of potatoes	*[frequency density]*
$50 < w \leqslant 70$	20	$20 \div 20 = 1$
$70 < w \leqslant 80$	50	$50 \div 10 = 5$
$80 < w \leqslant 90$	60	$60 \div 10 = 6$
$90 < w \leqslant 110$	30	$30 \div 20 = 1.5$

On the grid, draw a histogram for this information.
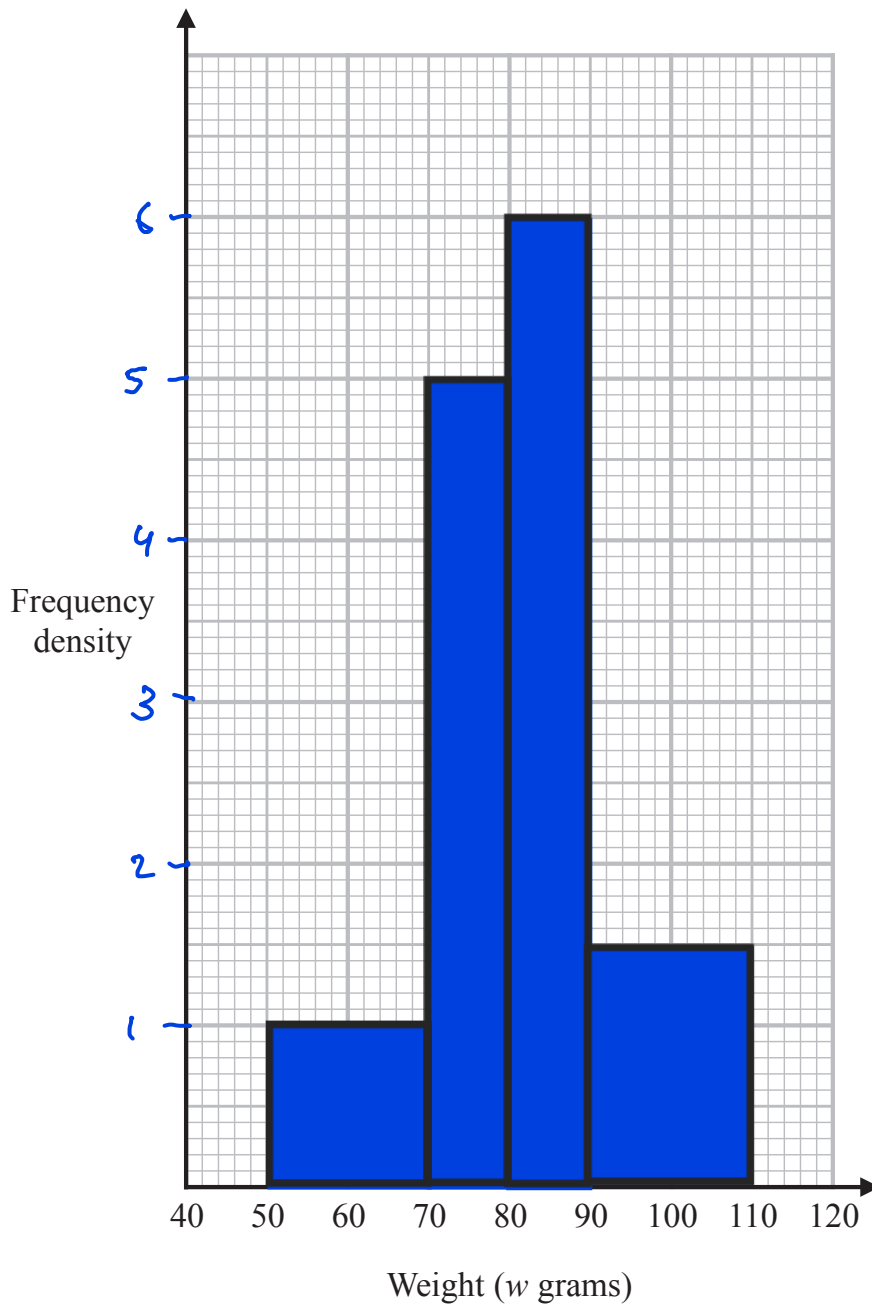
(Total for Question 14 is 3 marks)

14

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

18 cm

18 cm

$x°$

The length of the arc is 4π cm.

Work out the value of x.

arc length formula $= \dfrac{\theta}{360°} \times 2\pi r$

we have

$\theta = x$

$r = 18$

$\dfrac{x}{360} \times 2 \times \pi \times 18 = 4\pi$ ①

$\dfrac{x\pi}{10} = 4\pi$ $\Big\} \div \pi$

$\dfrac{x}{10} = 4$ $\Big\} \times 10$

$x = 40$ ②

$x = $ __40__

(Total for Question 15 is 3 marks)

16 (a) Prove that
$$(2m + 1)^2 - (2n - 1)^2 = 4(m + n)(m - n + 1)$$

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

$= (2m+1+[2n-1])(2m+1-[2n-1])$ ①

$= (2m+2n)(2m-2n+2)$ ① $\}$ factor out 2 from both brackets

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

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

$= RHS$ 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. ①
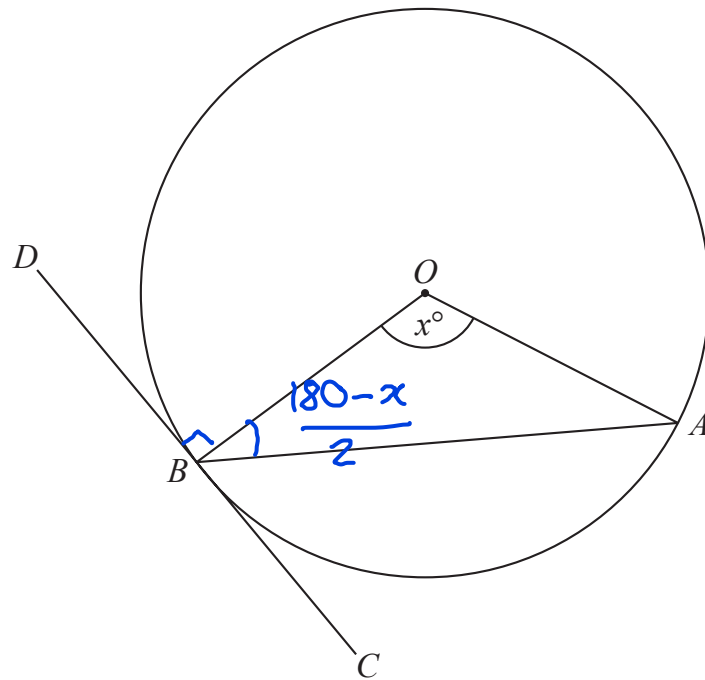
(1)

(Total for Question 16 is 4 marks)

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

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

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

(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°

Show that angle $ABC = \frac{1}{2}x°$

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

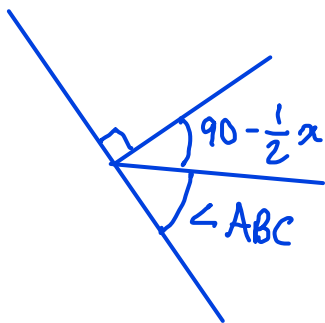$\angle OBD = 90°$ ① the tangent to a circle is perpendicular to the radius

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

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

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

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

$\angle ABC = \frac{1}{2}x$ ①

(Total for Question 18 is 3 marks)

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

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

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

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

$$\frac{x+1-x}{x(x+1)} = 4 \;①$$

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

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

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

$$4x^2 + 4x - 1 = 0 \;①$$

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

quadratic formula:

$$x = \frac{-4 \pm \sqrt{16 - 4 \times 4 \times -1}}{2 \times 4} \;①$$

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

$$\sqrt{32} = \sqrt{2 \times 16}$$
$$= \sqrt{2} \times \sqrt{16}$$
$$= 4\sqrt{2}$$

$$x = \frac{-4 \pm 4\sqrt{2}}{8} \;①$$

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

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

(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(takes different colours) = 1 - P(takes same colour)
Since probabilities add to 1.

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

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

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

Add all together:

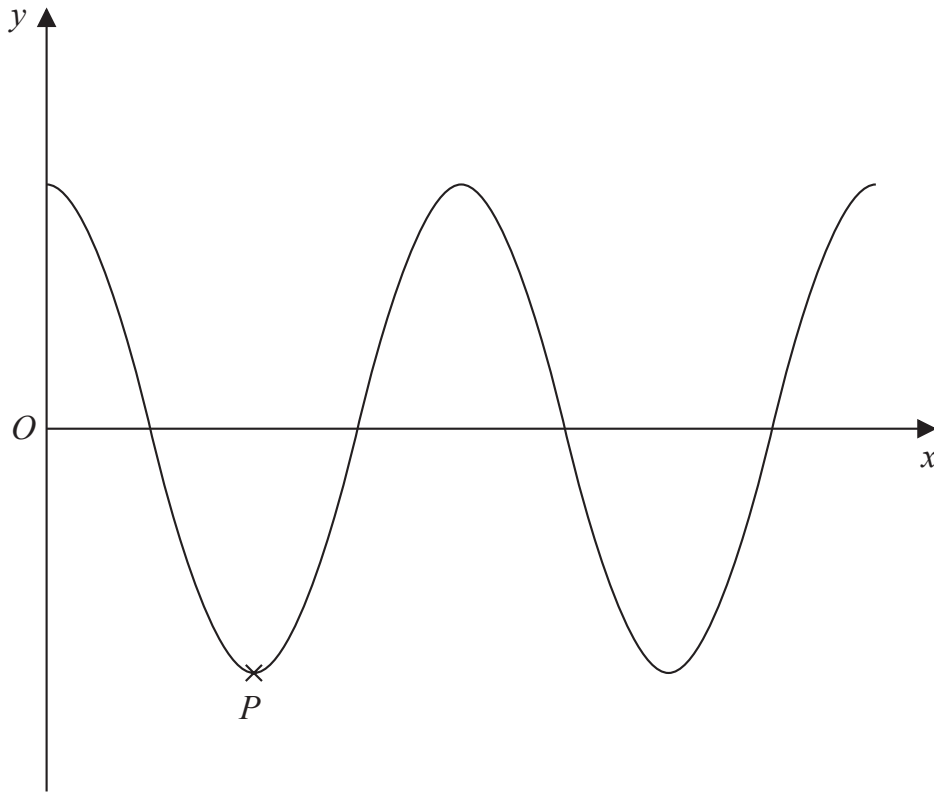$P(\text{takes same colour}) = \frac{6}{110} + \frac{42}{110} + 0 = \frac{48}{110}$ ①

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

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

(Total for Question 20 is 3 marks)

21

The diagram shows a sketch of part of the curve with equation $y = \cos x°$
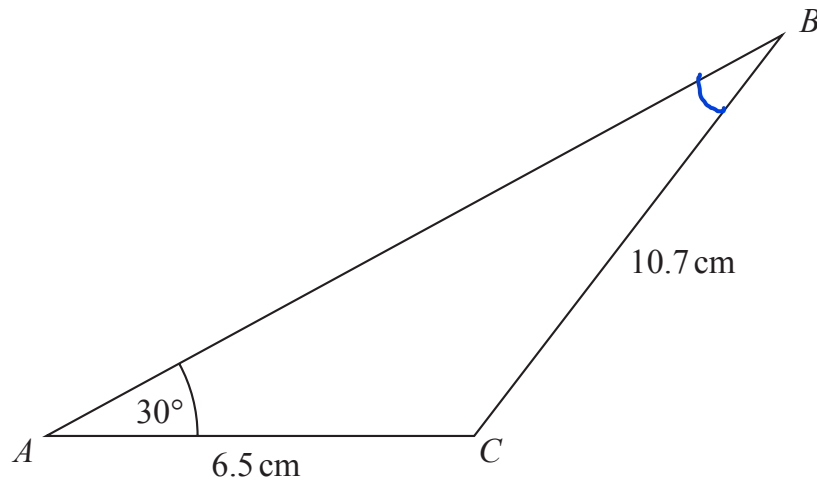
P is a minimum point on the curve.

Write down the coordinates of P.

The first minimum point on
y=cosx is (180,-1).

(180 ① , -1 ①)

(Total for Question 21 is 2 marks)

22 Here is a triangle ABC.

Work out the value of $\sin ABC$

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

Using sine rule :

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

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

as $\sin 30 = \frac{1}{2}$ ①

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

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

multiplying by reciprocal

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

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

$$= \frac{65}{214} \quad ①$$

.......................$\dfrac{65}{214}$.......................

(Total for Question 22 is 4 marks)

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

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

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

finding the common ratio:

$r = \dfrac{10}{\sqrt{5}} = \dfrac{10\sqrt{5}}{\sqrt{5}\sqrt{5}} = \dfrac{10}{5}\sqrt{5} = 2\sqrt{5}$ ①

so next term is

$400\sqrt{5} \times 2\sqrt{5}$
$= 400 \times 2 \times 5$
$= 400 \times 10$
$= 4000$ ①

.... 4000 ....

(2)

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

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

Given that the terms of this sequence are <mark>all positive,</mark>

(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 ÷ r^3 to get a.

let the common ratio be r.

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

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

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

$r^2 = \dfrac{1}{2}$ ①

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

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

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

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

as all terms are positive

first term is

$\dfrac{5\sqrt{2}}{4} \div \left[\dfrac{1}{\sqrt{2}}\right]^3$ ①

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

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

$= 5$ ①

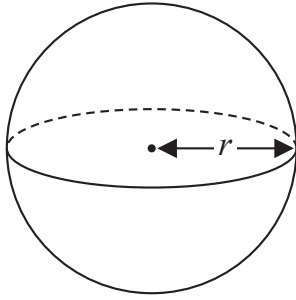.......................... 5 ....
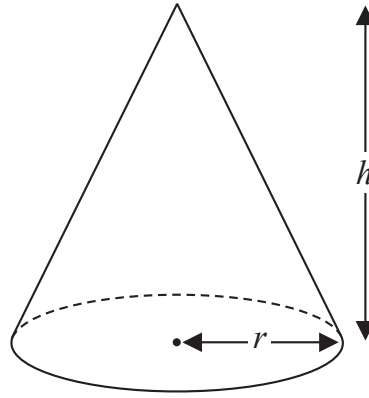
(3)

(Total for Question 23 is 5 marks)

23

24 Here is a solid sphere and a solid cone.

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

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

$\Big\} \times 3$

$$4\pi r^3 = \pi r^2 h$$

$\Big\} \div \pi$

$$4r^3 = r^2 h$$

$\Big\} \div r^2$

$$4r = h$$
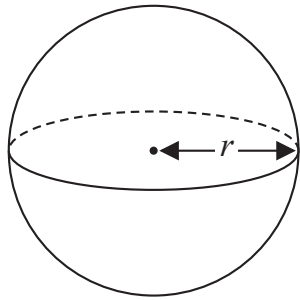
$r:h$

$1:4$ ①

h is four times r
so h is bigger
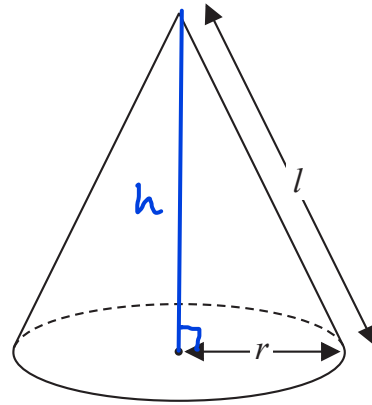
$1:4$

(2)

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

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

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

SA of sphere = $4\pi r^2$

SA of cone = $\pi rl + \pi r^2$

$4\pi r^2 = \pi rl + \pi r^2$ ①

$4r = l + r$

$l = 3r$

from right angled triangle:

sub in $l = 3r$

$h = \sqrt{l^2 - r^2}$

$h = \sqrt{(3r)^2 - r^2}$ ①

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

$h = \sqrt{8}\,r$ ①

$r:h$

$1:\sqrt{8}$ ①

(4)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS

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