

Please check the examination details below before entering your candidate information

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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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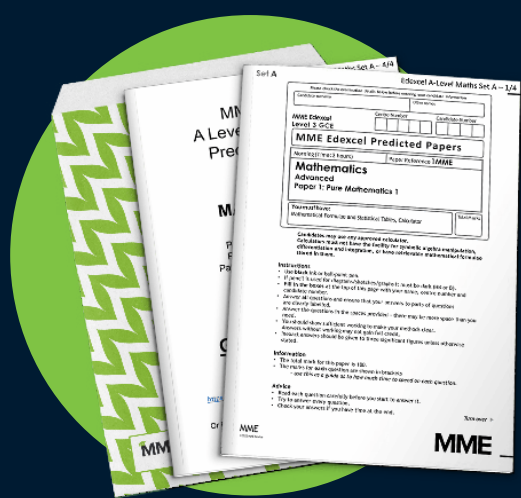
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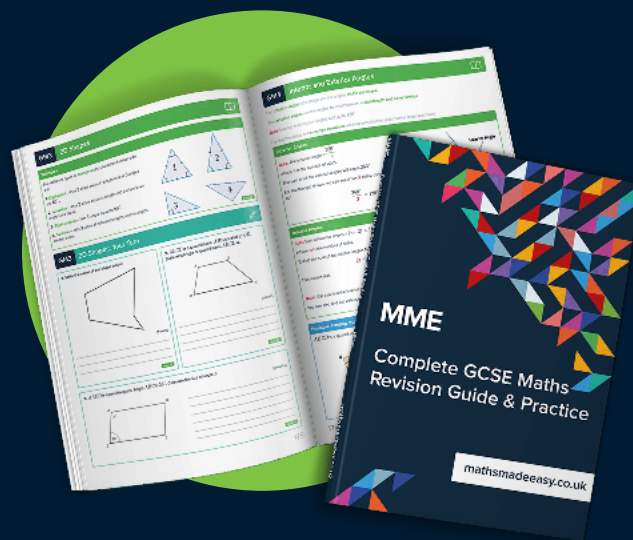


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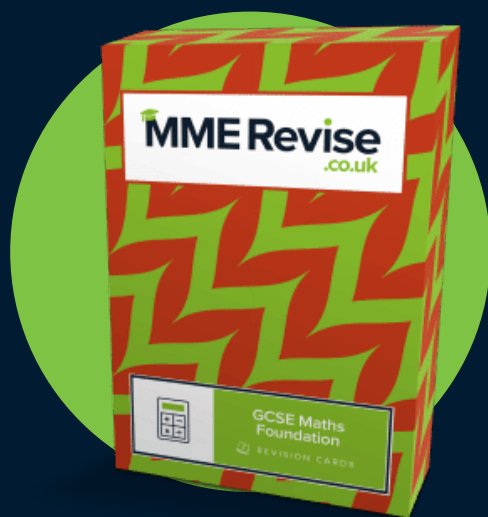
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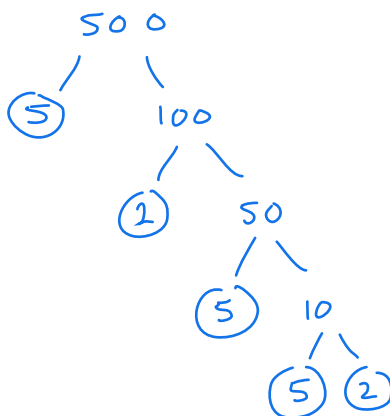
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Answer ALL questions.

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.



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

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

(Total for Question 1 is 3 marks)

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

Give your answer as a mixed number.

$$\begin{aligned}
 &= \frac{8}{5} + \frac{9}{4} \\
 &= \frac{32}{20} + \frac{45}{20} \\
 &= \frac{77}{20} \\
 &= 3\frac{17}{20}
 \end{aligned}$$

$$3\frac{17}{20}$$

(2)

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

$$\begin{aligned}
 &2\frac{2}{3} \div 6 \\
 &= \frac{8}{3} \times \frac{1}{6} \\
 &= \frac{8}{18} \\
 &= \frac{4}{9}
 \end{aligned}$$

(2)

(Total for Question 2 is 4 marks)



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

Give your answer as a power of 2

$$(2^3)^2 = 2^6$$

.....
 2^6

(Total for Question 3 is 2 marks)

4 Work out 0.004×0.32

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

$$0.00128$$

.....
 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

total 80

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

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

$$B \text{ is } \frac{15}{80}$$

$$\text{So we need } \frac{15}{80} \times 40,000$$

$$\frac{1}{80} \text{ of } 40,000 = 40,000 \div 80 = 4000 \div 8 = 500$$

$$\frac{15}{80} \text{ of } 40,000 = 15 \times 500 = 7500$$

7500

(Total for Question 5 is 2 marks)



6 Rizwan writes down three numbers a , b and c

$$a:b = 1:3$$

$$b:c = 6:5$$

(a) (i) Find $a:b:c$ *make b match on both ratios*

$$a:b = 1:3$$

$$= 2:6$$

$$b:c = 6:5$$

Now b is the same for both, combine ratios $a:b:c$
 $= 2:6:5$

$$2:6:5$$

(2)

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

$$a : b : c$$

$$\frac{2}{13} : \frac{6}{13} : \frac{5}{13}$$

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

(2)

Emma writes down three numbers m , n and p

$$n = 2m$$

$$p = 5n$$

(b) Find $m:p$

$$p = 5 \times 2m$$

$$p = 10m$$

If $m=1, p=10$ so ratio $m:p$ is $1:10$

$$1:10$$

(2)

(Total for Question 6 is 6 marks)

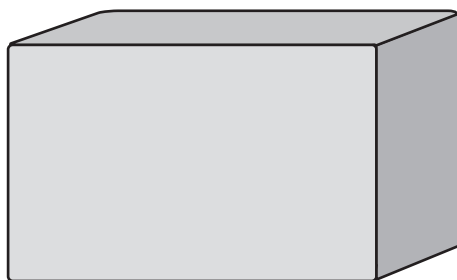


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7



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

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.

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

$$\text{Force} = 10,000 \text{ N}$$

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

$$= \frac{10,000}{8}$$

$$= \frac{5000}{4}$$

$$= 1250 \text{ N/m}^2$$

..... 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 .

Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40...

Multiples of 7: 7, 14, 21, 28, 35, 42...

35 is a multiple of 5 and has a factor of 7 so say $m = 35$

n is any even multiple of 7

$$m = 35$$

$$n = 14$$

(Total for Question 8 is 2 marks)

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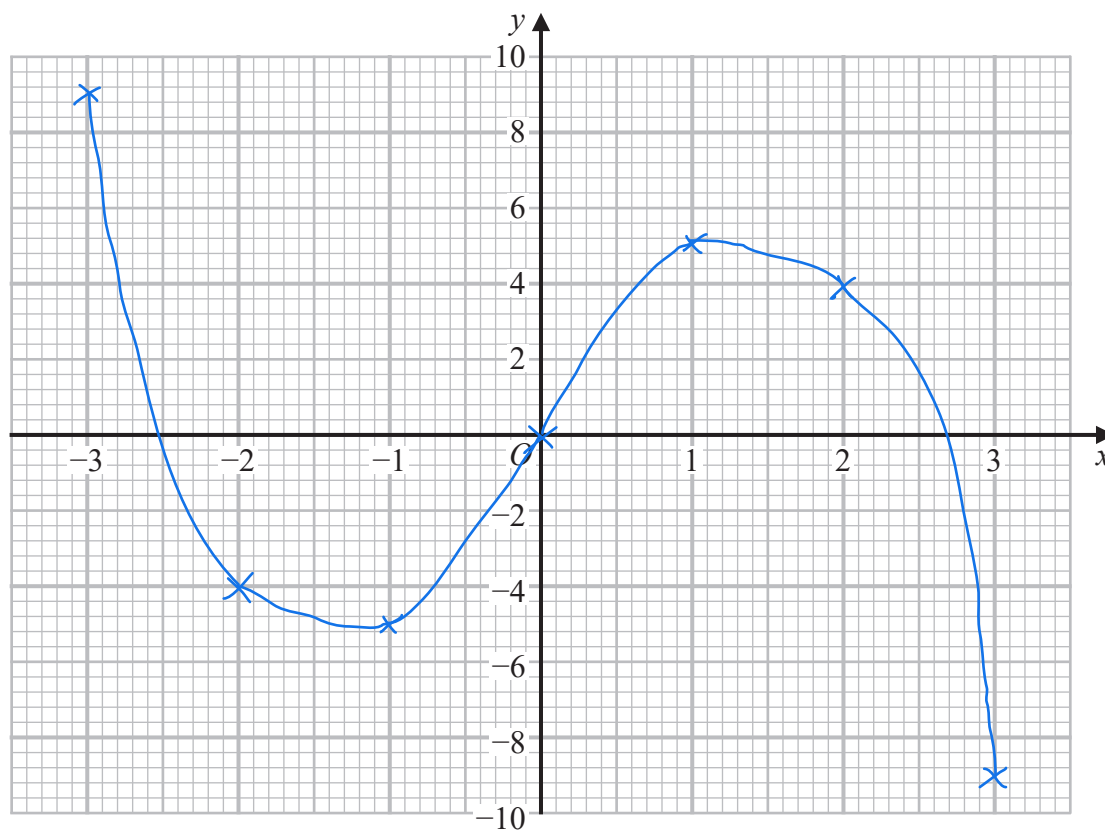


- 9 (a) Complete the table of values for $y = 6x - x^3$

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

(2)

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

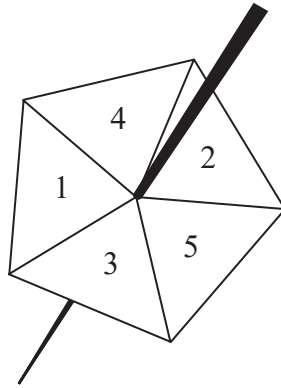


(2)

(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	<i>total = 40</i>

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.

probability of getting a 5 is $\frac{10}{40} = \frac{1}{4}$

probability of getting a 5 both times is $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$

..... $\frac{1}{16}$
(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

probability of getting 1 is $\frac{6}{40} = \frac{3}{20} = \frac{15}{100} = 15\%$

..... 15 %
(2)

(Total for Question 10 is 4 marks)

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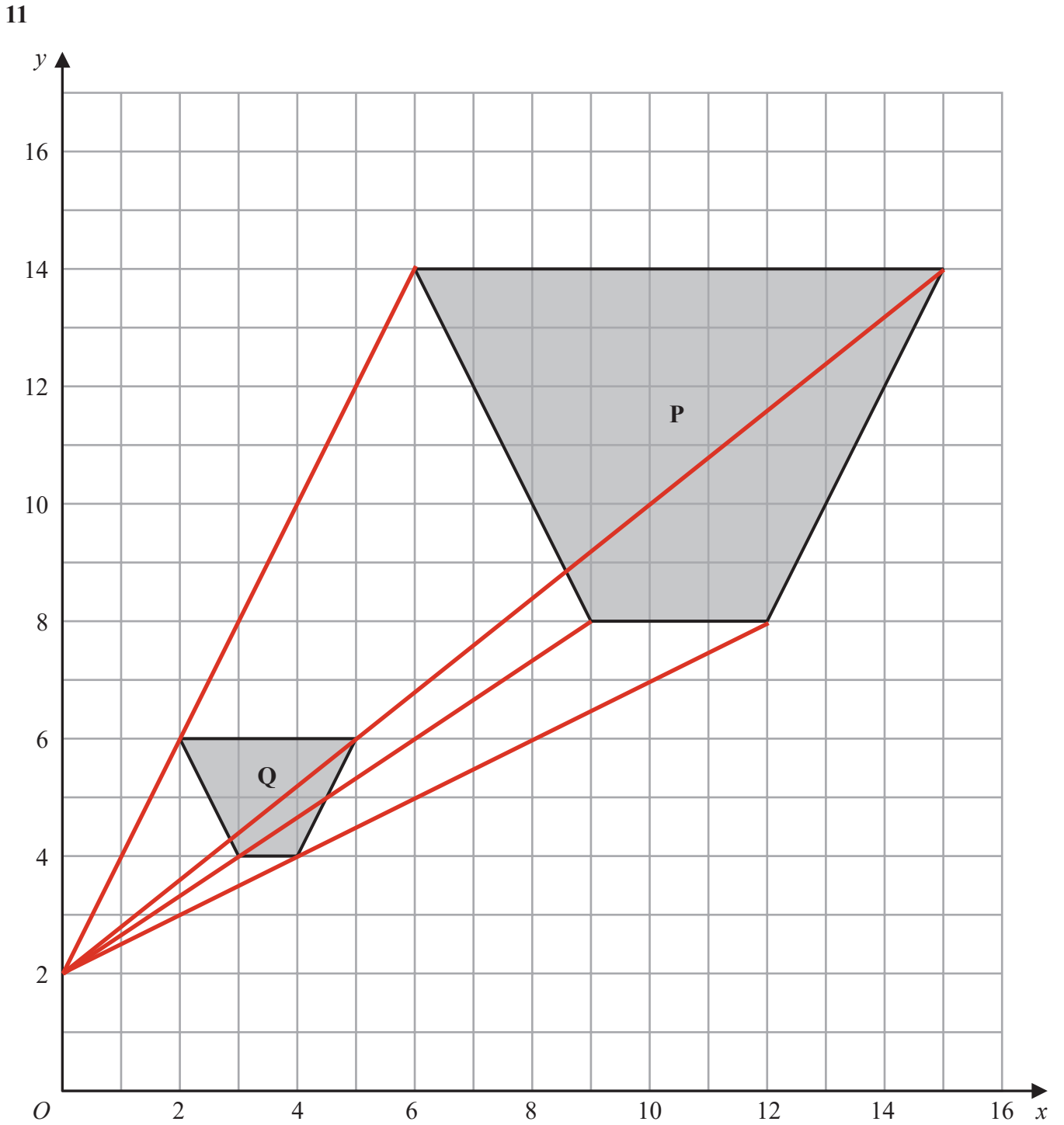
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Describe fully the single transformation that maps shape **P** onto shape **Q**.

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

(Total for Question 11 is 2 marks)



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

12 Solve the simultaneous equations

$$5x + 2y = 11 \quad \text{--- (1)}$$

$$4x + 3y = 6 \quad \text{--- (2)}$$

(1) $\times 3$ gives

$$15x + 6y = 33 \quad \text{--- (3)}$$

(2) $\times 2$ gives

$$8x + 6y = 12 \quad \text{--- (4)}$$

(3) $-$ (4) gives

$$7x = 21$$

$$x = 3$$

Substitute into (1)

$$5 \times 3 + 2y = 11$$

$$15 + 2y = 11$$

$$2y = -4$$

$$y = -2$$

$$x = 3$$

$$y = -2$$

(Total for Question 12 is 4 marks)

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13 p is inversely proportional to t — so $p = \frac{k}{t}$

Complete the table of values.

t	100	25	20	2
p	1	4	5	50

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

We know $p=1$ when $t=100$ so $1 = \frac{k}{100}$
 $k = 100$

so $p = \frac{100}{t}$

• when $t = 25$, $p = \frac{100}{25} = 4$

• when $t = 2$, $p = \frac{100}{2} = 50$

• when $p = 5$, $5 = \frac{100}{t}$
 $t = 20$

(Total for Question 13 is 3 marks)

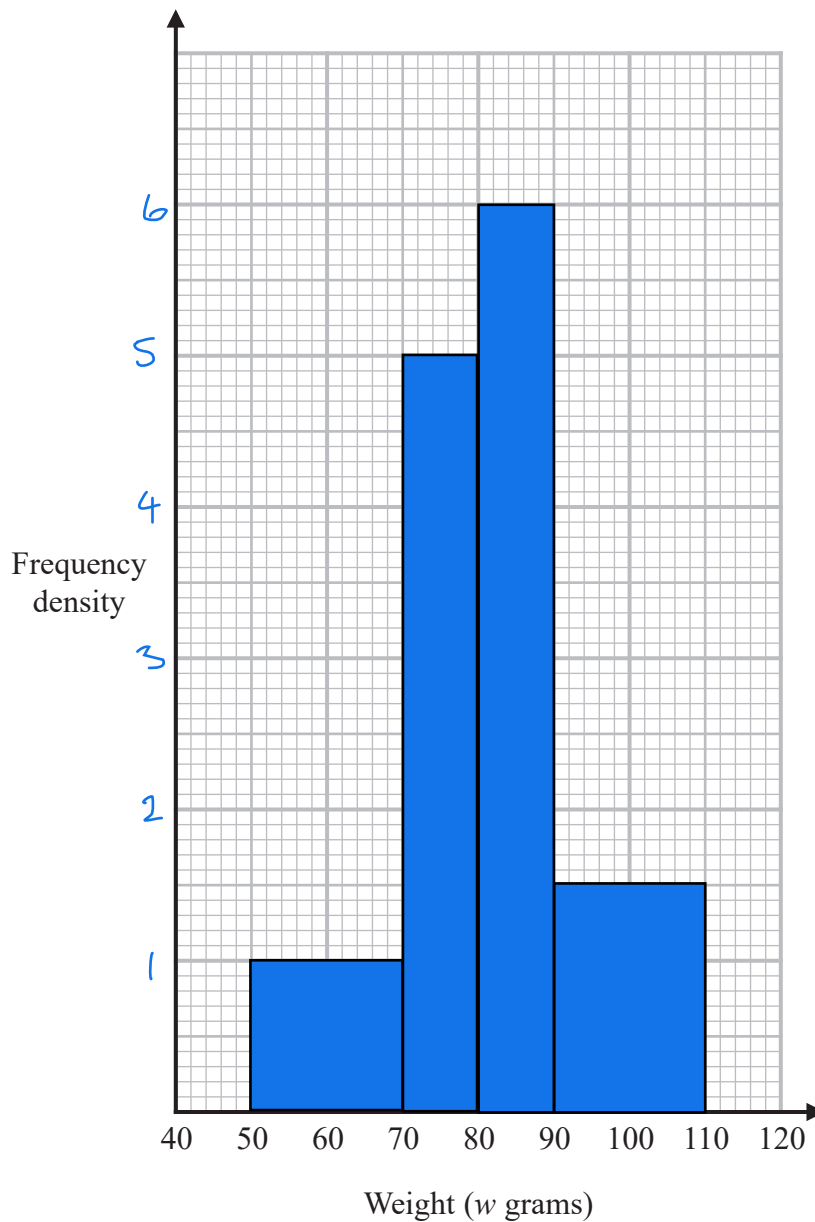


14 The table shows information about the weights, in grams, of some potatoes.

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

class width	frequency density
20	$20 \div 20 = 1$
10	$50 \div 10 = 5$
10	$60 \div 10 = 6$
20	$30 \div 20 = 1.5$

On the grid, draw a histogram for this information.



(Total for Question 14 is 3 marks)

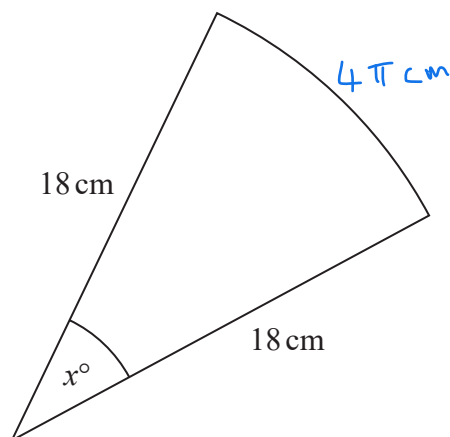


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15 The diagram shows a sector of a circle of radius 18 cm.



The length of the arc is 4π cm.

Work out the value of x .

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

$$\frac{36\cancel{\pi} x}{360} = 4\cancel{\pi}$$

$$\frac{36x}{360} = 4$$

$$\frac{x}{10} = 4$$

$$x = 40$$

$$x = \underline{40}$$

(Total for Question 15 is 3 marks)



16 (a) Prove that

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

$$\begin{aligned} (2m+1)^2 - (2n-1)^2 &= (2m+1)(2m+1) - (2n-1)(2n-1) \\ &= (4m^2 + 2m + 2m + 1) - (4n^2 - 2n - 2n + 1) \\ &= (4m^2 + 4m + 1) - (4n^2 - 4n + 1) \\ &= 4m^2 + 4m + 1 - 4n^2 + 4n - 1 \\ &= 4m^2 - 4n^2 + 4m + 4n \\ &= 4(m^2 - n^2 + m + n) \\ &= 4((m+n)(m-n) + (m+n)) \\ &= 4((m+n)(m-n+1)) \\ &= 4(m+n)(m-n+1) \end{aligned}$$

(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 - for any integers m and n , $2m+1$ and $2n-1$ must be odd. We've shown the difference of their squares is $4(m+n)(m-n+1)$ which must be a multiple of 4

(1)

(Total for Question 16 is 4 marks)



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

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

$$= \left(\sqrt[3]{\frac{8}{27}} \right)^4$$

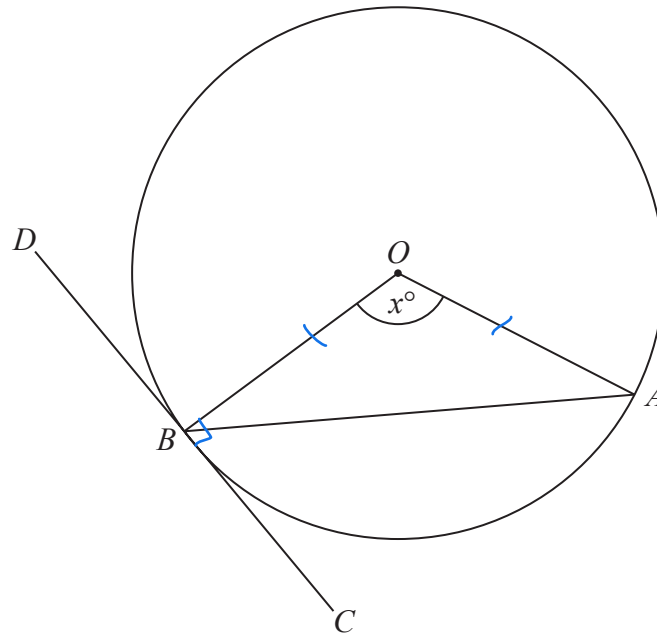
$$= \left(\frac{2}{3} \right)^4$$

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

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

(Total for Question 17 is 2 marks)





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 $OBC = 90^\circ$ as a radius is perpendicular to a tangent

Angle $OBA = \frac{180-x}{2}$ as triangle OBA is isosceles and angles in a triangle add to 180°

$$\begin{aligned} \text{Angle } ABC &= 90 - \left(\frac{180-x}{2}\right) \\ &= \frac{180}{2} - \left(\frac{180-x}{2}\right) \\ &= \frac{180 - 180 + x}{2} \\ &= \frac{x}{2} \end{aligned}$$

(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.

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

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

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

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

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

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

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

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

$$= \frac{-4 \pm \sqrt{16 - (-16)}}{8}$$

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

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

(Total for Question 19 is 5 marks)

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

$$= -\frac{1}{2} \pm \frac{\sqrt{16}\sqrt{2}}{8}$$

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



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. (no replacement)

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

will be $1 - P(\text{both cards the same colour})$

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

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

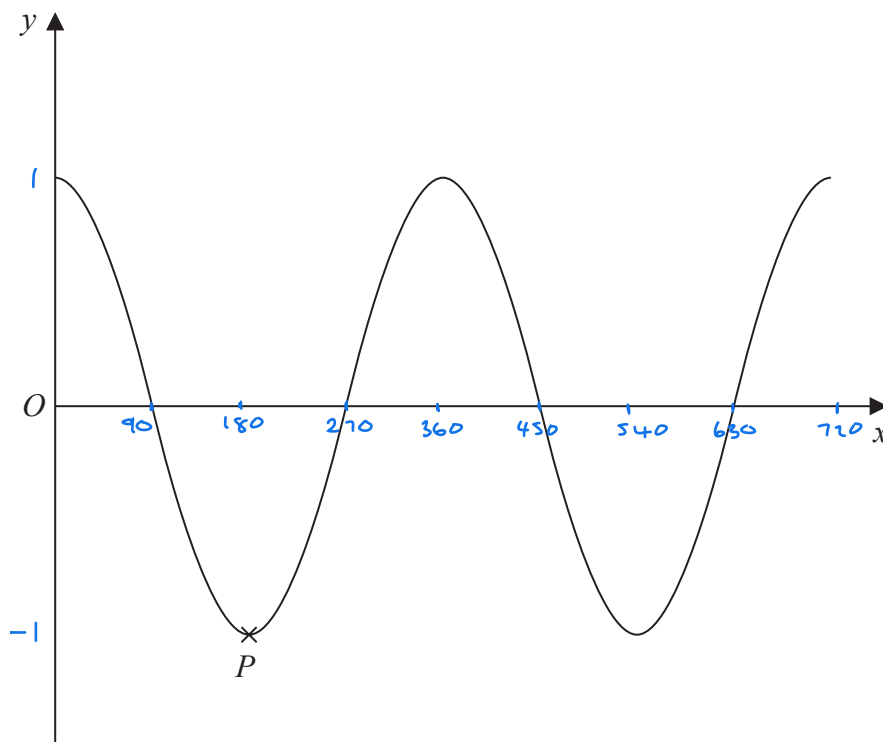
$$\begin{aligned} \text{So } P(\text{both different colours}) &= 1 - \left(\frac{6}{110} + \frac{42}{110} \right) \\ &= 1 - \frac{48}{110} \\ &= \frac{110}{110} - \frac{48}{110} \\ &= \frac{62}{110} \end{aligned}$$

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

(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.

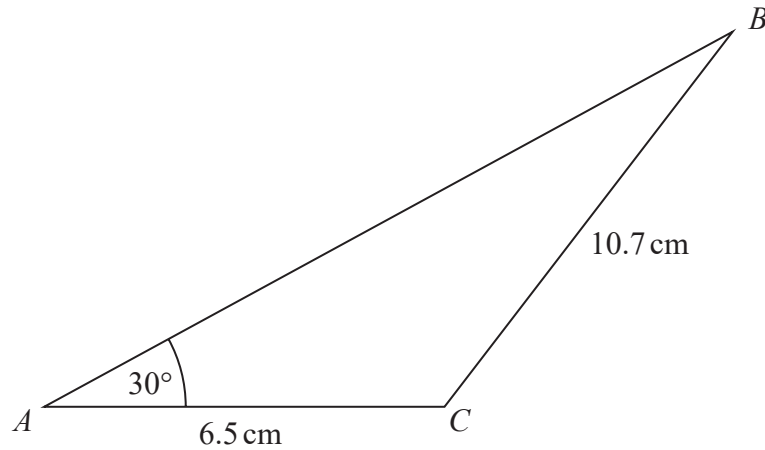
Write down the coordinates of P .

(..... 180 , -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 $\frac{m}{n}$ where m and n are integers.

Using sine rule,

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

$$\frac{\sin ABC}{6.5} = \frac{0.5}{10.7}$$

$$\sin ABC = \frac{0.5}{10.7} \times 6.5$$

$$= \frac{3.25}{10.7}$$

$$= \frac{325}{1070}$$

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

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

(Total for Question 22 is 4 marks)



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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.

$$\text{Common ratio} = \frac{10}{\sqrt{5}}$$

$$\text{next term} = 400\sqrt{5} \times \frac{10}{\sqrt{5}}$$

$$= 400 \times 10$$

$$= 4000$$

4000

(2)

The 4th term of a different geometric sequence is $\frac{5\sqrt{2}}{4}$? ? ? $\frac{5\sqrt{2}}{4}$? $\frac{5\sqrt{2}}{8}$

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.

$$\text{ratio between 4th and 6th terms is } \frac{\frac{5\sqrt{2}}{8}}{\frac{5\sqrt{2}}{4}} = \frac{5\sqrt{2}}{10\sqrt{2}} = \frac{5}{10} = \frac{1}{2}$$

x 8
x 8

So common ratio between consecutive terms is $\sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$

$$\text{So first term is } \frac{5\sqrt{2}}{4} \div \frac{1}{\sqrt{2}} \div \frac{1}{\sqrt{2}} \div \frac{1}{\sqrt{2}}$$

$$= \frac{5\sqrt{2}}{4} \div \frac{1}{2\sqrt{2}}$$

$$= \frac{5\sqrt{2}}{4} \times \frac{2\sqrt{2}}{1}$$

5

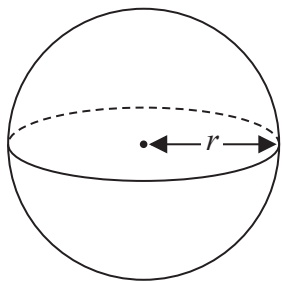
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(Total for Question 23 is 5 marks)

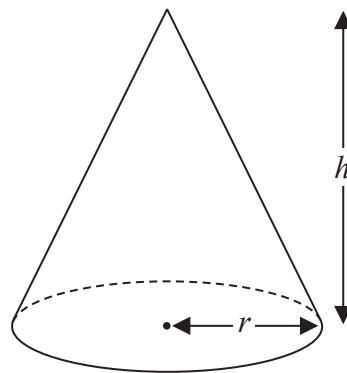
$$= \frac{10 \times 2}{4} = \frac{20}{4} = 5$$



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.

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

$$4r = h$$

when $r=1, h=4$ so $r:h = 1:4$

1:4

(2)

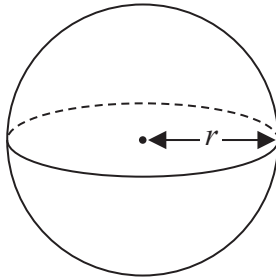
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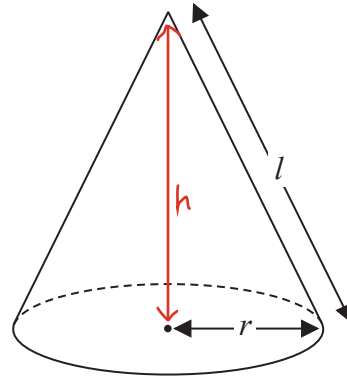
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Here is a different solid sphere and a different solid cone.



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



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 of sphere = total surface area of cone

$$4\pi r^2 = \pi r l + \pi r^2$$

$$4r = l + r$$

$$3r = l$$

Using Pythagoras, $l = \sqrt{h^2 + r^2}$

substituting in, $3r = \sqrt{h^2 + r^2}$ } square both sides

$$9r^2 = h^2 + r^2$$

$$8r^2 = h^2$$

$$\text{If } r=1, 8 \times 1^2 = h^2$$

$$8 = h^2$$

$$\sqrt{8} = h$$

so $r:h = 1:\sqrt{8}$

$1:\sqrt{8}$

(4)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS



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