Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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 ▶

P68721A

B:1/1/1/1/

P 6 8 7 2 1 A 0 1 2 8

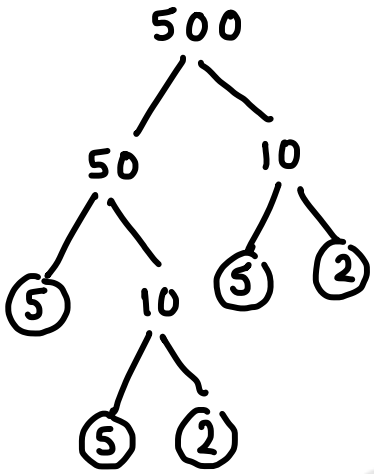
Pearson

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.



$2 \times 2 \times 5 \times 5 \times 5$

$2^2 \times 5^3$

$2^2 \times 5^3$

(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.

$1 + 2 = 3$

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

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

$3\frac{17}{20}$

$3\frac{17}{20}$

(2)

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

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

K C F

$\frac{8}{3} \div \frac{6}{1}$

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

(2)

(Total for Question 2 is 4 marks)

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

Give your answer as a power of 2

$2^{-5+8} = 2^{3}$

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

2^{6}

(Total for Question 3 is 2 marks)

4 Work out 0.004×0.32

×1000 ↙ ↙ ×100

$4 \times 32 = 128$

↓ ÷100,000

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.

$\frac{15}{80} \times 40{,}000$

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

$\frac{120{,}000}{16}$

$\frac{30{,}000}{4} = 7500$

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 $a : b : c$

a : b b : c
1 : 3 6 : 5
×2 ×2
2 : 6 6 : 5
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

$\frac{2}{13}$

$\frac{2}{13}$

(2)

Emma writes down three numbers m, n and p

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

(b) Find $m : p$

n = 2m
÷2 ÷2
$\frac{n}{2} = m$ p = 5n

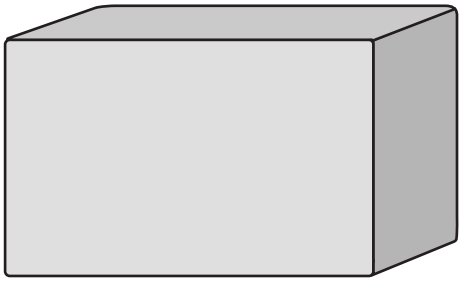
m : p
$\frac{n}{2}$: 5n
×2 ×2
n : 10n
1 : 10

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.

$F = 10,000\,N$

$A = l \times w$

$= 4m \times 2m$

$= 8m^2$

$P = \frac{10,000\,N}{8m^2}$

$= 1250\ N/m^2$

1250 newtons / m^2

(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.

7 14 21 28 35 42 49 56 63

e.g. $m = 35$

$n = 14$

$m =$ 35

$n =$ 14

(Total for Question 8 is 2 marks)

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

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

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

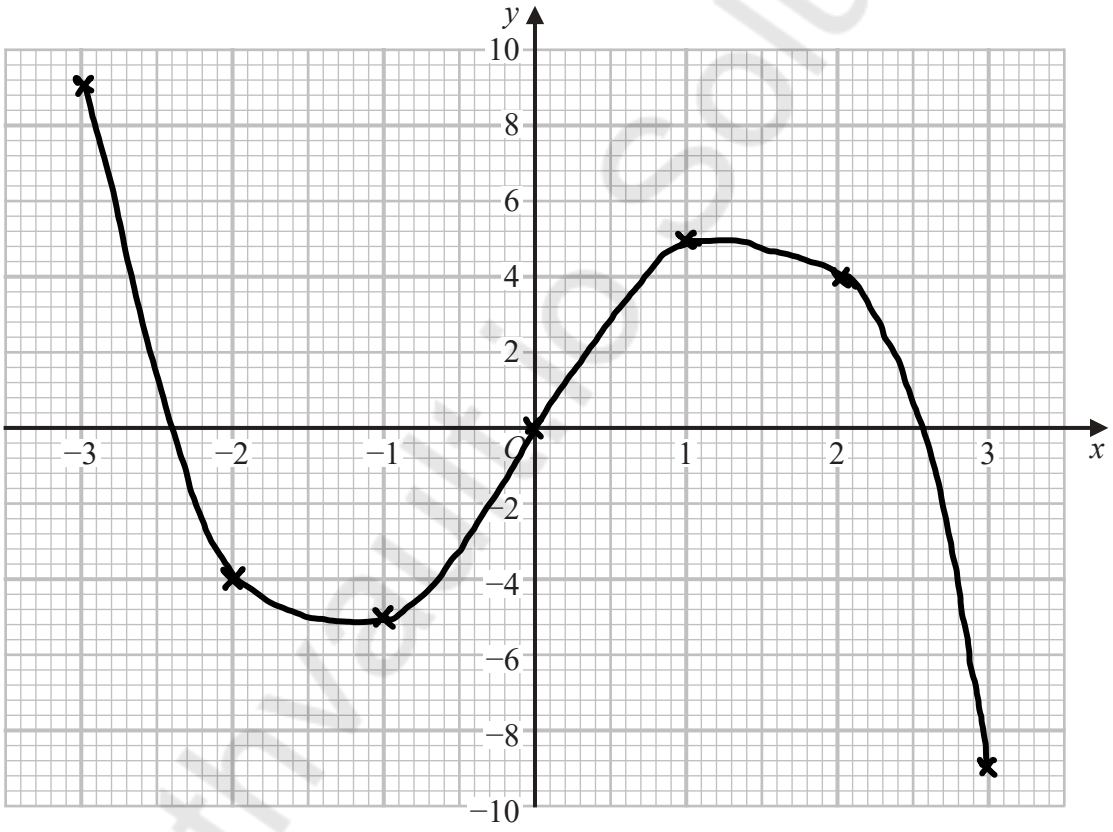
$y = 6(1) - (1)^3$
$= 6 - 1$

x	−3	−2	−1	0	1	2	3
y	9	−4	−5	0	5	4	−9

$6(0) - (0)^3$

(2)

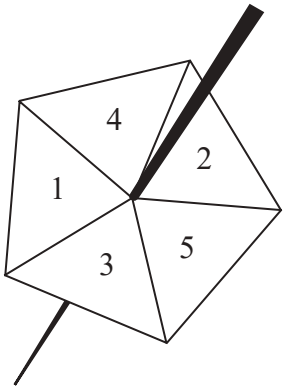
(b) On the grid, draw the graph of $y = 6x - x^3$ for values of x from −3 to 3



(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

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.

$P(5) = \frac{10}{40} = \frac{1}{4}$

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

$\frac{1}{16}$

(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

$P(1) = \frac{6}{40} \div 2 \div 2$

$= \frac{3}{20} \times 5 \times 5$

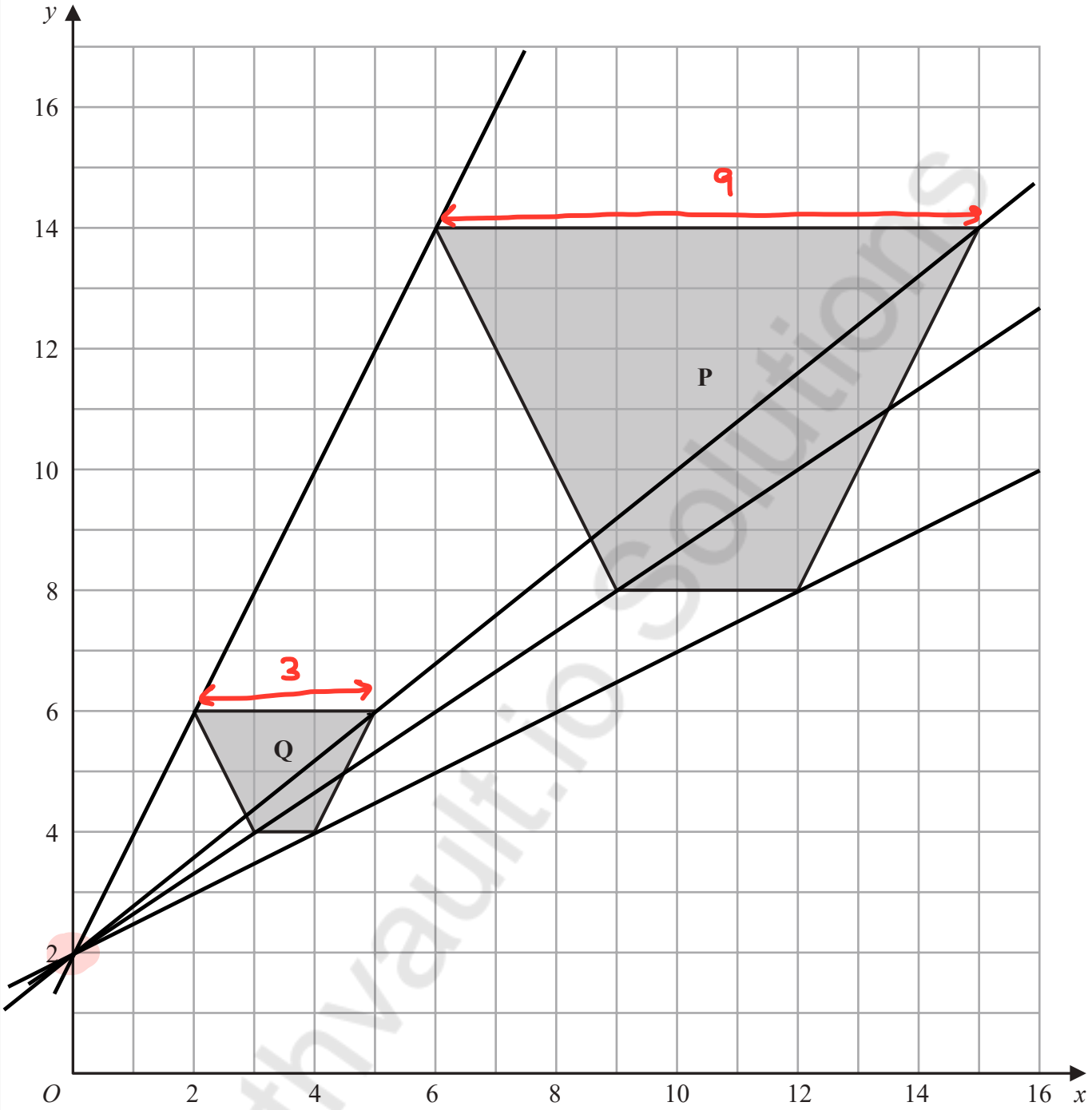
$= \frac{15}{100} = 15\%$

15 %

(2)

(Total for Question 10 is 4 marks)

11



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)

12 Solve the simultaneous equations

$5x + 2y = 11$ ×4
$4x + 3y = 6$ ×5

$20x + 8y = 44$
$20x + 15y = 30$

$-7y = 14$

÷ −7 ÷ −7

$y = -2$

$5x + 2y = 11$

$5x + 2(-2) = 11$

$5x - 4 = 11$

$+4 \quad +4$

$5x = 15$

÷5 ÷5

$x = 3$

$x =$ 3

$y =$ −2

(Total for Question 12 is 4 marks)

13 p is inversely proportional to t

Complete the table of values.

$5 = \frac{100}{t}$ $t = \frac{100}{5}$

t	100	25	20	2
p	1	4	5	50

$\frac{100}{25}$ $\frac{100}{2}$

$p \propto \frac{1}{t}$

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

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

$\times 100$ $\times 100$

$100 = k$

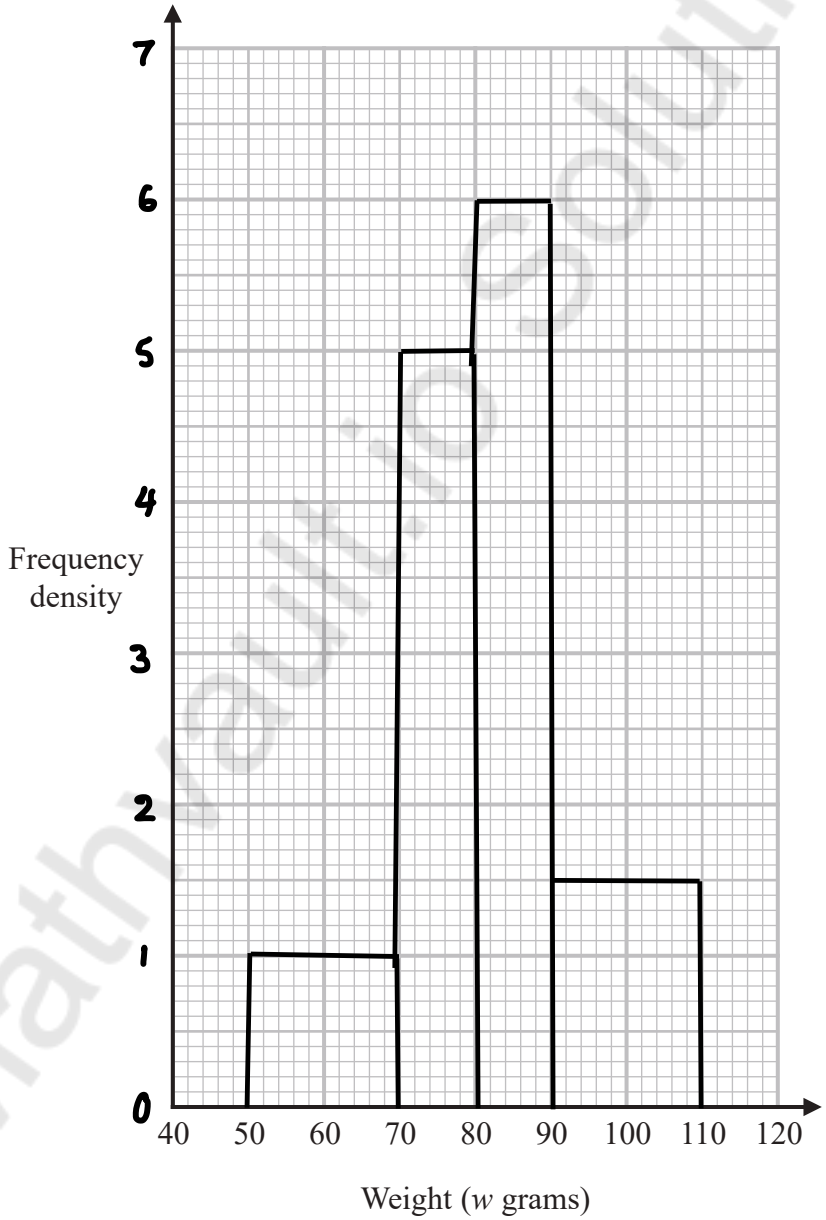
$p = \frac{100}{t}$

(Total for Question 13 is 3 marks)

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

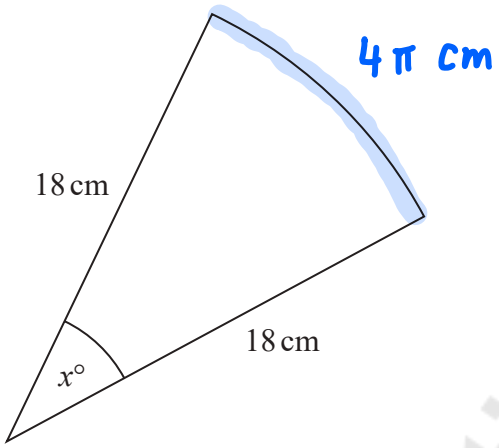
Weight (w grams)	Number of potatoes
$50 < w \leqslant 70$	20
$70 < w \leqslant 80$	50
$80 < w \leqslant 90$	60
$90 < w \leqslant 110$	30

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 $= \frac{\theta}{360} \times 2\pi r$

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

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

$\div \pi$ $\div \pi$

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

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

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

$40 = x$

$x =$ 40

(Total for Question 15 is 3 marks)

16 (a) Prove that

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

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

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

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

$4m^2 + 4m - 4n^2 + 4n$

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

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

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

$4(m+n)[(m-n+1)]$

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

(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 $(2m+1)^2 - (2n-1)^2$ is the difference between the squares of any two odd numbers.

$4(m+n)(m-n+1)$ is a multiple of 4.

(1)

(Total for Question 16 is 4 marks)

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

$$x^{\frac{a}{b}} = \left(\sqrt[b]{x}\right)^{a}$$

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

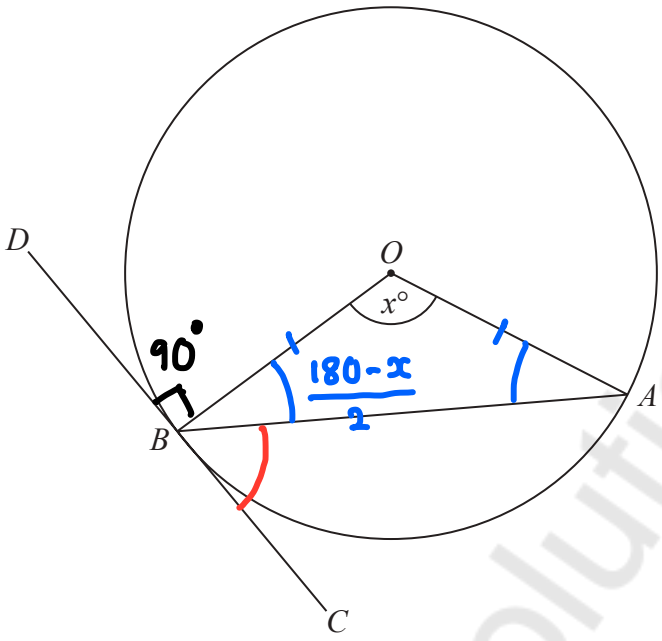
$$\left(\frac{2}{3}\right)^{4}$$

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

$\frac{16}{81}$

(Total for Question 17 is 2 marks)

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.

$\angle DBO = 90°$ Tangent meets radius at $90°$

$\angle OBA$ and $\angle OAB = \frac{180 - x}{2}$ Base angles of an isosceles are equal

$90 + \frac{180 - x}{2}$

$90 + 90 - \frac{x}{2}$

$180 - \frac{x}{2}$

$180 - \left(180 - \frac{x}{2}\right)$ Angles on a straight line sum to $180°$

$\frac{x}{2} = \angle ABC$ $\angle ABC = \frac{1}{2}x°$

(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.

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

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

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

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

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

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

$$-1 \qquad -1$$

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

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

$a = 4 \quad b = 4 \quad c = -1$

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

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

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

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

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

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

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

(Total for Question 19 is 5 marks)

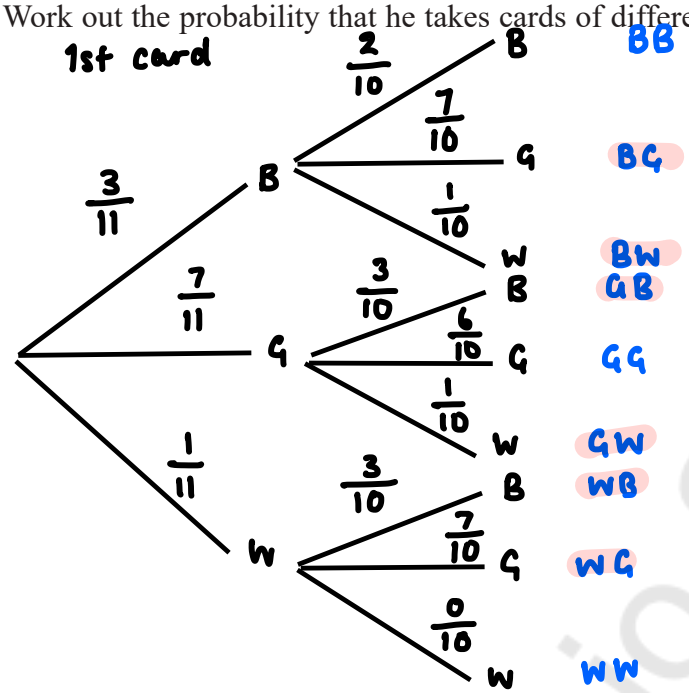
20 Alfie has 11 cards.

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.



$1 - p(BB) + p(GG) + p(WW)$

$p(BB) = \frac{3}{11} \times \frac{2}{10} = \frac{6}{110}$

$p(GG) = \frac{7}{11} \times \frac{6}{10} = \frac{42}{110}$

$p(WW) = \frac{1}{11} \times \frac{0}{10} = \frac{0}{110}$

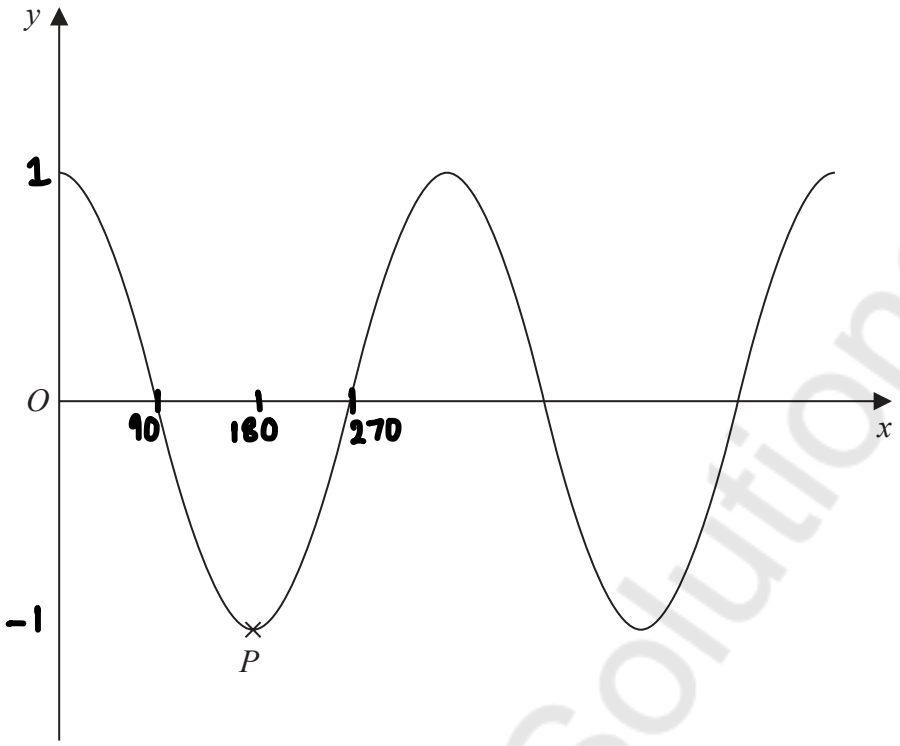
$\frac{48}{110}$

$1 - \frac{48}{110} = \frac{62}{110}$

$\frac{62}{110}$

(Total for Question 20 is 3 marks)

21



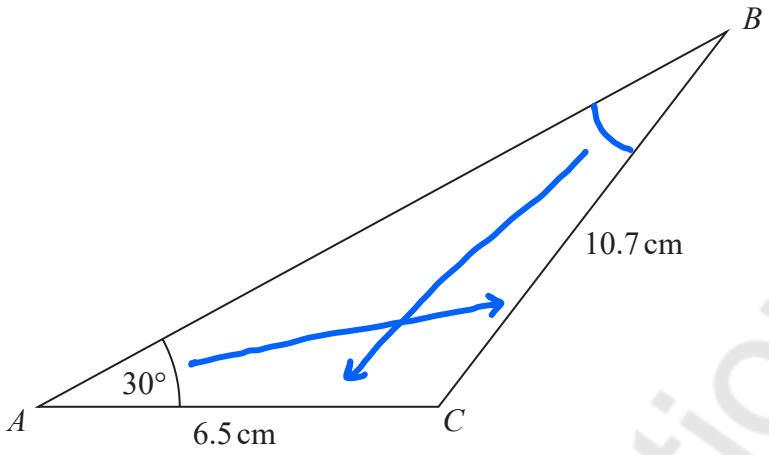
The diagram shows a sketch of part of the curve with equation $y = \cos x°$
P is a minimum point on the curve.

Write down the coordinates of P.

(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.

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

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

$\times 6.5$ $\times 6.5$

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

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

$$= \frac{3.25}{10.7} \quad \begin{matrix}\times 100 \\ \times 100\end{matrix}$$

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

$\frac{325}{1070}$

(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 $\quad$ $400\sqrt{5}$

$\times\sqrt{20}$ $\quad$ $\sqrt{100}$ $\quad$ $\times\sqrt{20}$

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

$\sqrt{20} = \sqrt{5}\sqrt{4}$

$= 2\sqrt{5}$

$400\sqrt{5} \times 2\sqrt{5}$

$800 \times 5 = 4000$

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.

4th $\quad$ 5th $\quad$ 6th

$\frac{5\sqrt{2}}{4}$ $\xrightarrow{\times x}$ $\frac{5\sqrt{2}}{8}$

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

$\frac{40\sqrt{2}}{4} \times x^2 = 5\sqrt{2}$

$10\sqrt{2} \times x^2 = 5\sqrt{2}$

$\div 10\sqrt{2}$ $\quad$ $\div 10\sqrt{2}$

$x^2 = \frac{5\sqrt{2}}{10\sqrt{2}}$

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

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

1st $\quad$ 2nd $\quad$ 3rd $\quad$ 4th

$\div 1/\sqrt{2}$ $\quad$ $\div 1/\sqrt{2}$ $\quad$ $\div 1/\sqrt{2}$

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

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

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

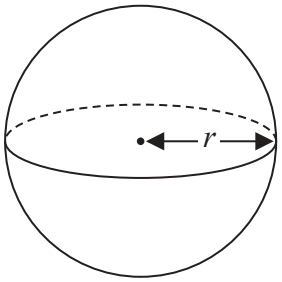
$\frac{20}{4} = 5$

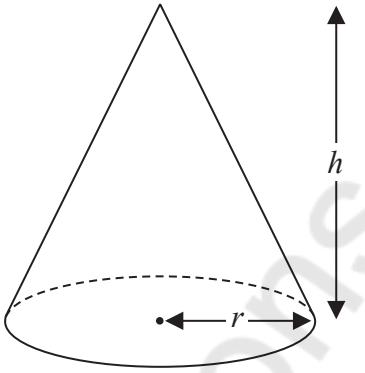
5

(3)

(Total for Question 23 is 5 marks)

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.

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

$\div \pi$ $\div \pi$

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

$\div r^2$ $\div r^2$

$\frac{4}{3} r = \frac{1}{3} h$

$\times 3$ $\times 3$

$4r = h$

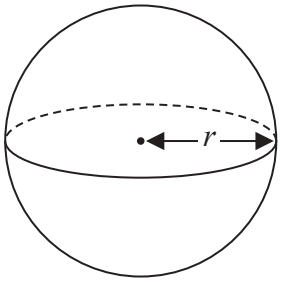
$r : h$

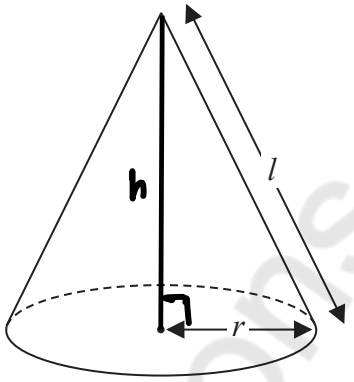
$1 : 4$

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.

$l^2 = r^2 + h^2$

$\sqrt{\quad}\qquad\sqrt{\quad}$

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

(b) Find $r : h$

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

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

$\div \pi \qquad\qquad \div \pi$

$4r^2 = rl + r^2$

$\div r \qquad\qquad \div r$

$4r = l + r$

$-r \qquad -r$

$3r = l$

$3r = \sqrt{r^2+h^2}$

$2 \qquad\quad 2$

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

$-r^2 \quad -r^2$

$8r^2 = h^2$

$\sqrt{\quad}\qquad\sqrt{\quad}$

$\sqrt{8}\,r = h$

$r : h$

$1 : \sqrt{8}$

$1 : \sqrt{8}$

(4)

(Total for Question 24 is 6 marks)

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