

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**

November 2022
LH Worked Solutions

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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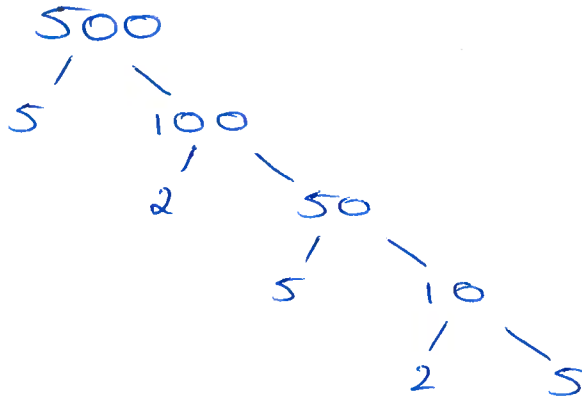

Pearson

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.



$$500 = 2 \times 2 \times 5 \times 5 \times 5$$

or

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

(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.

method 1

$$1 + 2 = 3$$

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

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

$$= \frac{17}{20}$$

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

method 2

$$1\frac{3}{5} + 2\frac{1}{4}$$

$$= \frac{8 \times 4}{5 \times 4} + \frac{9 \times 5}{4 \times 5}$$

$$= \frac{32}{20} + \frac{45}{20}$$

$$= \frac{77}{20}$$

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

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

(2)

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

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

$$= \frac{8}{3} \times \frac{1}{6}$$

$$= \frac{8 \div 2}{18 \div 2}$$

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

(2)

(Total for Question 2 is 4 marks)

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

Give your answer as a power of 2

$$\begin{aligned} & (2^{-5+8})^2 \\ &= (2^3)^2 \\ &= 2^{3 \times 2} \\ &= 2^6 \end{aligned}$$

$$2^6$$

(Total for Question 3 is 2 marks)

4 Work out 0.004×0.32

$$\begin{aligned} & \frac{4}{1000} \times \frac{32}{100} \\ &= \frac{128}{100000} \\ &= 0.00128 \end{aligned}$$

$$0.00128$$

(Total for Question 4 is 2 marks)

$$\text{or } 1.28 \times 10^{-3}$$

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- 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.

$$\begin{aligned} & \frac{15}{80} \text{ of } 40\,000 \\ &= \frac{3}{16} \times \frac{2500}{1} \times \frac{40\,000}{1} \\ &= 3 \times 2500 \\ &= 7500 \end{aligned}$$

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 $a:b:c$

$$\begin{array}{cc} a:b & b:c \\ 1:3 & 6:5 \\ \times 2 & \times 2 \\ 2:6 & \end{array}$$

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

need to make b the same

$$2:6:5$$

(2)

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

$$\frac{2}{2+6+5} \\ = \frac{2}{13}$$

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

(2)

Emma writes down three numbers m , n and p

$$n = 2m$$

$$p = 5n$$

(b) Find $m:p$

$$\begin{array}{l} n = 2m \\ \frac{n}{2} = m \end{array}$$

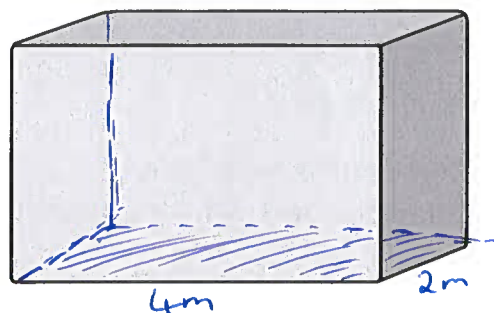
$$\begin{array}{ccc} m:p & & \\ \downarrow \times 2 & & \downarrow \times 2 \\ \frac{n}{2}:5n & & \\ \downarrow \div n & & \downarrow \div n \\ n:10n & & \\ \downarrow \div n & & \downarrow \div n \\ 1:10 & & \end{array}$$

$$1:10$$

(2)

(Total for Question 6 is 6 marks)





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

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.

$$\begin{aligned} \text{Area base} &= 4\text{m} \times 2\text{m} \\ &= 8\text{m}^2 \end{aligned}$$

$$\text{Pressure} = \frac{10000\text{ N}}{8\text{m}^2}$$

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

$$= \frac{2500}{2}$$

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

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 with a factor of 7

35, 70, -----

even numbers with a factor of 7

14, 28, -----

$m = 35$

$n = 14$

(Total for Question 8 is 2 marks)

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

$$x = -2, y = 6(-2) - (-2)^3$$

$$= -12 - (-8)$$

$$= -12 + 8$$

$$= -4$$

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

$$= -6 - (-1)$$

$$= -6 + 1$$

$$= -5$$

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

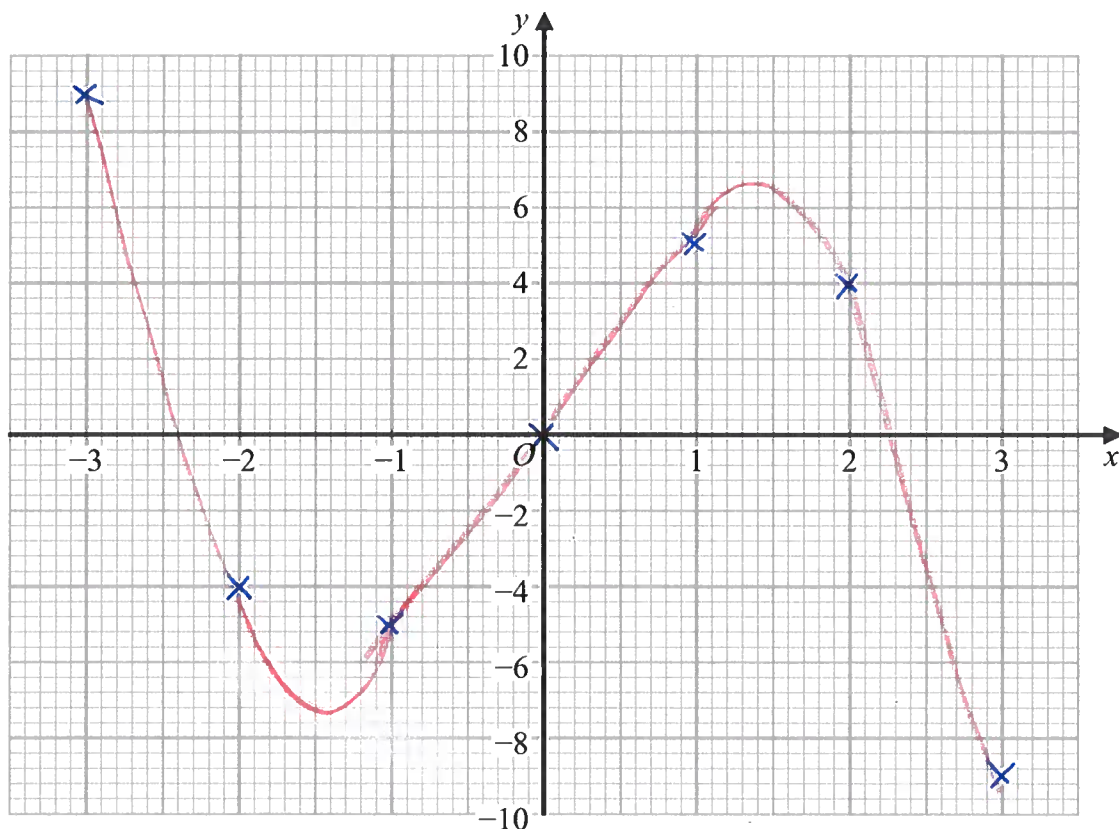
$$= 6 - 1$$

$$= 5$$

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

(2)

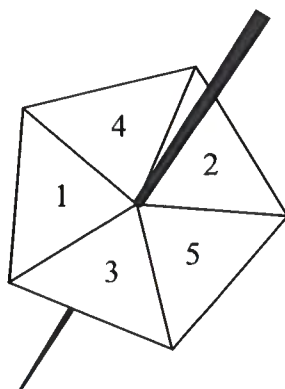
- (b) On the grid, draw the graph of $y = 6x - x^3$ for values of x from -3 to 3



(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.

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

$$\begin{aligned} P(5 \text{ AND } 5) &= P(5) \times P(5) \\ &= \frac{1}{4} \times \frac{1}{4} \\ &= \frac{1}{16} \end{aligned}$$

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

(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

$$\begin{aligned} P(1) &= \frac{6}{40} \\ &= \frac{3 \times 5}{20 \times 5} \\ &= \frac{15}{100} \\ &= 15\% \end{aligned}$$

$$15$$

(2)

%

(Total for Question 10 is 4 marks)

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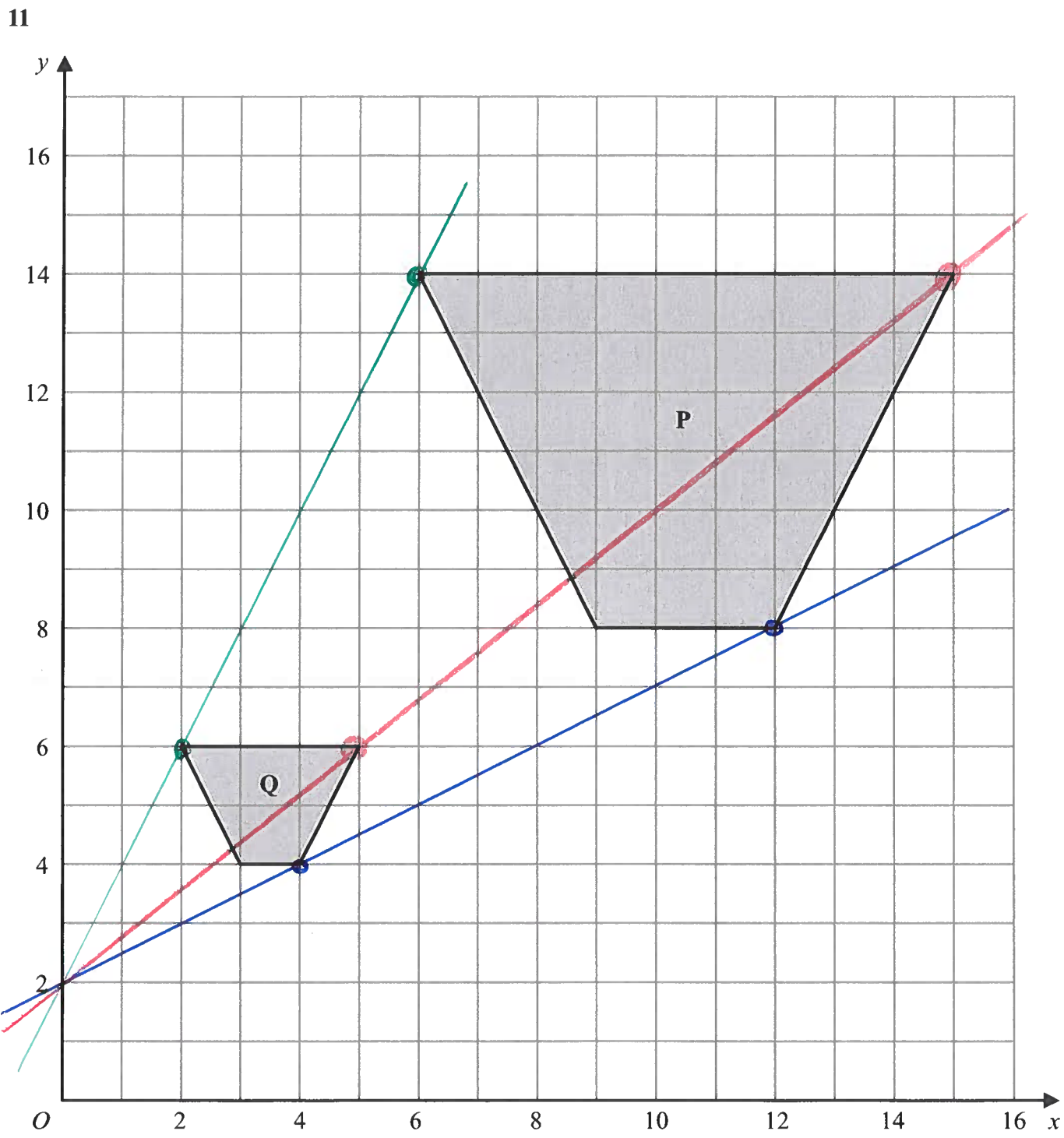
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Describe fully the single transformation that maps shape P onto shape Q.

Enlargement
Scale factor $\frac{1}{3}$
Centre (0, 2)

(Total for Question 11 is 2 marks)

12 Solve the simultaneous equations

$$\begin{array}{l} 5x + 2y = 11 \quad \textcircled{1} \\ 4x + 3y = 6 \quad \textcircled{2} \end{array}$$

$$\textcircled{1} \times 3:$$

$$\textcircled{2} \times 2:$$

$$\begin{array}{l} 15x + 6y = 33 \quad \textcircled{3} \\ 8x + 6y = 12 \quad \textcircled{4} \end{array}$$

①ASS

$$\textcircled{3} - \textcircled{4}:$$

$$\begin{array}{rcl} 7x & = & 21 \\ x & = & 3 \end{array} \quad [\div 7]$$

Subs $x=3$
in $\textcircled{1}$ to find y :

$$\begin{array}{rcl} 5(3) + 2y & = & 11 \\ 15 + 2y & = & 11 \quad [-15] \\ 2y & = & -4 \quad [\div 2] \\ y & = & -2 \end{array}$$

$$x = 3$$

$$y = -2$$

(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

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

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

When $p = 1$, $t = 100$

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

$$100 = k$$

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

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

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

$$p = 5, \quad 5 = \frac{100}{t}$$

$$5t = 100$$

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

$$= 20$$

(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

$$\text{frequency density} = \frac{\text{frequency}}{\text{class width}}$$

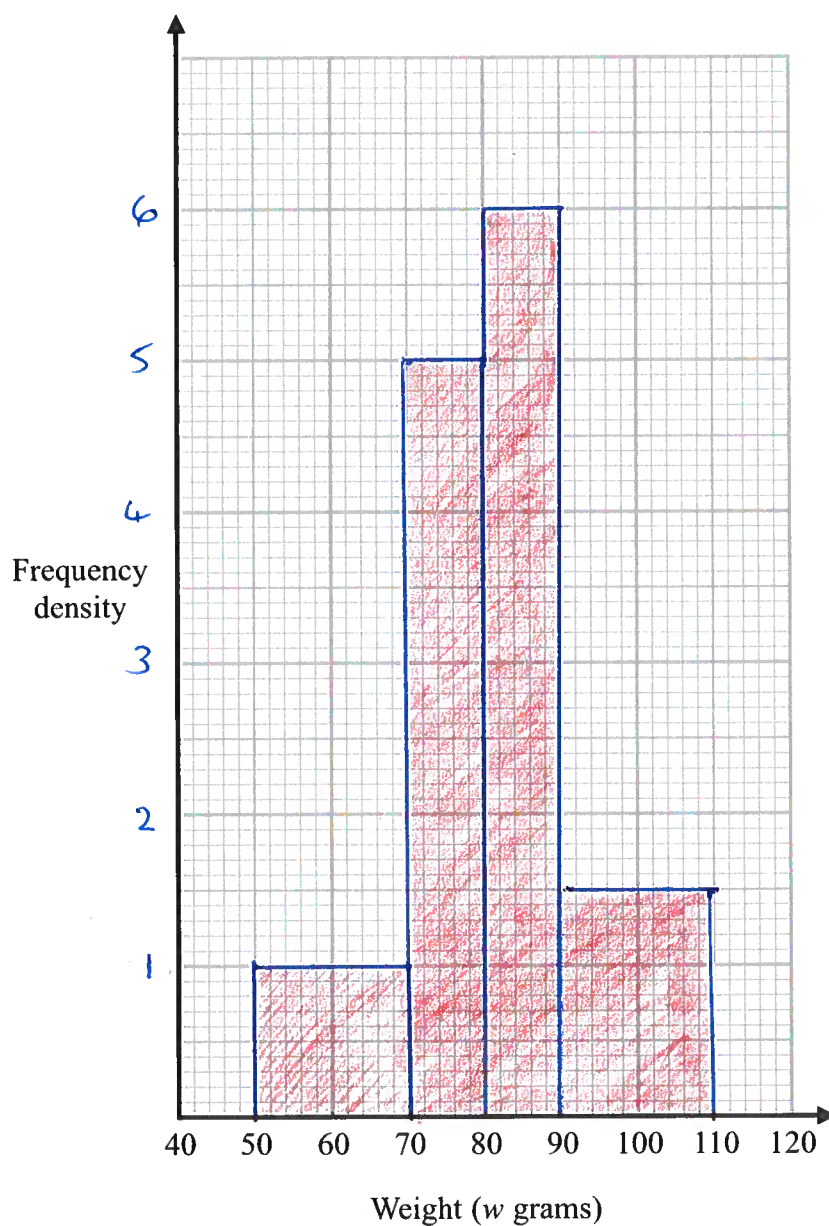
1

5

6

1.5

On the grid, draw a histogram for this information.



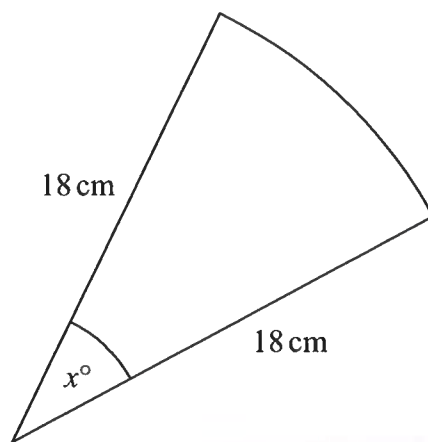
(Total for Question 14 is 3 marks)

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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 .

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

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

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

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

$$\underline{x = 40^\circ}$$

$$\begin{aligned} \text{Arc length} &= \frac{\theta}{360} \times \pi d \\ &= \frac{\theta}{360} \times 2\pi r \\ &= \frac{\pi r \theta}{180} \end{aligned}$$

$$[\div \pi]$$

$$[\times 10]$$

$$x = 40^\circ$$

(Total for Question 15 is 3 marks)

16 (a) Prove that

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

LHS

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

OR

notice that LHS is the difference of two squares
 $[a^2 - b^2 = (a+b)(a-b)]$

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

RHS

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

$$\text{LHS} = \text{RHS}$$

(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 Sophia is correct

$(2m+1)$ and $(2n-1)$ are odd numbers
 The difference between the squares of these odd numbers is a multiple of 4 as shown on the RHS in part a) (1)

(Total for Question 16 is 4 marks)

m and n can be any positive integer values



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

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

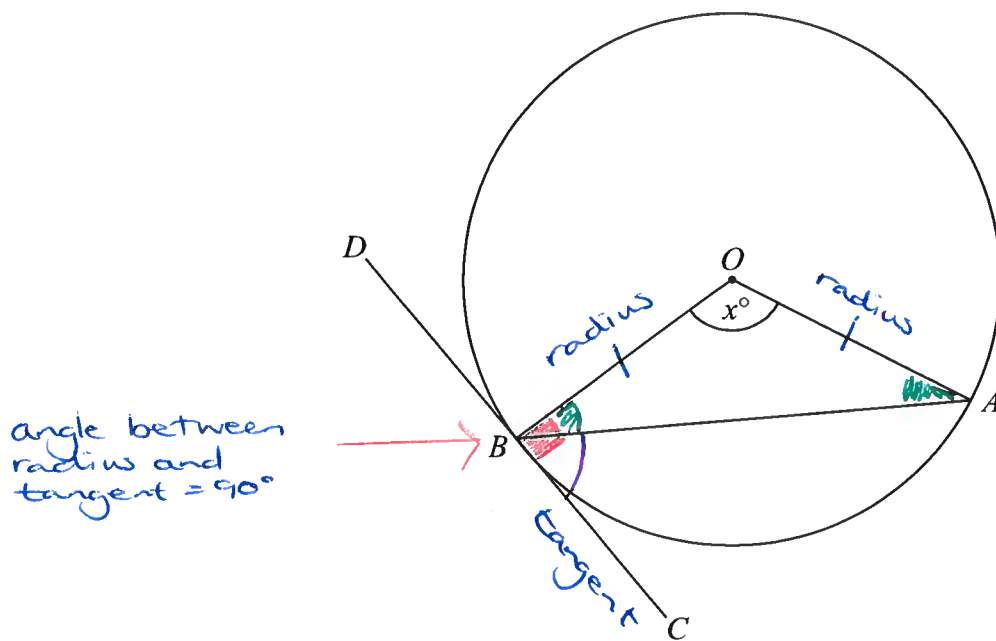
$$= \left(\frac{\sqrt[3]{8}}{\sqrt[3]{27}} \right)^4$$

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

$$= \frac{2^4}{3^4}$$

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

(Total for Question 17 is 2 marks)



angle between
radius and
tangent = 90°

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 $OBC = 90^\circ$ (angle between tangent and radius is 90°)

angle $OBA = \text{angle } OAB = \frac{180 - x}{2}$

- Base angles in isosceles triangle are equal

- Angles in a triangle add up to 180°

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

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

$$\begin{aligned} \text{angle } ABC &= 90^\circ - \text{angle } OBA \\ &= 90^\circ - \left(90^\circ - \frac{x^\circ}{2}\right) \\ &= 90^\circ - 90^\circ + \frac{x}{2}^\circ \\ &= \frac{x}{2} \\ &\text{or } \frac{1}{2}x^\circ \end{aligned}$$

(Total for Question 18 is 3 marks)



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

this is a clue that the quadratic will not factorise

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

get common denominator on LHS

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

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

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

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

$$[x \cdot x(x+1)]$$

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

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

$$[-1]$$

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

use quadratic formula

$$a=4, b=4, c=-1$$

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

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

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

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

(Total for Question 19 is 5 marks)

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

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

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

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

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

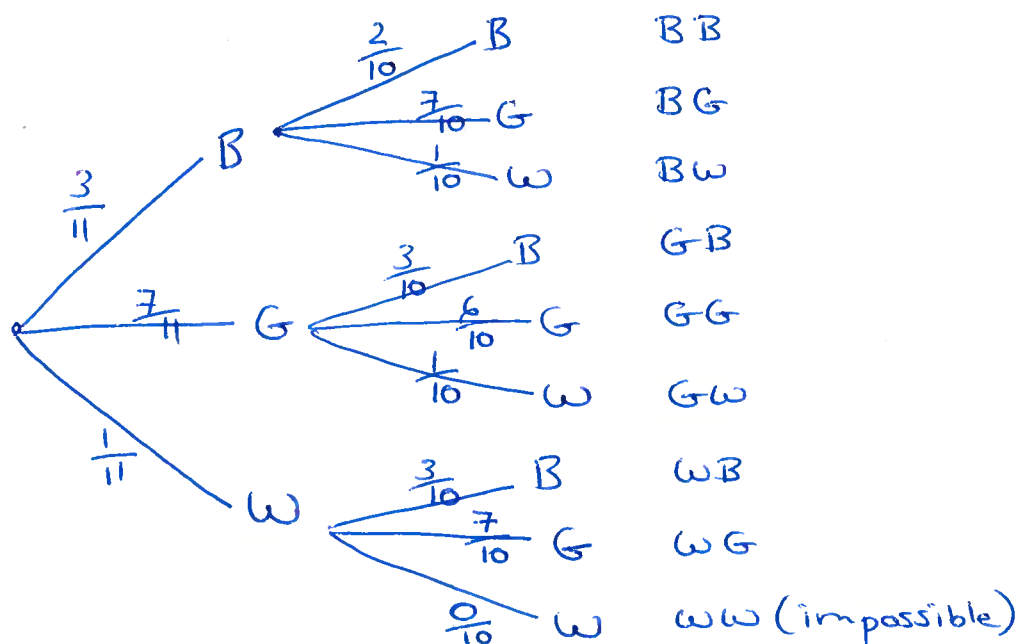
20 Alfie has 11 cards.

He has

3 blue cards
7 green cards
and 1 white card.

Alfie takes at random 2 of these cards.

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



$P(2 \text{ different colours})$

$$= 1 - [P(BB) + P(GG) + P(WW)]$$

$$= 1 - \left[\frac{3}{11} \times \frac{2}{10} + \frac{7}{11} \times \frac{6}{10} + 0 \right]$$

$$= 1 - \left[\frac{6}{110} + \frac{42}{110} \right]$$

$$= 1 - \left[\frac{48}{110} \right]$$

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

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

$$= \frac{31}{55}$$

(Total for Question 20 is 3 marks)

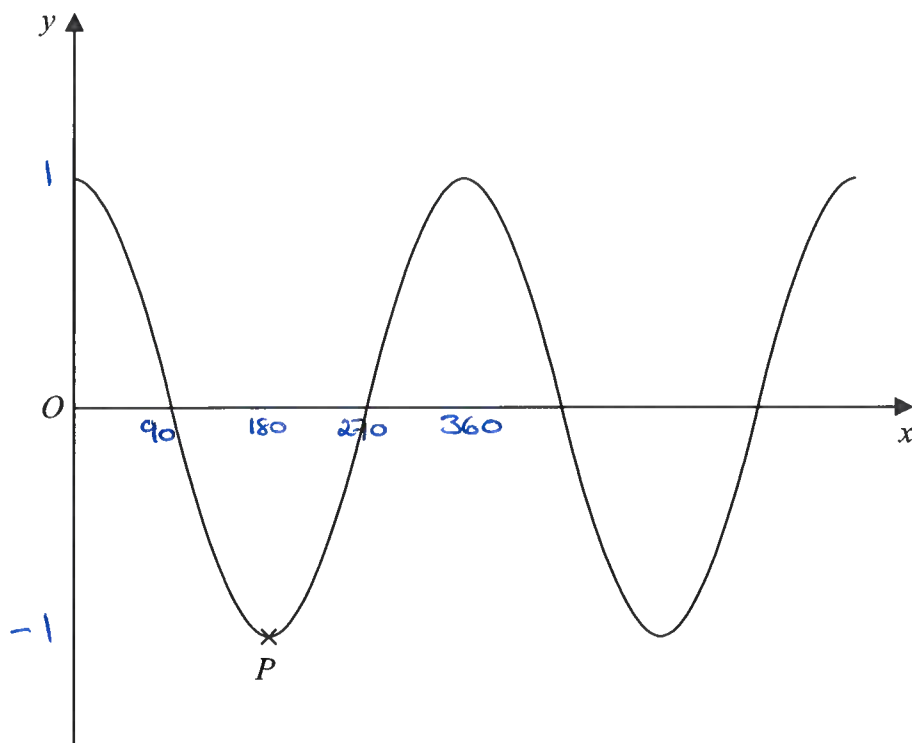
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21



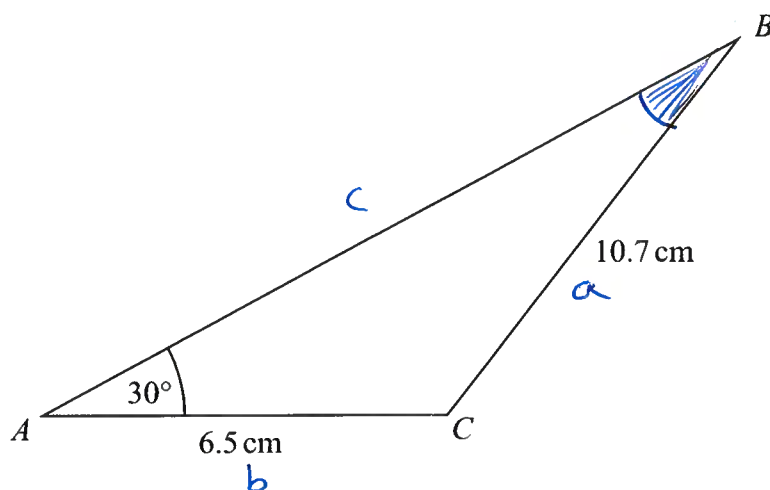
The diagram shows a sketch of part of the curve with equation $y = \cos x^\circ$
 P is a minimum point on the curve.

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.

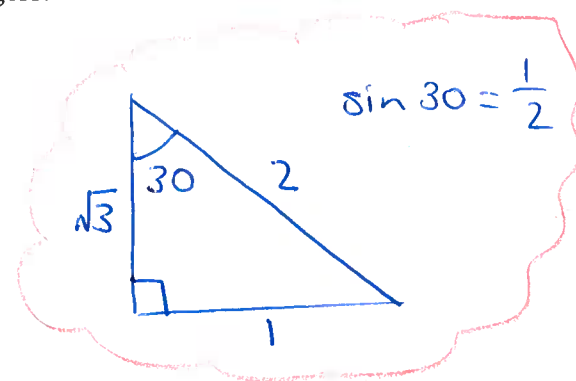
$$\frac{\sin B}{b} = \frac{\sin A}{a}$$

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

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

$$\sin B = \frac{0.5}{10.7} \times \frac{6.5}{1}$$

$$\begin{aligned} \sin ABC &= \left(\frac{1}{2} \div \frac{107}{10} \right) \times \frac{13}{2} \\ &= \left(\frac{1}{2} \times \frac{10}{107} \right) \times \frac{13}{2} \\ &= \frac{130}{428} \end{aligned}$$



(Total for Question 22 is 4 marks)

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

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

$$\sqrt{5} \xrightarrow{\times r} 10 \xrightarrow{\times r} 20\sqrt{5} \quad 200 \quad 400\sqrt{5}$$

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

$$r = \frac{10}{\sqrt{5}}$$

$$\text{next term } 400\sqrt{5} \times \frac{10}{\sqrt{5}} = 4000$$

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.

Geometric Sequence
first term a
common ratio r

term $a, ar, ar^2, ar^3, ar^4, ar^5$
1, 2, 3, 4, 5, 6

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

to get from 4th to 6th terms we $\times r^2$

$$6^{\text{th}} \text{ term } ar^5 = \frac{5\sqrt{2}}{8}$$

$$4^{\text{th}} \text{ term } ar^3 = \frac{5\sqrt{2}}{4}$$

$$\frac{ar^5}{ar^3} = \frac{\frac{5\sqrt{2}}{8}}{\frac{5\sqrt{2}}{4}}$$

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

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

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

1st term a

$$ar^3 = \frac{5\sqrt{2}}{4}$$

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

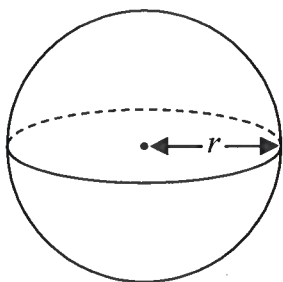
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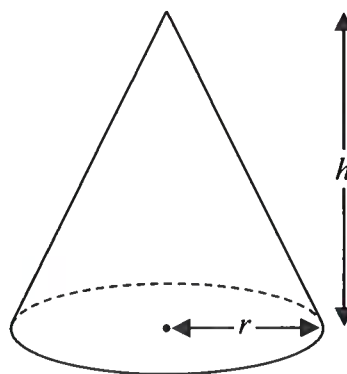
(Total for Question 23 is 5 marks)

$$a = \frac{5\sqrt{2}}{4} \times \left(\frac{\sqrt{2}}{1}\right)^3 = \frac{5\sqrt{2} \sqrt{2} \sqrt{2} \sqrt{2}}{4} = \frac{20}{4} = 5$$

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.

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

$[\div \pi]$

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

$[\div r^2]$

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

$[\times 3]$

$$4r = h$$

$$r : h$$

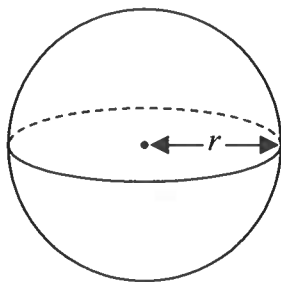
$$\begin{array}{l} r : 4r \\ \div r \quad \quad \div r \\ \hline 1 : 4 \end{array}$$

$$\frac{1}{4}$$

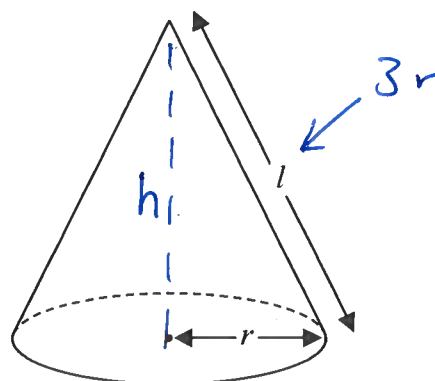
(2)



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



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



Curved area of cone = $\pi r l$

Area base = πr^2

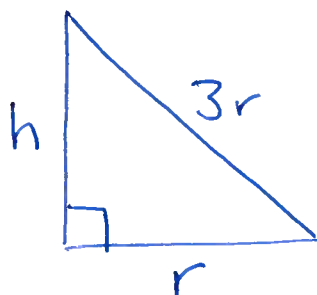
All measurements are in cm.

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.

$$\begin{aligned} 4\pi r^2 &= \pi r l + \pi r^2 \\ 4\pi r^2 &= \pi r (l + r) & [\div \pi r] \\ 4r &= l + r & [-r] \\ 3r &= l \\ \text{then} \end{aligned}$$



using pythagoras' theorem to find h

$$\begin{aligned} h^2 &= (3r)^2 - r^2 \\ h^2 &= 9r^2 - r^2 \\ h^2 &= 8r^2 \\ h &= \sqrt{8} r \end{aligned}$$

$r : h$

$\div r \begin{matrix} r : \sqrt{8} r \\ 1 : \sqrt{8} \end{matrix}$

$1 : \sqrt{8}$
(4)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS

Alternative Q23 part b)

$$\frac{6^{\text{th}} \text{ term}}{4^{\text{th}} \text{ term}} = r^2$$

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

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

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

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

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

$$2^{\text{nd}} \text{ term} = \frac{5\sqrt{2}}{2}$$

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$$1^{\text{st}} \text{ term} = 2^{\text{nd}} \text{ term} \div r$$

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

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

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

$$= \underline{\underline{5}}$$

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