



SECONDARY 4 PRELIMINARY EXAMINATION
in preparation for the
General Certificate of Education Ordinary Level

CANDIDATE
NAME

SOLUTIONS

CENTRE
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MATHEMATICS

4052/01

Paper 1

October/November 2026

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE ON ANY BARCODES.

Answer **all** the questions.

The number of marks is given in brackets [] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total of the marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

This document consists of **21** printed pages and **1** blank page.

***Mathematical Formulae****Compound interest*

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Mensuration

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

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

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

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

$$\text{Area of a triangle } ABC = \frac{1}{2}ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$





Answer **all** questions.

1 $\sin x^\circ = 0.7954$

Give two possible values of x in the range $0 \leq x \leq 180$.

$$\begin{aligned}x^\circ &= \sin^{-1}(0.7954) \\&= 52.7^\circ \text{ or } 180^\circ - 52.7^\circ = 127.3^\circ\end{aligned}$$

Answer $x = \dots\dots\dots 52.7 \dots\dots\dots$ or $\dots\dots\dots 127.3 \dots\dots\dots$ [2]

- 2 The resistance of a wire, R , in ohms is inversely proportional to the square of the current, I , in ampere.

The current of a wire is increased by 60%.

Calculate the percentage reduction in the resistance of a wire.

$$R = \frac{k}{I^2}$$

When $I = 1$, $R = k$.

When $I = 1.6$, $R = \frac{k}{2.56}$.

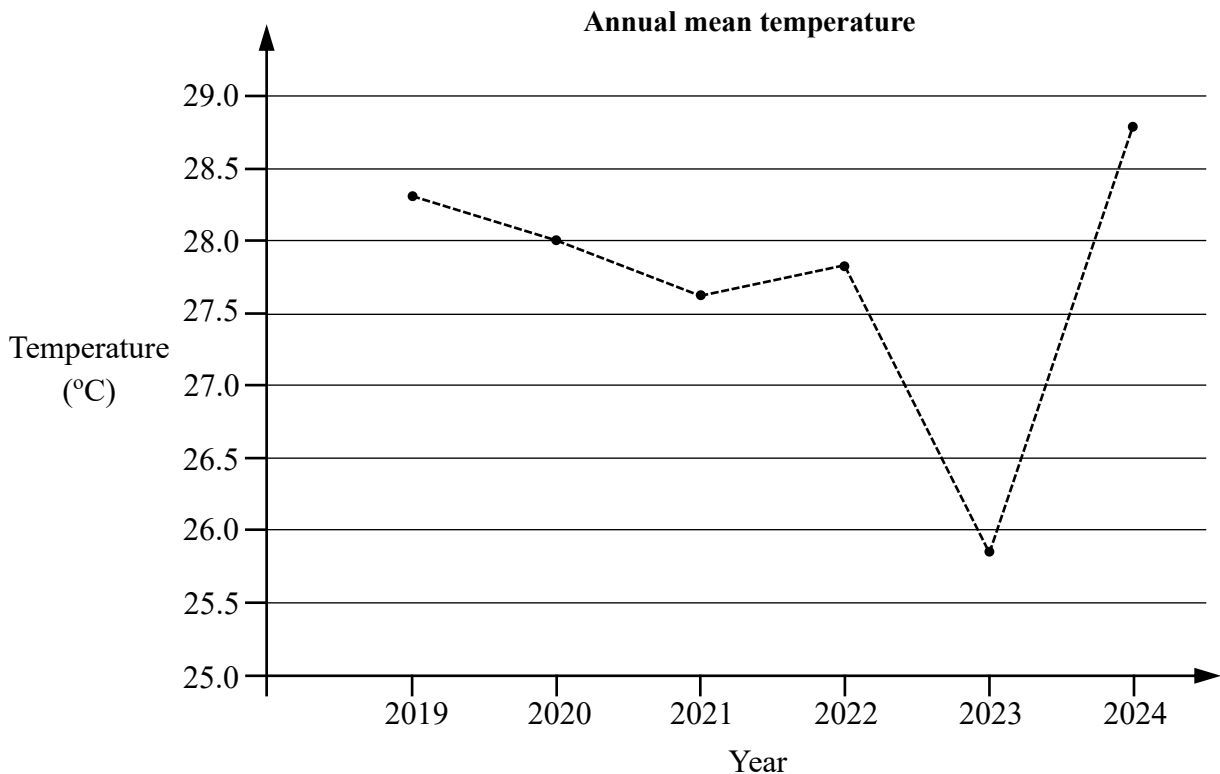
$$\begin{aligned}\text{Percentage reduction} &= \left[\left(k - \frac{k}{2.56} \right) \times \frac{1}{k} \right] \times 100\% \\&= \left[\left(\frac{2.56k - k}{2.56} \right) \times \frac{1}{k} \right] \times 100\% \\&= \left(\frac{1.56k}{2.56} \times \frac{1}{k} \right) \times 100\% \\&= \frac{1.56}{2.56} \times 100\% \\&= 60.9\% \text{ (3 s.f.)}\end{aligned}$$

Answer $\dots\dots\dots 60.9 \dots\dots\dots$ % [2]





- 3 The line graph shows the annual mean temperature over the six years.



- (a) (i) Tabita says that there is **one** outlier in the graph.

Identify the outlier.

2023 [1]

- (ii) Explain how this outlier affects the rest of the data in the graph.

The mean temperature in 2023 is much lower than the other years.

This pulls the mean down, making it seem like the temperature is cooler overall than it actually was in most years. [1]

- (b) (i) State one misleading feature of the graph.

The vertical axis, representing temperature, does not start from 0 °C.

..... [1]

- (ii) Explain how this feature affects the reader's interpretation of the graph.

The reader may think that the difference in temperature from 2023 to 2024

increases by about 3 °C but in the graph, it looks like there is a huge increase. [1]



4 $\mathbf{A} = (a \quad b \quad c)$ $\mathbf{B} = \begin{pmatrix} u & v \\ w & x \\ y & z \end{pmatrix}$ $\mathbf{C} = \mathbf{BA}$

Explain why matrix $\mathbf{C}$ is not possible.

The order of matrix $\mathbf{A}$ is 1 by 3 and the order of matrix $\mathbf{B}$ is 3 by 2.

Since the number of columns of matrix $\mathbf{B}$ is not equal to the number of rows of matrix $\mathbf{A}$,
hence, matrix $\mathbf{C}$ is not possible.

[2]

- 5 Jamie invested \$3700 at a simple interest rate of 1.4% per year for 3 years.
Work out the total value of his investment at the end of 3 years.

$$\begin{aligned} \text{Simple interest, } I &= \frac{PRT}{100} \\ &= \frac{(3700)(1.4)(3)}{100} \\ &= \$155.40 \end{aligned}$$

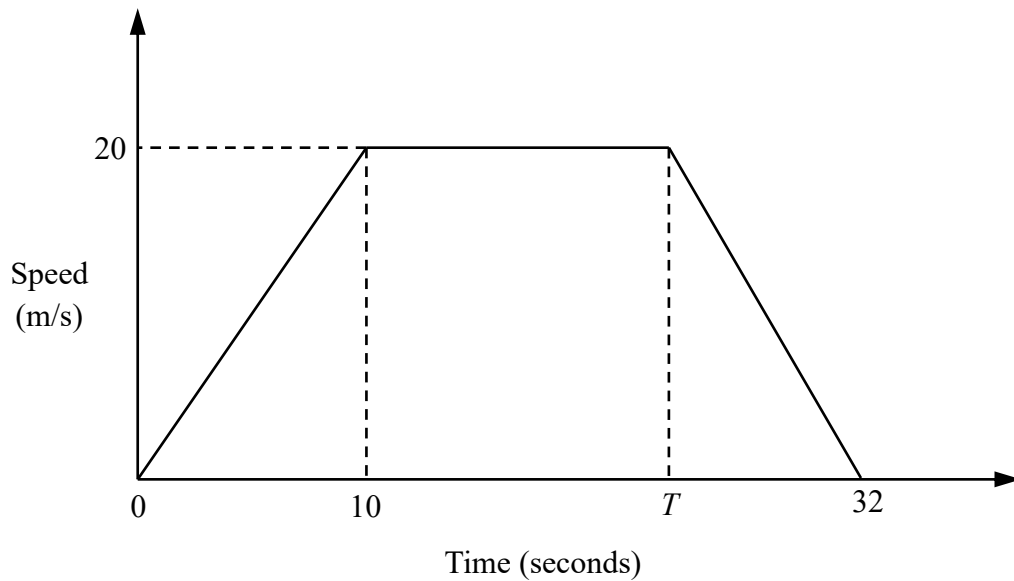
$$\begin{aligned} \text{Total amount} &= \$3700 + \$155.40 \\ &= \$3855.40 \end{aligned}$$

Answer \$3855.40..... [2]





- 6 The diagram shows the speed-time graph for part of a car journey.



- (a) Calculate the acceleration of the car in the first 10 seconds of the journey.

$$\begin{aligned}\text{Acceleration} &= \frac{20 - 0}{10 - 0} \\ &= \frac{1}{2} \\ &= 0.5 \text{ m/s}^2\end{aligned}$$

Answer0.5..... m/s² [1]

- (b) The car decelerates at 2.5 m/s² after T seconds.

Calculate the total distance travelled by car.

$$\frac{0 - 20}{32 - T} = -2.5$$

$$T = 24 \text{ seconds}$$

Area under graph = area of trapezium

$$\frac{1}{2}(14 + 32)(20) = 460 \text{ m}$$

Answer460..... m [2]



- 7 Solve the equation $\frac{x}{5} - \frac{2x-3}{4} = -3$.

$$\begin{aligned}\frac{x}{5} - \frac{2x-3}{4} &= -3 \\ 4x - 5(2x-3) &= -60 \\ 4x - 10x + 15 &= -60 \\ 6x &= 75 \\ x &= 12.5\end{aligned}$$

Answer $x = \dots\dots\dots 12.5$ [3]

- 8 Written as a product of its prime factors, $72 = 2^3 \times 3^2$.
(a) Write 540 as a product of its prime factors.

Answer $\dots\dots\dots 540 = 2^2 \times 3^3 \times 5$ [1]

- (b) Find the lowest common multiple (LCM) of 72 and 540.

$$\begin{aligned}72 &= 2^3 \times 3^2 \\ 540 &= 2^2 \times 3^3 \times 5 \\ \text{LCM} &= 2^3 \times 3^3 \times 5 \\ &= 1080\end{aligned}$$

Answer $\dots\dots\dots 1080$ [1]

- (a) The number $\frac{540p}{q}$ is a perfect square, where p and q are prime numbers and $p > q$.
Find the values of p and q .

$$\begin{aligned}\sqrt{\frac{540p}{q}} &= \sqrt{\frac{2^2 \times 3^3 \times 5 \times p}{q}} \\ &= \sqrt{\frac{2^2 \times 3^3 \times 5 \times 5}{3}} \\ &= \sqrt{2^2 \times 3^2 \times 5^2} \\ &= 2 \times 3 \times 5 \\ &= 30\end{aligned}$$

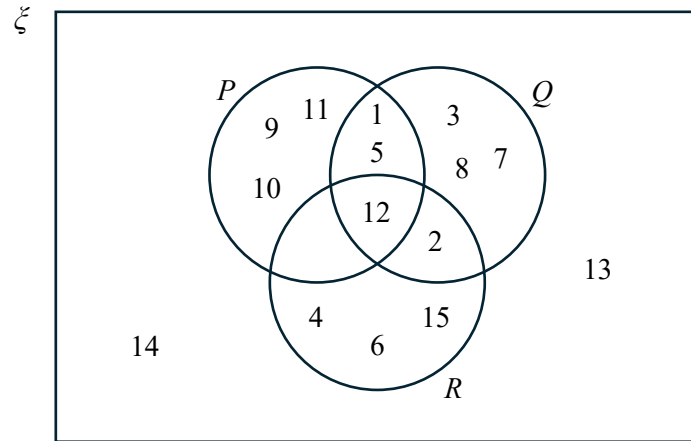
Answer $p = \dots\dots\dots 5$
 $q = \dots\dots\dots 3$ [2]





- 9 $\xi = \{\text{integers } x : 1 \leq x \leq 15\}$

The Venn diagram shows the elements of ξ and three sets P , Q and R .



Use one of the symbols below to complete each statements.

$\emptyset \subset \subseteq \notin \in \xi$

- (a) $\{1, 10\} \dots\dots\dots^{\subset} P$ [1]
(b) $7 \dots\dots\dots^{\in} Q$ [1]
(c) $P \cap R = \dots\dots\dots^{12}$ [1]

- 10 A salesman earns a 3% commission on the sales he makes.
He earned \$35 after selling a laptop that was on a 25% discount.
Find the original selling price of the laptop.

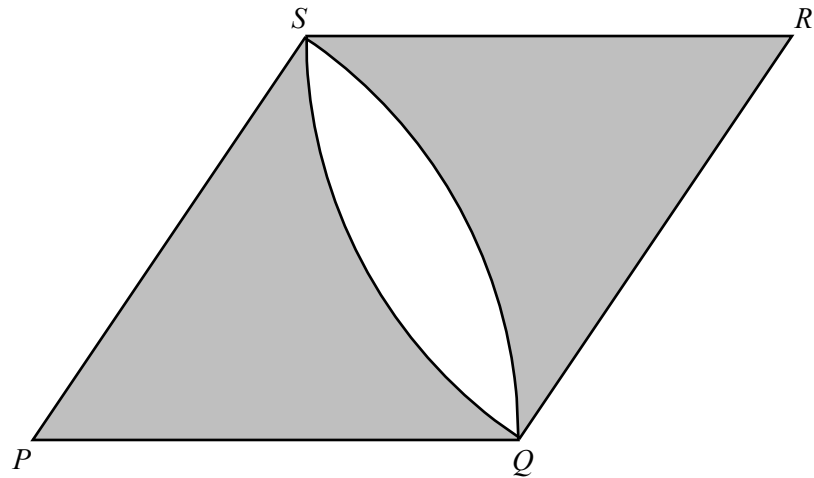
$$\begin{aligned} \text{discounted selling price} &= \$35 \div 3\% \\ &= \$1166.70 \text{ (5 s.f.)} \end{aligned}$$

$$\begin{aligned} \text{original selling price} &= \$1166.70 \div 75\% \\ &= \$156000 \text{ (3 s.f.)} \end{aligned}$$

Answer \$¹⁵⁶⁰⁰⁰ [2]



11



$PQRS$ is a rhombus.

S and Q are the intersection points of the two circles, centres P and R respectively.

Angle $QPS = 0.9$ radians.

$PQ = 12$ cm.

Calculate the total shaded area.

$$\begin{aligned}\text{Area of sector } PSQ &= \frac{1}{2} \times 12^2 \times 0.9 \\ &= 64.8 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of triangle } PSQ &= \frac{1}{2} \times (12)(12) \times \sin 0.9 \\ &= 56.400 \text{ cm}^2 \text{ (5 s.f.)}\end{aligned}$$

$$\begin{aligned}\text{Area of minor segment} &= 64.8 - 56.400 \\ &= 8.4 \text{ cm}^2\end{aligned}$$

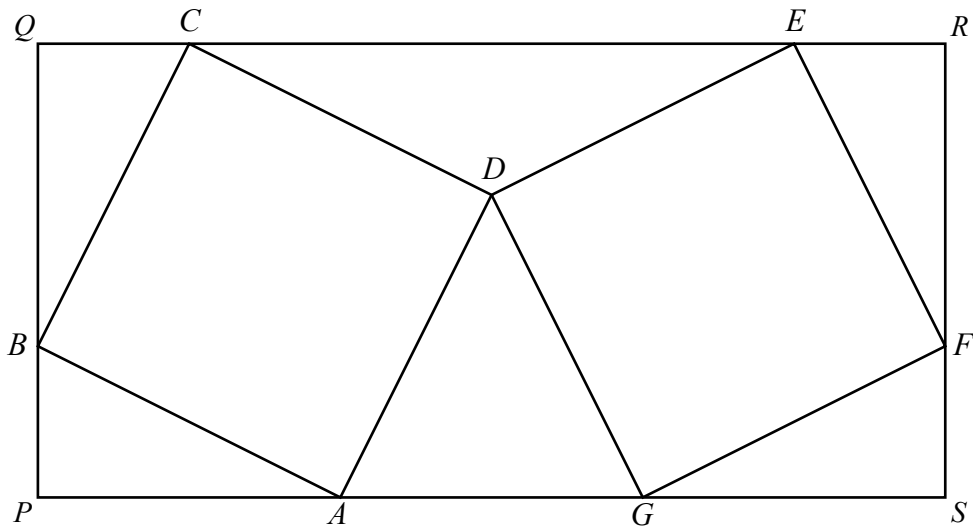
$$\begin{aligned}\text{Total shaded area} &= 2 \times (64.8 - 2 \times 8.4) \\ &= 96 \text{ cm}^2\end{aligned}$$

Answer 96 cm² [4]





12



ABCD and *DEFG* are identical squares.
PQRS is a rectangle.

(a) Prove that *APB* and *GSF* are congruent triangles.

$$\angle BAP = \angle FGS \text{ (angle)}$$

$$AB = GF \text{ (sides of a square are equal)}$$

$$\angle APB = \angle GSF = 90^\circ \text{ (interior angle in a square)}$$

Hence, triangle *APB* and *GSF* are congruent (test ASA)

[3]

(b) Given that angle $ADG = x^\circ$, find angle *DCE* in terms of x .

$$\angle ADC = \angle GDE = 90^\circ \text{ (interior angle in a square)}$$

$$\angle CDE = 360^\circ - 90^\circ - 90^\circ - x^\circ$$

$$= 180^\circ - x^\circ \text{ (\angle s at a pt.)}$$

$$\angle DCE = \angle DEC \text{ (base of isoc. } \Delta \text{)}$$

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

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

$$\text{Answer Angle } DCE = 90^\circ - \frac{x^\circ}{2} \quad [2]$$



- 13 The time, to the nearest minute, that each of 21 boys spent on playing mobile games in a week was recorded.
The results are shown on the stem-and-leaf diagram.

15		0	2	3	4				
16		1	2	2	4	5	7	8	9
17		3	3	4	5	6	8		
18		0	6	7					

Key: 15 | 0 represents 150 minutes

- (a) Write down the median time, in minutes.

Answer168..... minutes [1]

- (b) Find the percentage of the boys who spent less than 170 minutes on mobile games.

$$\begin{aligned}\text{Percentage} &= \frac{12}{21} \times 100\% \\ &= 57.1\% \text{ (3 s.f.)}\end{aligned}$$

Answer57.1..... % [2]

-
- 14 The cash price of a watch is \$300.
Amid buys the watch using hire purchase.
He pays a deposit of 15% of the cash price plus 12 equal monthly payment of \$35.

- (a) Calculate the total amount that Amid pays for the watch.

$$\begin{aligned}\text{Deposit} &= 15\% \times \$300 \\ &= \$45 \\ \text{Total amount paid} &= \$45 + 12 \times \$35\end{aligned}$$

= \$465 Answer \$465..... [2]

- (b) Express the extra cost of using hire purchase as a percentage of the cash price.

$$\begin{aligned}\text{Extra cost} &= \$465 - \$300 \\ &= \$165\end{aligned}$$

$$\begin{aligned}\text{Percentage} &= \frac{165}{300} \times 100\% \\ &= 55\%\end{aligned}$$

Answer55..... % [2]



- 15 Two shops are selling bicycles.

Shop A sells 15 mountain bikes, 20 racing bikes and 25 folding bikes.

Shop B sells x mountain bikes, $(x + 4)$ racing bikes and 22 folding bikes.

This information can be represented by the matrix $\mathbf{P} = \begin{pmatrix} 15 & 20 & 25 \\ x & x + 4 & 22 \end{pmatrix}$.

A mountain bike costs \$350, a racing bike costs \$420 and a folding bike costs \$300.

This information can be represented by the matrix $\mathbf{Q} = \begin{pmatrix} 350 \\ 420 \\ 300 \end{pmatrix}$.

- (a) Find, in terms of x , the matrix $\mathbf{T} = \mathbf{PQ}$.

$$\begin{aligned} \mathbf{T} &= \begin{pmatrix} 15 & 20 & 25 \\ x & x + 4 & 22 \end{pmatrix} \begin{pmatrix} 350 \\ 420 \\ 300 \end{pmatrix} = \begin{pmatrix} 15 \times 350 + 20 \times 420 + 25 \times 300 \\ 350x + 420(x + 4) + 22 \times 300 \end{pmatrix} \\ &= \begin{pmatrix} 21150 \\ 770x + 8280 \end{pmatrix} \end{aligned}$$

$$\text{Answer } \mathbf{T} = \begin{pmatrix} 21150 \\ 770x + 8280 \end{pmatrix} \quad [2]$$

- (b) Explain what each element in matrix $\mathbf{T}$ represents.

The element in matrix $\mathbf{T}$ each represents the total amount collected after selling all
the bicycles by Shop A and Shop B respectively. [1]

- (c) Shop A collected \$3630 more than shop B.

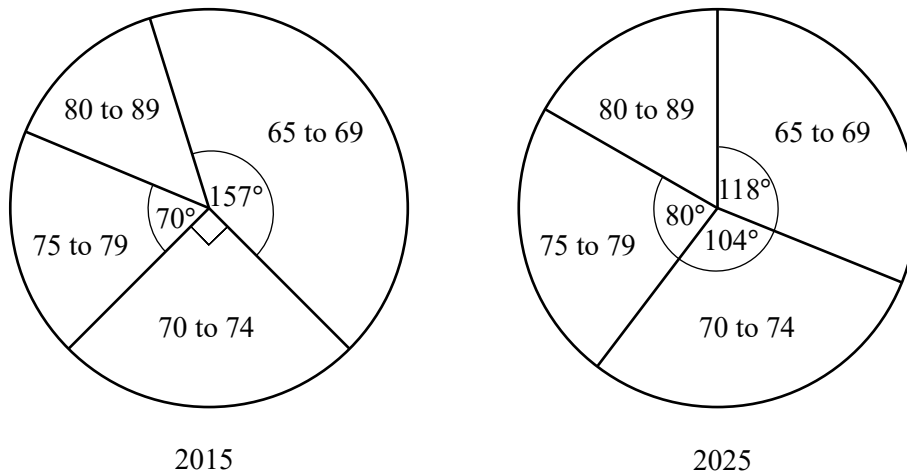
Find the value of x .

$$\begin{aligned} 770x + 8280 + 3630 &= 21150 \\ x &= 12 \end{aligned}$$

$$\text{Answer } x = \dots\dots\dots 12 \quad [1]$$



16



The pie charts show information about the ages of the elderly resident population of Singapore in 2015 and 2025.

- (a) There are 78 552 elderly residents who aged 75 to 79 in 2015.

Work out the total number of elderly residents in 2015.
Give your answer in standard form.

$$70^\circ \rightarrow 78\,552$$

$$360^\circ \rightarrow \frac{78\,552}{70} \times 360 = 4.04 \times 10^5$$

Answer 4.04×10^5 [2]

- (b) The number of elderly residents aged 80 to 89 has increased by 54% from 2015 to 2025.

Work out the number of elderly residents who aged 80 to 89 in 2025.
Give your answer in standard form.

$$360^\circ - 157^\circ - 90^\circ - 70^\circ = 43^\circ \text{ (}\angle\text{s at a pt.)}$$

$$70^\circ \rightarrow 78\,552$$

$$43^\circ \rightarrow \frac{78\,552}{70} \times 43 = 48253 \text{ (5 s.f.)}$$

$$100\% \text{ (2015)} \rightarrow 48253$$

$$154\% \text{ (2025)} \rightarrow \frac{48253}{100} \times 154 = 7.43 \times 10^4$$

Answer 7.43×10^4 [3]



- 17 Explain why the sum of two consecutive odd numbers is always even.

Let the first odd number be $2n + 1$

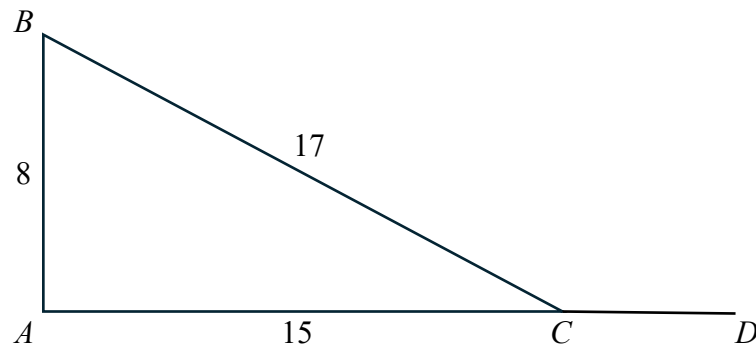
Let the second odd number be $2n + 3$

$$2n + 1 + 2n + 3 = 4n + 4 = 4(n + 1)$$

Since the sum is divisible by 4, hence it is always even.

[2]

18



ABC is a triangle, where $AB = 8$ cm, $BC = 17$ cm and $AC = 15$ cm.
 ACD is a straight line.

- (a) Explain why $\angle BAC = 90^\circ$.

$$AB^2 + AC^2 = 8^2 + 15^2$$
$$= 289$$

$$BC^2 = 17^2$$
$$= 289$$

Since $AB^2 + AC^2 = BC^2$, by converse of Pythagoras' Theorem, hence triangle ABC

is a right-angled triangle, where $\angle BAC = 90^\circ$ (proven)

[3]

- (b) Find the exact value of $\cos \angle BCD$.

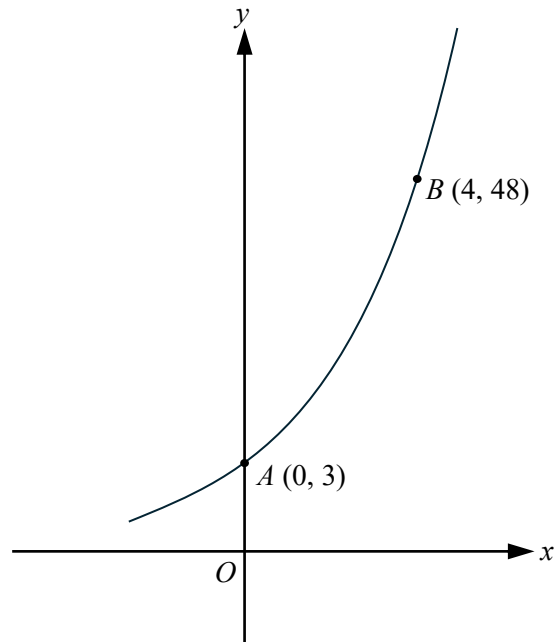
$$\cos \angle BCD = -\cos \angle BCA$$
$$= -\frac{15}{17}$$

Answer $-\frac{15}{17}$ [1]



- 19 The sketch shows the graph of $y = ka^x$.

The graph passes through points $A(0, 3)$ and $B(4, 48)$.



- (a) Find the values of k and a .

At point A,
 $3 = ka^0$
 $k = 3$

At point B,
 $48 = 3a^4$
 $a = 2$

Answer $k = \dots\dots\dots 3 \dots\dots\dots$

$a = \dots\dots\dots 2 \dots\dots\dots$

[2]

- (b) A straight line was drawn from A to B .

Find the length of line AB .

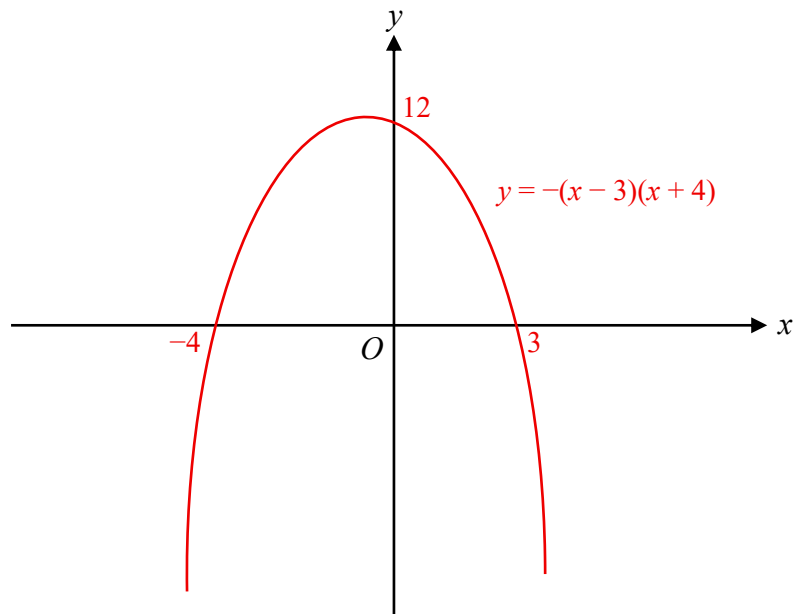
$$AB = \sqrt{(4 - 0)^2 + (48 - 3)^2}$$
$$= 45.2 \text{ units (3 s.f.)}$$

Answer $AB = \dots\dots\dots 45.2 \dots\dots\dots$ units [2]





- 20 Sketch the graph of $y = -(x - 3)(x + 4)$.



[2]

- 21 A map has a scale of 1 : 50 000.

- (a) The distance between Sentosa and Pulau Ubin is 41 km.

Calculate, in centimetres, the distance between Sentosa and Pulau Ubin on the map.

Actual : Map

50 000 cm : 1 cm

41 000 cm : $\frac{41\,000}{50\,000} = 0.82$ cm

Answer 0.82 cm [2]

- (b) The area of Jewel Changi Airport is 135 700 m².

Calculate the area, in square centimetres, of Jewel Changi Airport on the map.

Actual : Map

50 000 cm : 1 cm

500 m : 1 cm

250 000 m² : 1 cm²

135 700 m² : $\frac{135\,700}{250\,000} = 0.543$ cm² (3 s.f.)

Answer 0.543 cm² [2]



- 22 Given that $512^4 = 16^{-2y}$, find y .

$$\begin{aligned}512^4 &= 16^{-2y} \\ (2^9)^4 &= (2^4)^{-2y} \\ 2^{36} &= 2^{-8y} \\ -8y &= 36 \\ y &= -4.5\end{aligned}$$

Answer $y = \dots\dots\dots -4.5$ [2]

- 23 Factorise completely

- (a) $10pq^2 - 8p^2q^2$.

$$10pq^2 - 8p^2q^2 = 2pq^2(5 - 4p)$$

Answer $\dots\dots\dots 2pq^2(5 - 4p)$ [2]

- (b) $4ax + 12by - 16ay - 3bx$.

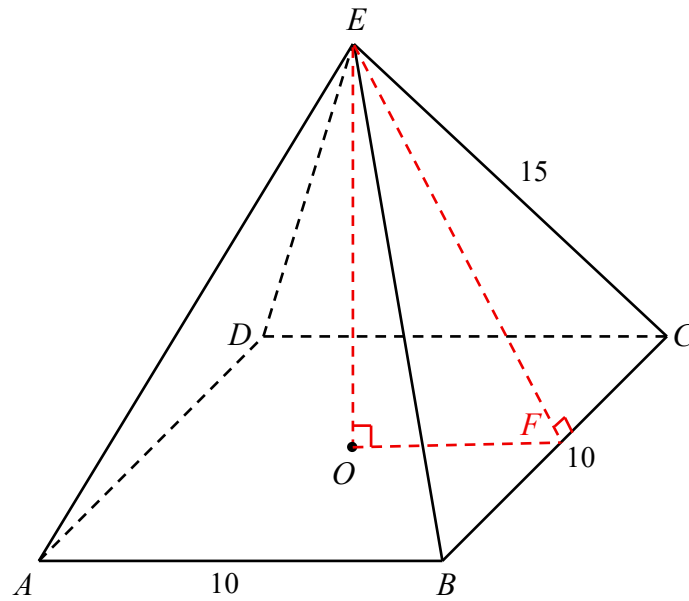
$$\begin{aligned}4ax + 12by - 16ay - 3bx &= 4ax - 16ay + 12by - 3bx \\ &= 4a(x - 4y) + 3b(x - 4y) \\ &= (4a + 3b)(x - 4y)\end{aligned}$$

Answer $\dots\dots\dots (4a + 3b)(x - 4y)$ [2]





24



The diagram shows a pyramid $ABCDE$.

$ABCD$ is a square with sides of 10 cm, where O is the centre of the square.

E is the vertex of the pyramid.

$AE = BE = CE = DE = 15$ cm.

Calculate the volume of the pyramid.

$$CF = 5 \text{ cm}$$

$$EF^2 = 15^2 - 5^2$$

$$EF = \sqrt{200} \text{ cm}$$

$$OE^2 = 200 - 5^2$$

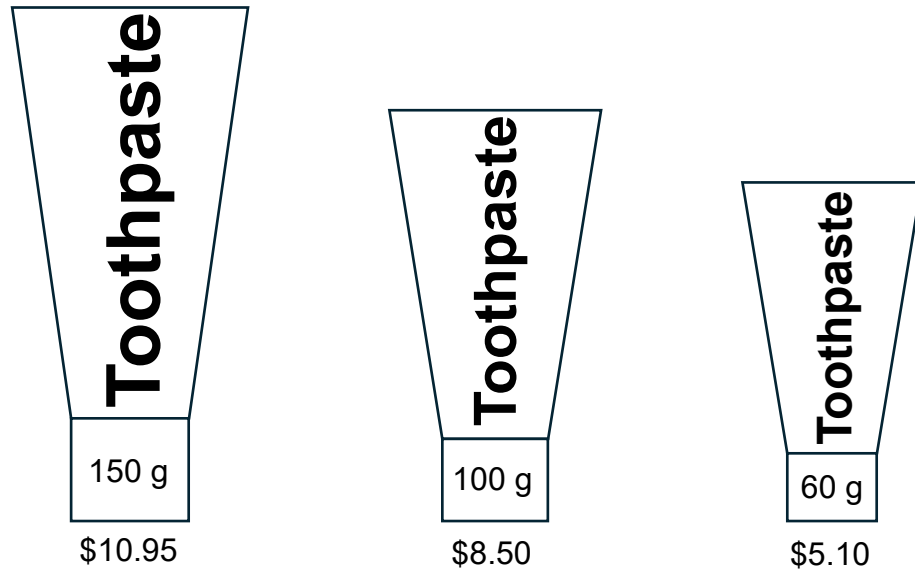
$$OE = \sqrt{175} \text{ cm}$$

$$\begin{aligned} \text{Volume} &= \frac{1}{3} \times 10^2 \times \sqrt{175} \\ &= 441 \text{ cm}^3 \text{ (3 s.f.)} \end{aligned}$$

Answer 441 cm^3 [3]



25 (a)



A factory manufactures three masses of the same brand of toothpaste.

Show that the cost of the toothpaste is **not** proportional to the mass of toothpaste.

$$150 \text{ g} \rightarrow \$10.95$$

$$1 \text{ g} \rightarrow \frac{10.95}{150} = \$0.073$$

The price per mass for all three toothpastes are not equal.

Hence, the cost of the toothpaste is not proportional to the mass of toothpaste. (shown)

$$100 \text{ g} \rightarrow \$8.50$$

$$1 \text{ g} \rightarrow \frac{8.50}{100} = \$0.085$$

$$60 \text{ g} \rightarrow \$5.10$$

$$1 \text{ g} \rightarrow \frac{5.10}{60} = \$0.085$$

[2]

(b) Another factory manufactures two geometrically similar jugs.

The height of each jug is 20 cm and 25 cm respectively.

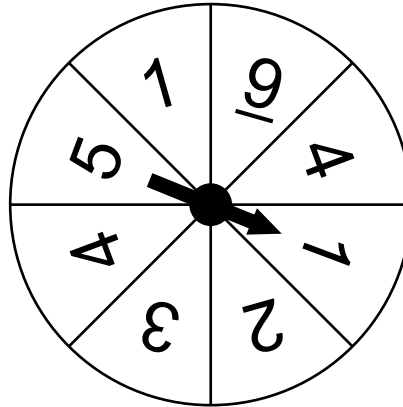
Find the ratio of the volume of the smaller jug : volume of the larger jug.

$$\begin{aligned}\frac{V_1}{V_2} &= \left(\frac{l_1}{l_2}\right)^3 \\ &= \left(\frac{20}{25}\right)^3 \\ &= \frac{64}{125}\end{aligned}$$

Answer 64 : 125 [2]



- 26 The diagram shows a fair spinner with eight numbered sectors.



Each time the pointer is spun it is equally likely to stop on any of the sectors.

- (a) Amir spins the pointer once.

Find the probability that the pointer lands on a prime number.

$$P(\text{prime number}) = \frac{3}{8}$$

Answer $\frac{3}{8}$ [1]

- (b) David spins the pointer twice.

Find the probability that the pointer lands on an even number both times.

$$\begin{aligned} P(\text{even number on both times}) &= \frac{3}{8} \times \frac{3}{8} \\ &= \frac{9}{64} \end{aligned}$$

Answer $\frac{9}{64}$ [1]

- (c) Nur spins the pointer twice.

Her score is obtained by adding up the numbers from her two spins.

Find the probability that her score is **not** 5.

$$\begin{aligned} P(\text{score not 5}) &= 1 - \left(\frac{2}{8} \times \frac{2}{8} + \frac{2}{8} \times \frac{2}{8} + \frac{1}{8} \times \frac{1}{8} + \frac{1}{8} \times \frac{1}{8} \right) \\ &= \frac{27}{32} \end{aligned}$$

Answer $\frac{27}{32}$ [2]



- 27 Some boxes are filled with beads.
The number of beads in each box is counted.
The table shows the results.

Number of beads	20	21	22	23	24	25
Frequency	35	23	$3p^2$	24	22	21

The mean number of beads is 22.25 .

- (a) Calculate the value of p .

$$\frac{35(20) + 23(21) + 3p^2(22) + 24(23) + 22(24) + 21(25)}{35 + 23 + 3p^2 + 24 + 22 + 21} = 22.25$$

$$\frac{700 + 483 + 66p^2 + 552 + 528 + 525}{35 + 23 + 3p^2 + 24 + 22 + 21} = 22.25$$

$$\frac{2788 + 66p^2}{125 + 3p^2} = 22.25$$

$$22.25(125 + 3p^2) = 2788 + 66p^2$$

$$2781.25 + 66.75p^2 = 2788 + 66p^2$$

$$0.75p^2 = 6.75$$

$$p = \sqrt{\frac{6.75}{0.75}}$$
$$= 3$$

Answer $p = \dots\dots\dots 3 \dots\dots\dots$ [4]

- (b) Calculate the standard deviation.

$$\begin{aligned} \text{Standard deviation} &= \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2} \\ &= \sqrt{\frac{75604}{152} - 22.25^2} \\ &= 1.53 \text{ (3 s.f.)} \end{aligned}$$

Answer $\dots\dots\dots 1.53 \dots\dots\dots$ [1]





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