

Name:	Class:	Class Register Number:
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中正中學

CHUNG CHENG HIGH SCHOOL (MAIN)

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Marking Scheme

PRELIMINARY EXAMINATION 2026 SECONDARY 4

MATHEMATICS

4052/01

Paper 1

Thursday 20 August 2026

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number 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.

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.

For Examiner's Use

Total

/ 90

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

[Turn over

Mathematical Formulae*Compound interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions.

- 1 (a) Factorise $4p^2 - 2q - 8pq + p$.

$$\begin{aligned} 4p^2 - 2q - 8pq + p &= 4p^2 - 8pq + p - 2q \\ &= 4p(p - 2q) + (p - 2q) \quad [\text{B1}] \\ &= (4p + 1)(p - 2q) \quad [\text{B1}] \end{aligned}$$

Alternative

$$\begin{aligned} 4p^2 - 2q - 8pq + p &= 4p^2 + p - 2q - 8pq \\ &= p(4p + 1) - 2q(1 + 4p) \quad [\text{B1}] \\ &= (4p + 1)(p - 2q) \quad [\text{B1}] \end{aligned}$$

$$(4p + 1)(p - 2q)$$

Answer [2]

- (b) Simplify $\frac{x^2 y^3}{\sqrt{z}} \div \frac{(xy)^2}{z^{\frac{3}{2}}}$.

$$\begin{aligned} \left(\frac{x^2 y^3}{\sqrt{z}} \right) \div \frac{(xy)^2}{z^{\frac{3}{2}}} &= \frac{x^2 y^3}{z^{\frac{1}{2}}} \times \frac{z^{\frac{3}{2}}}{x^2 y^2} \\ &= x^{2-2} y^{3-2} z^{\frac{3}{2} - \frac{1}{2}} \quad [\text{M1, M1} - \text{Any 2 Laws of Indices}] \\ &= yz \quad [\text{A1}] \end{aligned}$$

$$yz$$

Answer [3]

- 2 (a) Solve the inequalities $x + 7 < 4x - 2 \leq 3x + 8$.

$$x + 7 < 4x - 2 \text{ and } 4x - 2 \leq 3x + 8$$

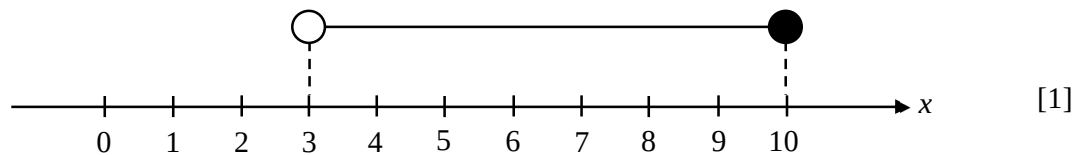
$$9 < 3x \quad x \leq 10 \quad [\text{B1} - \text{Any correct inequality}]$$

$$x > 3$$

$$\therefore 3 < x \leq 10 \quad [\text{A1}]$$

Answer $3 < x \leq 10$ [2]

- (b) Illustrate your answer to part (a) in the number line below.



- 3 Solve the equation $\frac{1}{3^{2x}} \div 4^x = 36$.

$$\frac{1}{3^{2x}} \times \frac{1}{4^x} = 36$$

$$\frac{1}{9^x} \times \frac{1}{4^x} = 36 \quad [\text{M1} - \text{Change } 3^{2x} \text{ into } 9^x]$$

$$\frac{1}{36^x} = 36 \quad [\text{M1} - \text{Comparing power with same base}]$$

$$x = -1 \quad [\text{A1}]$$

Alternative

$$\frac{1}{3^{2x}} \times \frac{1}{4^x} = 36$$

$$\frac{1}{3^{2x}} \times \frac{1}{2^{2x}} = 6^2 \quad [\text{M1} - \text{Change } 4^x \text{ into } 2^{2x}]$$

$$\frac{1}{6^{2x}} = \frac{1}{6^{-2}} \quad [\text{M1} - \text{Comparing power with same base}]$$

$$2x = -2$$

$$x = -1 \quad [\text{A1}]$$

Answer $x = -1$ [3]

- 4 Expand $(4x-3)(x+1)$.

$$(4x-3)(x+1) = 4x^2 + 4x - 3x - 3$$

$$= 4x^2 + x - 3$$

[B2 – All 3 terms correct]

[B1 – Any one wrong term]

$$4x^2 + x - 3$$

Answer [2]

- 5 Light takes approximately 8 minutes to travel 150 million kilometres.

- (a) Find the average speed of light, in metres per second. Give your answer in standard form.

Speed = $\frac{150 \times 10^6 \times 10^3 \text{ m}}{8 \times 60 \text{ s}}$ [M1 – Speed formula, correct 150 and 8 × 60]

150 million kilometres
Converting minutes into seconds

$$= 3.125 \times 10^8 \text{ m/s} \quad [\text{A1}]$$

$$3.125 \times 10^8$$

Answer m/s [2]

- (b) The star Proxima Centauri is 4×10^{13} km from Earth.
Find the time, in years, it takes for light to travel from Proxima Centauri to Earth.
[Assume 1 year = 365 days]

Convert into metres

$$\text{Time} = \frac{(4 \times 10^{13} \times 10^3) \text{ m}}{(3.125 \times 10^8)(60)(60)(24)(365)}$$

[√M1 – Time formula with (60)(60)(24)(365)]

$$= 4.06 \text{ years (3 sig. fig.)} \quad [\text{A1}]$$

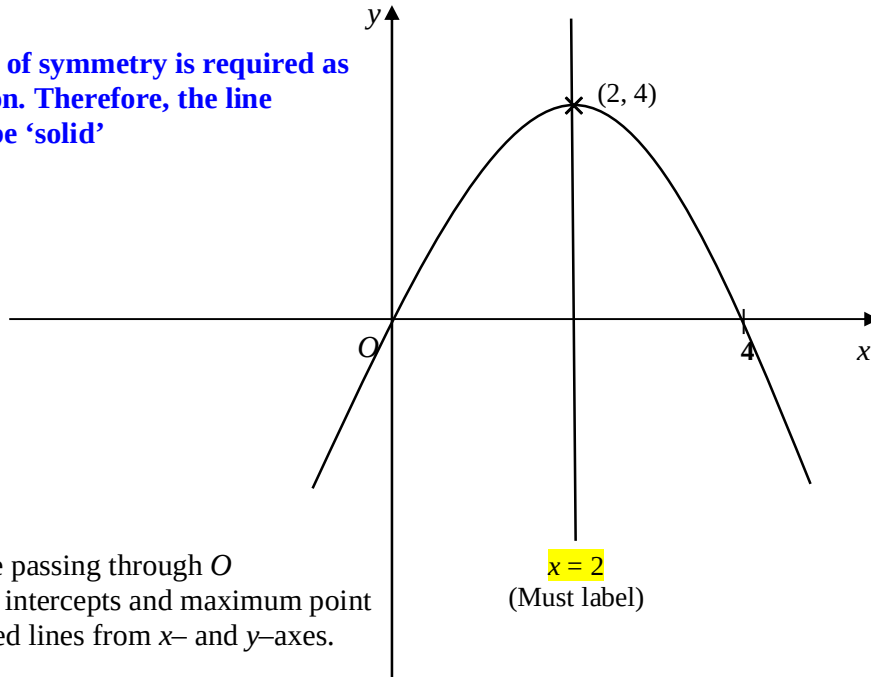
$$\begin{aligned} \text{Time} &= \frac{\text{Distance (m)}}{\text{Speed (m/s)}} \text{ seconds} \\ &= \frac{4 \times 10^{13} \times 10^3 \text{ m}}{3.125 \times 10^8 \text{ m/s}} \\ &= 1.28 \times 10^8 \text{ seconds } (\div 60) \\ &= 2133333.333 \text{ minutes} \\ &= 35555.55 \text{ hours} \\ &= 1481.481 \text{ days} \\ &= 4.058... \text{ years} \\ &= 4.06 \text{ years (3sf)} \end{aligned}$$

$$4.06$$

Answer years [2]

- 6 (a) Sketch the graph of $y = -(x-2)^2 + 4$ on the axes below. Indicate clearly the turning point and the points where the graph crosses the axes.

The line of symmetry is required as a solution. Therefore, the line should be 'solid'



Part (a)

G1 – Correct shape passing through O

G1 – Correct x-, y- intercepts and maximum point (can use dotted lines from x- and y-axes.)

$x = 2$
(Must label)

Part (b)

B1 – Correct line of symmetry with label (equation)

[2]

- (b) On the same graph in (a), draw and label the line of symmetry of the graph

[1]

- 7 In a regular n -sided polygon, the interior angle is 3 times that of the exterior angle. Find the value of n .

Method 1

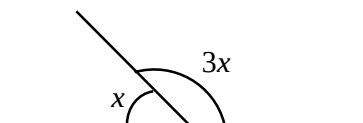
Let exterior angle be x

$$x + 3x = 180^\circ \quad [\text{M1}]$$

$$4x = 180^\circ$$

$$x = 45^\circ$$

$$n = \frac{360^\circ}{45^\circ} = 8 \quad [\text{A1}]$$



Method 2

$$\frac{n-2}{n} \times 180^\circ = 3 \left(\frac{360^\circ}{n} \right) \quad [\text{M1}]$$

$$\frac{n-2}{n} = 3 \left(\frac{2}{n} \right)$$

$$\frac{n-2}{n} = \frac{6}{n}$$

$$n^2 - 2n = 6n$$

$$n^2 - 8n = 0$$

$$n(n-8) = 0$$

$$n = 8 \text{ or } n = 0 \text{ (N.A.)} \quad [\text{A1}]$$

Answer $n = 8$ [2]

8 Solve the following equations.

(a) $\frac{x+4}{3} = \frac{3}{x-4}$

$$\frac{x+4}{3} = \frac{3}{x-4}$$

$$(x+4)(x-4) = 9 \quad [\text{B1} - \text{Multiplying both sides by } 3(x-4)]$$

$$x^2 - 16 = 9$$

$$x^2 = 25$$

$$x = 5 \text{ or } -5 \quad [\text{B1}]$$

Answer $x = -5$ or 5 [2]

(b) $\frac{x+3}{7} + \frac{x-1}{2} = 3$

$$\frac{x+3}{7} + \frac{x-1}{2} = 3$$

$$\frac{2(x+3) + 7(x-1)}{14} = 3 \quad [\text{B1} - \text{Common denominator (equivalent fractions)}]$$

$$2x + 6 + 7x - 7 = 42 \quad [\text{M1} - \text{Simplifying}]$$

$$9x - 1 = 42$$

$$9x = 43$$

$$x = 4\frac{7}{9} \quad [\text{A1} - \text{Accept } \frac{43}{9}, \text{ not 3 s.f.}]$$

Answer $x = 4\frac{7}{9}$ [3]

9 Solve these simultaneous equations.

$$x - 2y = 5$$

$$2x + y = 0$$

Method 1

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

$$2x + y = 0 \quad \text{--- (2)}$$

$$(1) \times 2:$$

$$2x - 4y = 10 \quad \text{--- (3)}$$

$$(2) - (3):$$

$$5y = -10 \quad [\text{M1} - \text{Attempting to make coefficient of } x \text{ or } y \text{ equal}]$$

$$y = -2 \quad [\text{A1}]$$

$$x = 1 \quad [\text{A1}]$$

Method 2

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

$$2x + y = 0 \quad \text{--- (2)}$$

Subst (1) into (2):

$$2(5 + 2y) + y = 0 \quad [\text{M1} - \text{Attempting to make } x \text{ or } y \text{ the subject}]$$

$$10 + 4y + 2y = 0$$

$$5y = -10$$

$$y = -2 \quad [\text{A1}]$$

$$x = 1 \quad [\text{A1}]$$

Answer $x = \dots\dots\dots 1$
 $y = \dots\dots\dots -2$ [3]

- 10 (a) $\xi = \{x : x \text{ is an integer, } 0 < x < 10\}$
 $P = \{x : x \text{ is a prime number}\} = \{2, 3, 5, 7\}$
 $S = \{x : x \text{ is a perfect square}\} = \{1, 4, 9\}$
 $E = \{x : x \text{ is an even number}\} = \{2, 4, 6, 8\}$

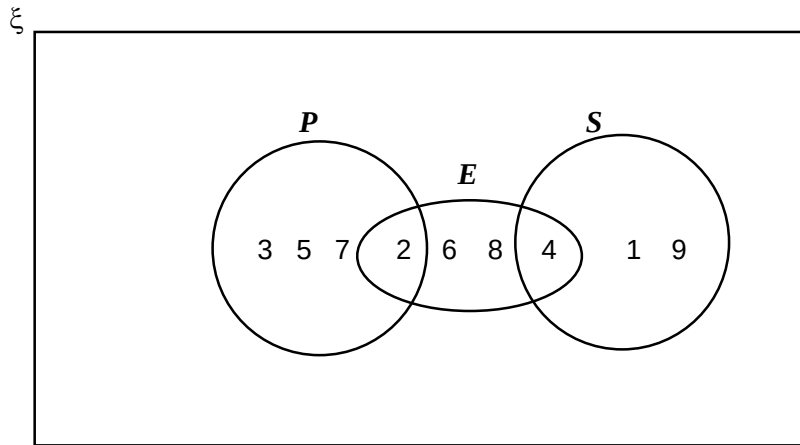
- (i) Write down the relationship between set P and S using set notation.

Statements such as $P \neq S$, $P \not\subset S$ are not precise.

$$P \cap S = \emptyset \text{ or}$$

$$\text{Answer } n(P \cap S) = 0 \dots\dots\dots [1]$$

- (ii) Complete the Venn Diagram below to represent set P , set S and set E .



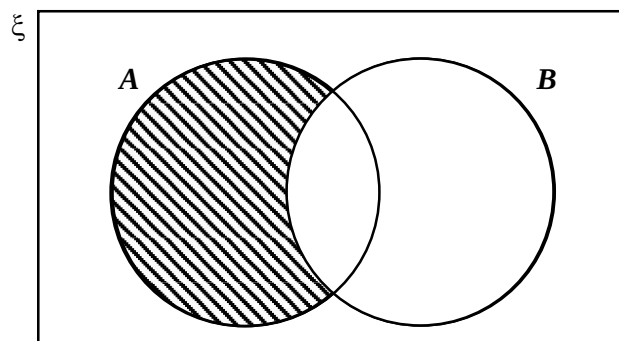
[B1 – All correct with empty overlap]
 [B2 – All correct]

[2]

The number 1 is not a prime number. Smallest prime starts from 2.

1 is a perfect square.

- (b) On the Venn diagram, shade the region which represents $A \cap B'$.



[1]

**Shade neatly using PENCIL
 with parallel lines and a ruler.**

- 11 The drink stall at a hawker centre sells tea, coffee and Milo.
In one week, the drink stall sells 500 cups of tea (T), 1200 cups of coffee (C) and 800 cups of Milo (M).
The next week, the drink stall sells 400, 900 and 700 cups of tea, coffee and Milo respectively.

(a) Represent this information in a 2×3 matrix, **P**.

Answer
$$\mathbf{P} = \begin{pmatrix} 500 & 1200 & 800 \\ 400 & 900 & 700 \end{pmatrix} \begin{matrix} \text{Week 1} \\ \text{Week 2} \end{matrix} \quad [1]$$

- (b) The cost of a cup of tea, coffee and Milo are \$1.00, \$1.10 and \$1.70 respectively.
Represent this information in a 3×1 matrix **R**.

There should be no units inside a matrix.

$$\begin{pmatrix} 1.0 \\ 1.1 \\ 1.7 \end{pmatrix} \quad [\text{B1}]$$

Answer $\mathbf{R} = \dots\dots\dots [1]$

- (c) Evaluate the matrix **PR**.

$$\begin{pmatrix} 500 & 1200 & 800 \\ 400 & 900 & 700 \end{pmatrix} \begin{pmatrix} 1.00 \\ 1.10 \\ 1.70 \end{pmatrix} = \begin{pmatrix} 500 + 1320 + 1360 \\ 400 + 990 + 1190 \end{pmatrix}$$

The B2 marks are only awarded if the matrices can be multiplied.

$$= \begin{pmatrix} 3180 \\ 2580 \end{pmatrix} \quad [\text{B1} - 3180, \text{B1} - 2580]$$

(No brackets no marks)

$$\begin{pmatrix} 3180 \\ 2580 \end{pmatrix}$$

Answer $\mathbf{PR} = \dots\dots\dots [2]$

- (d) Explain what each of the elements in the matrix **PR** represent.

The elements represent the **total amount of money collected**
by the stall from the **sale of tea, coffee and Milo**
in **weeks 1 and 2** respectively.

(Accept 'all three drinks', 'from each week') [1]

12 When written as products of their prime factors,

$$p = 2^3 \times 3^6$$

$$q = 2 \times 3^2 \times 7$$

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

Find

(a) the value of the cube root of p ,

$$\begin{aligned} \text{Value of the cube root of } p &= (2^3 \times 3^6)^{\frac{1}{3}} \\ &= 18 \end{aligned} \quad [\text{B1}]$$

18

Answer [1]

(b) the lowest common multiple of p , q and r , giving your answer as a product of its prime factors.

$$LCM = 2^3 \times 3^6 \times 5 \times 7 \quad [\text{B1}]$$

$2^3 \times 3^6 \times 5 \times 7$

Answer [1]

(c) the greatest positive integer that divides p , q and r exactly.

$$\begin{aligned} \text{Greatest number} &= 2 \times 3 \\ &= 6 \end{aligned} \quad [\text{B1}]$$

6

Answer [1]

- 13 A weather forecast gives the probabilities of rain on three consecutive days. The probabilities that it will rain on the first, second or third day are 0.2, 0.2 and 0.3 respectively.

The occurrence of rain on each day is independent of the day before.

- (a) Find the probability that it rains on all 3 days.

$$\begin{aligned} P(\text{rain on all 3 days}) &= (0.2)(0.2)(0.3) \\ &= 0.012 \text{ or } \frac{3}{250} \end{aligned}$$

$$\begin{aligned} P(\text{rain all 3 days}) &= P(\text{rain on 1}^{\text{st}} \text{ and rain on 2}^{\text{nd}} \text{ and rain on 3}^{\text{rd}}) \\ &= 0.2 \times 0.2 \times 0.3 \end{aligned}$$

$$\begin{aligned} P(\text{rain on one of the 3 days}) &= P(\text{rain on 1}^{\text{st}} \text{ OR rain on 2}^{\text{nd}} \text{ OR rain on 3}^{\text{rd}}) \\ &= 0.2 + 0.2 + 0.3 \end{aligned}$$

Answer 0.012 or $\frac{3}{250}$ [1]

- (b) Given that it rains on the third day, find the probability it will rain on exactly one of the first two days.

$$\begin{aligned} P(\text{rain on exactly 1 of 2 days} \mid \text{rains on 3}^{\text{rd}} \text{ day}) \\ &= P(R, R') + P(R', R) \\ &= (0.2)(1-0.2) + (1-0.2)(0.2) \quad [\text{B1}] \\ &= 0.32 \quad [\text{B1}] \end{aligned}$$

We can ignore the 3rd day because it has been fixed. Therefore, the probability only depends on the first 2 days.

$$\begin{aligned} P(\text{rain 1}^{\text{st}} \text{ day, no rain on 2}^{\text{nd}} \text{ day OR no rain on 1}^{\text{st}} \text{ day, rain on 2}^{\text{nd}} \text{ day}) \\ &= P(\text{rain 1}^{\text{st}} \text{ day, no rain on 2}^{\text{nd}} \text{ day}) + P(\text{no rain on 1}^{\text{st}} \text{ day, rain on 2}^{\text{nd}} \text{ day}) \end{aligned}$$

Answer 0.32 or $\frac{8}{25}$ [2]

- 14 A donut shop recorded the number of boxes of cakes sold each day over a period of 30 days.

Number of boxes sold, n	Frequency
$100 \leq x < 120$ 110	4
$120 \leq x < 140$ 130	6
$140 \leq x < 160$ 150	12
$160 \leq x < 180$ 170	8

- (a) Calculate an estimate of
(i) the mean daily number of boxes sold,

Answer 146 [B1] [1]

- (ii) the standard deviation of the daily number of boxes sold.

Answer 19.6 [B1] [1]

- (b) There was an error in the recording. The shop had actually sold 30 fewer boxes of cakes each day than recorded.

Explain how this correction will affect the mean and standard deviation calculated in (a).

Answer

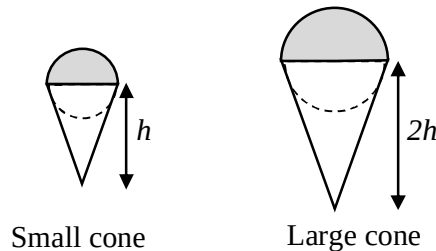
[2]

The mean will **decrease by 30 boxes** [B1]

.....
whereas the standard deviation will **remain unchanged**. [B1]
.....
.....

- 15 The diagram shows two geometrically similar coned-shaped wafers, each holding a spherical scoop of ice-cream. Each scoop fits exactly into the circular opening of the cone, with half the scoop inside the cone.

The ratio of the height of the smaller cone to the larger cone is 1 : 2.



- (a) Tom claims that the larger scoop contains twice as much ice-cream as the smaller scoop. Determine whether Tom is correct. Justify your answer with appropriate workings.

Answer

A is 8 times of B is **not the same as**
A is 8 times **more** than B.

[2]

Tom is incorrect.

$$\text{Since } \frac{V_L}{V_S} = \left(\frac{h_L}{h_S}\right)^3 = \left(\frac{2}{1}\right)^3 = 8, \text{ [B1]}$$

the **volume** of the larger scoop is actually **8 times that** of the smaller scoop. [B1]

- (b) The volume of ice-cream in the larger scoop is 0.4 litres. Calculate the volume of the ice-cream in the smaller scoop. Give your answer in cubic centimetres.

$$0.4\text{ l} = 400 \text{ cm}^3 \quad [\text{B1} - \text{Conversion to cm}^3]$$

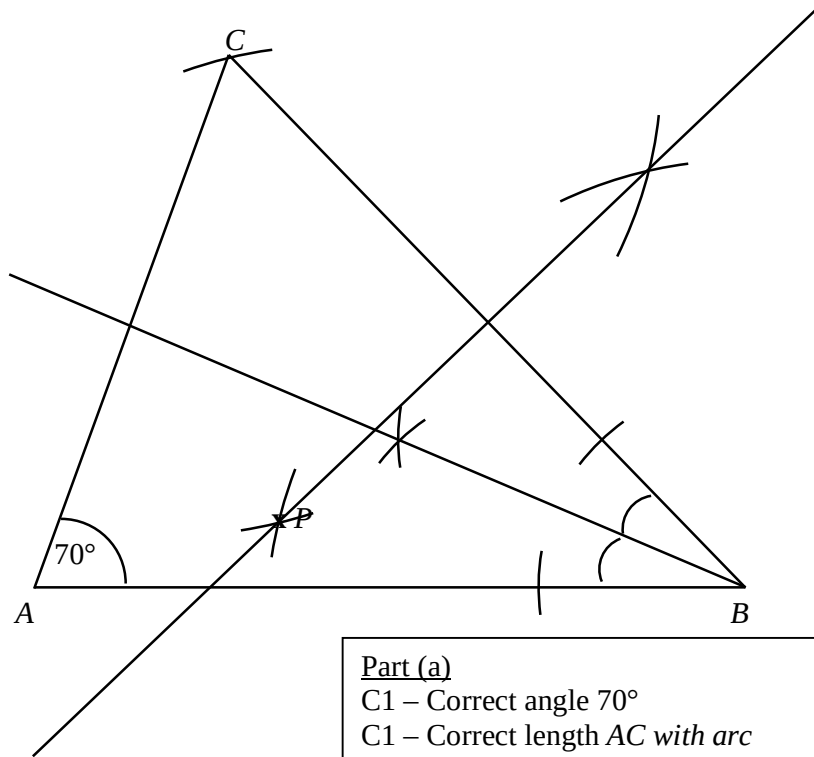
Volume of smaller ice-cream

$$= \frac{400}{8}$$

$$= 50 \text{ cm}^3 \quad [\text{B1}]$$

Answer **50** cm³ [2]

- 16 (a) In the diagram, $AB = 10$ cm. Given that $\angle BAC = 70^\circ$ and $AC = 8$ cm, construct the triangle ABC in the space given below.



Part (a)

C1 – Correct angle 70°

C1 – Correct length AC with arc

Part (b)

C1 – Correct $\perp$ bisector with 4 arcs

C1 – Correct angle bisector with 4 arcs

[2]

Part (c)

C1 – Correct P (allow FT)

[1]

- (b) On the same diagram, construct the

(i) perpendicular bisector of BC ,

[1]

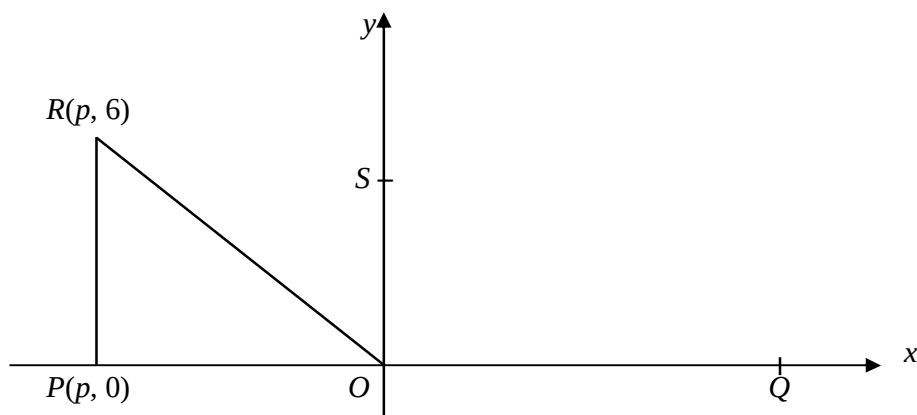
(ii) angle bisector of $\angle ABC$.

[1]

- (c) Mark and label on the diagram, the point P such that P is equidistant from point B and point C and is nearer to AB than BC .

[1]

- 17 The points $P(p, 0)$ and $R(p, 6)$ are shown in the diagram. Point Q lies on the x -axis while point S lies on the y -axis.



- (a) Explain clearly why triangle OPR is a right-angled triangle.

Since P and R have **same x-coordinate**, PR is a **vertical** line.

OP is a **horizontal** line since it lies along the x -axis.

Therefore, OPR is a right-angled triangle. [B1]

[1]

For those who attempted to use Converse of Pythagoras Theorem:

$$OP = |p| \text{ units}$$

$$OP^2 = p^2$$

$$PR^2 = 6^2$$

$$OR = \sqrt{(0-p)^2 + (0-6)^2}$$

$$OR^2 = p^2 + 6^2$$

Since $OP^2 + PR^2 = OR^2$, by converse of Pythagoras Theorem, triangle OPR is a right-angled triangle.

- (b) It is given that $\cos \angle ROQ = -\frac{4}{5}$.

$\frac{4}{5}$ is a ratio.

Without using a calculator, find

- (i) the value of p ,

$$\cos \angle ROQ = -\frac{4}{5}$$

$$OR = \sqrt{p^2 + 6^2} \quad [\text{B1}]$$

$$\cos \angle ROP = \frac{OP}{OR}$$

$$\frac{p}{\sqrt{p^2 + 6^2}} = \frac{4}{5} \quad \left[\sqrt{\text{M1}} - \text{Equate } \frac{OP}{OR} = \frac{4}{5} \right]$$

$$\frac{p^2}{p^2 + 6^2} = \frac{16}{25}$$

$$\frac{p^2}{p^2 + 6^2} = \frac{16}{25}$$

$$25p^2 = 16p^2 + 576$$

$$9p^2 = 576$$

$$p^2 = 64$$

$$p = -8 \text{ or } 8 \text{ (rej)} \quad [\text{A1}]$$

Alternative

$$\cos \angle ROP = \frac{4}{5}$$

$$\frac{OP}{OR} = \frac{4}{5}$$

$$OP : PR : OR = 4 : 3 : 5 \quad [\text{B1}]$$

$$= 8 : 6 : 10 \quad [\text{M1}]$$

$$p = -8 \quad [\text{A1}]$$

P is 8 units from O .

But since it lies on the **left** side, the x -coordinate should be negative.

Answer $p = \dots\dots\dots -8 \dots\dots\dots$ [3]

- (ii) the value of $\tan \angle ROS$.

$$\tan \angle ROS = \tan \angle ORP$$

$$= \frac{8}{6}$$

$$= \frac{4}{3} \quad [\text{B1}]$$

Answer $\tan \angle ROS = \dots\dots\dots \frac{4}{3} \dots\dots\dots$ [1]

18 The line l_1 passes through the points $A(3, -1)$ and $B(7, 2)$.

(a) The point $(2, a)$ lies on the line l_1 , find the value of a .

$$\text{Gradient of } AB = \frac{2 - (-1)}{7 - 3} \quad [\text{B1} - \text{Gradient}]$$

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

Eqn of AB :

$$y = \frac{3}{4}x + c$$

$$2 = \frac{3}{4}(7) + c \quad [\sqrt{\text{M1}} - \text{Substitution}]$$

$$c = -\frac{13}{4}$$

$$y = \frac{3}{4}x - \frac{13}{4}$$

When $x = 2$, $y = a$

$$a = \frac{3}{4}(2) - \frac{13}{4}$$

$$= 1.75, 1\frac{3}{4} \text{ or } -\frac{7}{4} \quad [\text{A1}]$$

Alternative Method

$$\frac{2 - (-1)}{7 - 3} = \frac{a - 2}{2 - 7} \quad [\text{B1}]$$

$$\frac{3}{4} = \frac{a - 2}{-5}$$

$$-15 = 4a - 8 \quad [\text{M1}]$$

$$4a = -7$$

$$a = -\frac{7}{4} \quad [\text{A1}]$$

Answer $a = -1\frac{3}{4}$ [3]

(b) The line l_2 passes through the point $D(0, 8)$.

Let S_1 and S_2 be the sets of all points lying on l_1 and l_2 respectively.

Given that $S_1 \cap S_2 = \emptyset$, find the equation of the line l_2 .

Since $l_1 \cap l_2 = \emptyset$, this means that the lines **do not** intersect.

$\therefore l_1$ is **parallel** to l_2

y -intercept is 8, hence

Equation of l_2 :

$$y = \frac{3}{4}x + 8 \quad [\sqrt{\text{B1}}, \text{B1}]$$

Answer $y = \frac{3}{4}x + 8$ [2]

19 Given that $A(-1, 2)$ and $B(2, 3)$.

(a) Find the length of AB .

$$\begin{aligned}
 AB &= \sqrt{(2 - (-1))^2 + (3 - 2)^2} \quad [\text{B1}] \\
 &= \sqrt{3^2 + 1^2} \\
 &= \sqrt{10} \text{ units} \\
 &= 3.16 \text{ units} \quad (3 \text{ sig. fig.}) \quad [\text{B1}]
 \end{aligned}$$

Do not leave in radical (surd) from unless required by the question.

Answer **3.16 units** [2]

Point B is translated by the vector $\begin{pmatrix} 5 \\ -1 \end{pmatrix}$ to point C .

(b) Find $\overrightarrow{OC}$.

$$\begin{aligned}
 \overrightarrow{BC} &= \begin{pmatrix} 5 \\ -1 \end{pmatrix} \\
 \overrightarrow{OC} &= \overrightarrow{OB} + \overrightarrow{BC} \quad [\text{M1} - \text{Law of vector addition}] \\
 &= \begin{pmatrix} 5 \\ -1 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix} \\
 &= \begin{pmatrix} 7 \\ 2 \end{pmatrix} \quad [\text{A1}]
 \end{aligned}$$

Answer **$\begin{pmatrix} 7 \\ 2 \end{pmatrix}$** [2]

20 A map is drawn to a scale of 1 : 50 000.

- (a) On the map, the distance between two towns is 40 cm.
Find the actual distance, in kilometres, between the two towns.

$$\begin{aligned}\text{Distance} &= 40(0.5) \\ &= 20 \text{ km} \quad [\text{B1}]\end{aligned}$$

$$1 \text{ cm} : 50\,000 \text{ cm}$$

$$= 1 \text{ cm} : \frac{50\,000}{100\,000} \text{ km}$$

$$= 1 \text{ cm} : 0.5 \text{ km}$$

$$1 \text{ km} = 1000 \text{ m}$$

$$= 1000 \times 100 \text{ cm}$$

$$= 100\,000 \text{ cm}$$

Answer **20** km [1]

- (b) A plantation has an actual area of 3.6 km^2 .
Find the area, in square centimetres, representing the plantation on the map.

$$1 \text{ cm} : 0.5 \text{ km}$$

$$(1 \text{ cm})^2 : (0.5 \text{ km})^2$$

$$1 \text{ cm}^2 : 0.25 \text{ km}^2 \quad [\text{M1} - \text{Finding area scale}]$$

$$\begin{aligned}\text{Area on map} &= \frac{3.6}{0.25} \quad [\text{A1}] \\ &= 14.4 \text{ cm}^2\end{aligned}$$

Answer **14.4** cm² [2]

- (c) On a second map, the same plantation in part (b) is represented by an area of 6.4 cm^2 .
The scale of the second map is $1 : k$. Find the value of k .

$$\left(\frac{k}{50000}\right)^2 = \frac{14.4}{6.4} = \frac{9}{4} \quad [\text{M1} - \text{Area formula or equivalent}]$$

$$\frac{k}{50000} = \frac{3}{2}$$

$$k = 75000 \quad [\text{A1}]$$

The properties of similar figures can be applied to solve questions involving map and scale.

Alternative Method :

Area Scale

$$= 6.4 \text{ cm}^2 : 3.6 \text{ km}^2$$

$$= 1 \text{ cm}^2 : \frac{9}{16} \text{ or } 0.5625 \text{ km}^2$$

Linear Scale

$$= 1 \text{ cm} : \sqrt{\frac{9}{16}} \text{ km}$$

$$= 1 \text{ cm} : \frac{3}{4} \text{ km}$$

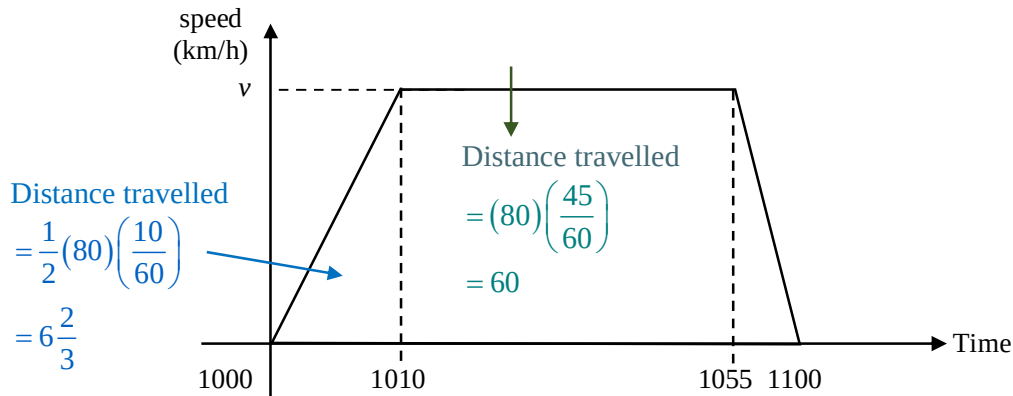
$$= 1 \text{ cm} : 0.75 \text{ km}$$

$$= 1 \text{ cm} : 0.75 \times 100\,000 \text{ cm}$$

$$= 1 : 75\,000$$

Answer $k =$ **75 000** [2]

- 21 The diagram shows the speed-time graph of a train travelling from Town P to Town Q. The train left Town P at 1000 hrs and accelerated at a constant rate before reaching a maximum speed of v km/h after 10 minutes. It then travels at a uniform speed for 45 minutes before decelerating at a uniform rate. The train arrived at town Q at 1100 hrs.



- (a) The area under the speed-time graph represents the distance travelled by the train. Given that the train travelled a total of 70 km, **show** that $v = 80$.

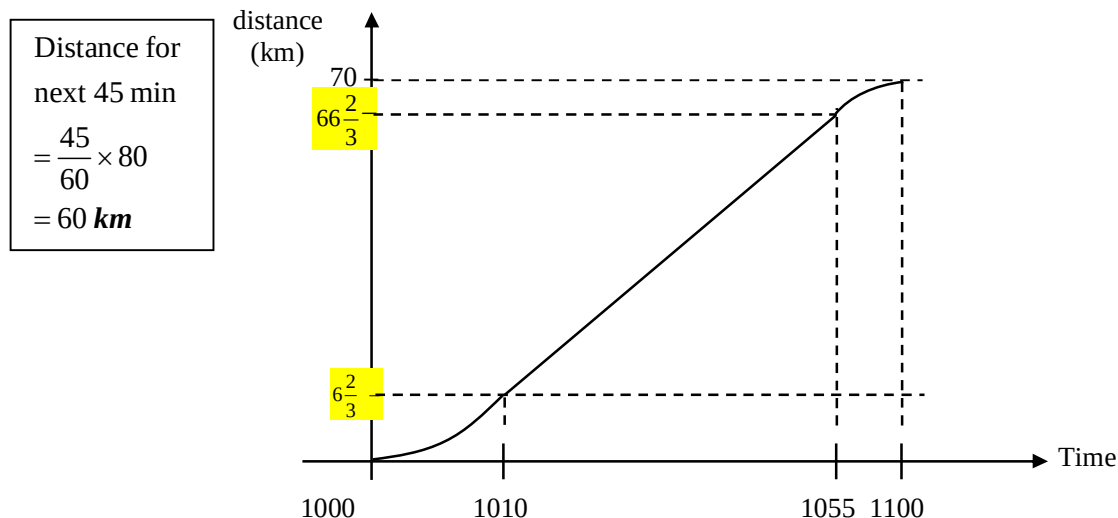
Answer

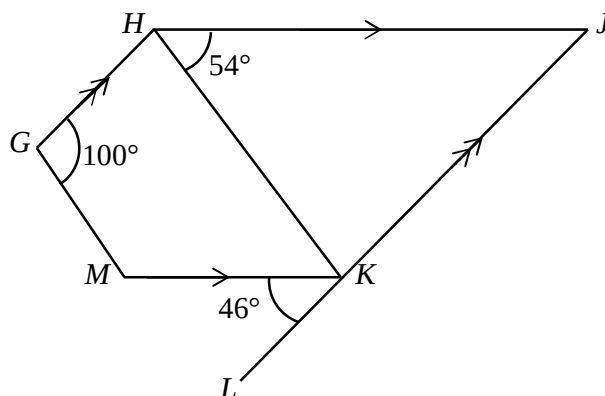
$$\begin{aligned}
 70 &= \frac{1}{2}\left(\frac{3}{4} + 1\right)v \quad [\text{B1}] & v &= \frac{8}{7}(70) \quad [\text{B1} - \text{multiplication with subst}] \\
 &= \frac{1}{2}\left(\frac{7}{4}\right)v & &= 80 \quad [\text{AG}] \\
 &= \frac{7}{8}v & & \\
 & & & [2]
 \end{aligned}$$

- (b) Calculate the acceleration of the train during the first 10 minutes of its journey.

$$\begin{aligned}
 a &= \frac{80}{\left(\frac{1}{6}\right)} \quad \text{Convert 10 mins into hour} \\
 &= 480 \text{ km/h}^2 \quad [\text{B1}] & \text{Answer } & \dots\dots\dots \text{ km/h}^2 \quad [1]
 \end{aligned}$$

- (c) Sketch the distance-time graph for the train during its journey from Town P to Q. [2]





In the diagram, GH is parallel to LKJ and HJ is parallel to MK .
 $\angle JHK = 54^\circ$, $\angle LKM = 46^\circ$ and $\angle HGM = 100^\circ$.

(a) Find

(i) angle HJK ,

$$\angle HJK = 46^\circ \text{ (Corresponding angles } HJ \parallel MK) \quad [B1]$$

Answer 46° [1]

(ii) angle GHK ,

$$\begin{aligned} \angle HKJ &= 180^\circ - 54^\circ - 46^\circ \text{ (}\angle \text{ sum of triangle)} \quad [M1] \\ &= 80^\circ \end{aligned}$$

$$\begin{aligned} \angle GHK &= \angle HKJ \text{ (Alternate angles } GH \parallel LJ) \\ &= 80^\circ \end{aligned}$$

[A1] 80°
 Answer [2]

(iii) angle GMK .

$$\begin{aligned} \angle HKM &= \angle JHK = 54^\circ \text{ (Alternative } \angle \text{s, } HJ \parallel MK) \\ \angle GMK &= 360^\circ - 100^\circ - 80^\circ - 54^\circ \text{ (}\angle \text{ sum of quadrilateral)} \quad [M1] \\ &= 126^\circ \quad [A1] \end{aligned}$$

Answer 126° [2]

(b) Explain why GM is parallel to HK .

Answer

GM is parallel to HK because $\angle GHK + \angle HGM = 80^\circ + 100^\circ = 180^\circ$

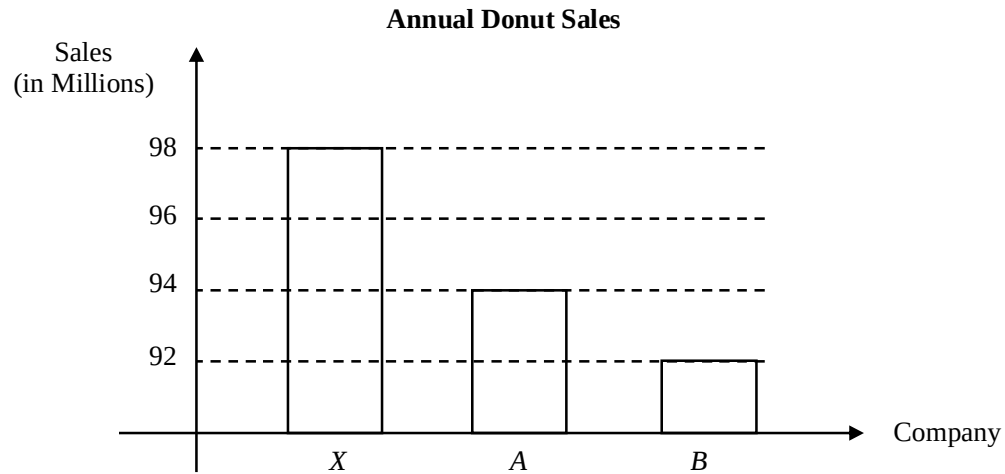
By converse property of interior angles between parallel lines are supplementary,

GM and HK are parallel.

Interior angles are angles that lie between two lines when they are cut by a transversal. Interior angles are not necessarily supplementary.

[1]

- 23 Companies X, A and B sell donuts. The CEO of company X used the following graph to compare the sale of company X's donuts with those of companies A and B.



State one aspect of the graph that may be misleading and how this leads to a misinterpretation of the graph.

Answer

By displaying only the top part of the graph and **not starting the vertical axis from 0** [B1]

It **gives the impression** that sales of the donuts from **company X is twice that of company** [2]

A (and/or) four times more than company B.

In reality, sales for company X equals $\frac{98}{92} \approx 1.065$ times that of the sales company B

or equals $\frac{98}{94} \approx 1.042$ times that the sales of company A.

[B1 – Can compare with either A or B]

The comparison should be based on a 'like-for-like basis'.
If you used a **ratio** to describe the misleading impression
("X appears **twice** as large as A") but an **absolute difference**
("4 million") to describe the actual data. This is **not appropriate**.

Compare both using ratios/percentage.

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