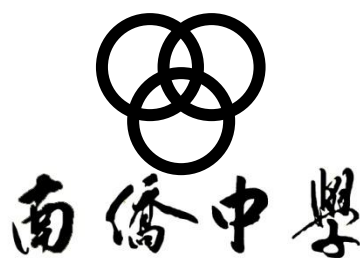


Name:

Register Number:

Class:



NAN CHIAU HIGH SCHOOL
PRELIMINARY EXAMINATION 2026
SECONDARY FOUR EXPRESS

For Marker's Use

90

MATHEMATICS

4052/02

Paper 2

24 August 2026, Monday

Candidates answer on the Question Paper.

2 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class 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.

Lack annotation/ units/ incorrect properties' name	–1
Accuracy	–1
Final answer	–1
Use of Pencil for essential working	–1

Mathematical Formulae*Compound interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer all questions.

1 (a) Solve $\frac{8}{2-3x} = 7$.

Answer [2]

(b) Factorise completely $10a - 4ba - 15c + 6bc$.

Answer [2]

(c) Solve the simultaneous equations.

$$3x + 5y = 2$$

$$5x - 4y = -6$$

You must show your working.

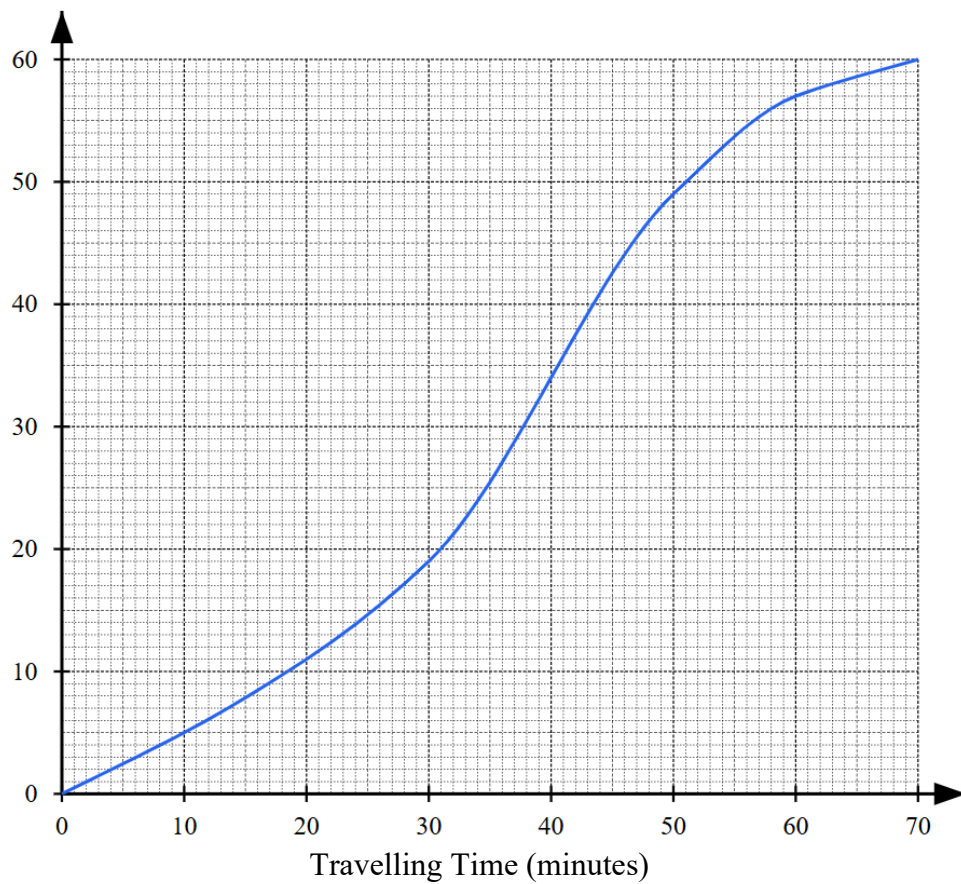
Answer $x = \dots\dots\dots, y = \dots\dots\dots$ [3]

- (d) Write as a single fraction in its simplest form $\frac{3x-20}{x^2-49} + \frac{5}{7-x}$.

Answer [3]

- 2 (a) The cumulative frequency diagram shows the travelling time of 60 adults travelling to work by MRT on Monday.

Cumulative Frequency



- (i) Use the diagram to estimate

(a) the median travelling time,

Answerminutes [1]

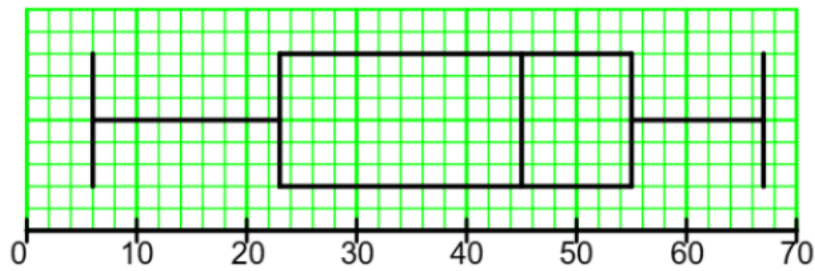
(b) the interquartile range of the travelling time,

Answerminutes [2]

(c) the 80th percentile of travelling time.

Answerminutes [1]

- (b) Another 60 adults travelled to work by MRT on Tuesday. The box-and-whisker diagram illustrates the distribution of the time taken.



Travelling Time (minutes)

Make two comparisons between the travelling times of the adults on Monday and on Tuesday.

Answer

.....

.....

.....

.....

[2]

- (c) In 2025, the total number of MRT trips by commuters is 3.49 millions. This represents a 2.29% increase from 2024. Calculate the total number of MRT trips in 2024. Give your answer in standard form.

Answer

[2]

- 3 (a) A recreational club organized three different groups to visit the zoo.
 Group A had 12 adults and 5 children.
 Group B had 20 adults and 6 children.
 Group C had 16 adults and 3 children.

The information can be represented by the matrix $\mathbf{L} = \begin{pmatrix} 12 & 5 \\ 20 & 6 \\ 16 & 3 \end{pmatrix}$

- (i) The entrance fee for an adult and a child is \$49 and \$34 respectively.
 Represent the entrance fees in a 2×1 column matrix $\mathbf{M}$.

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

- (ii) Evaluate the matrix $\mathbf{C} = \mathbf{LM}$.

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

- (iii) Evaluate $\mathbf{P} = (1 \ 1 \ 1)\mathbf{C}$.
 State what the elements of $\mathbf{P}$ represents.

Answer

.....

 [1]

- (b) A map is drawn to a scale of 1 : 250 000.

- (i) The Mandai Boardwalk is 3.3 km.
 Calculate the distance, in centimetres, of the Mandai Broadwalk on the map.

Answer cm [2]

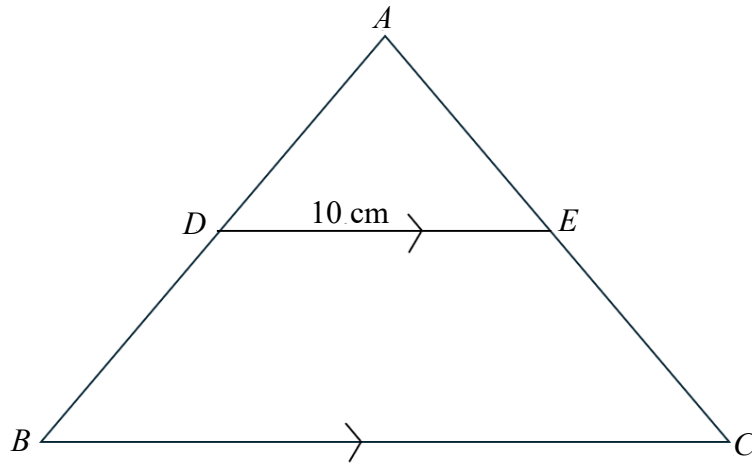
- (ii) A lake is represented by an area of 8 cm^2 on the map.
Calculate the actual area, in square kilometres, of the lake.

Answer km^2 [2]

- (c) Given that E is 130% of D and $\frac{2}{3}E = \frac{1}{2}F$.
Express the ratio of $D:E:F$ in its simplest form.

Answer [3]

4



The diagram shows a triangle ABC . D is a point on AB and E is a point on AC such that DE is parallel to BC and $DE = 10$ cm.

- (a) (i) Show that the triangles ADE and ABC are similar.
Give a reason for each statement you make.

Answer

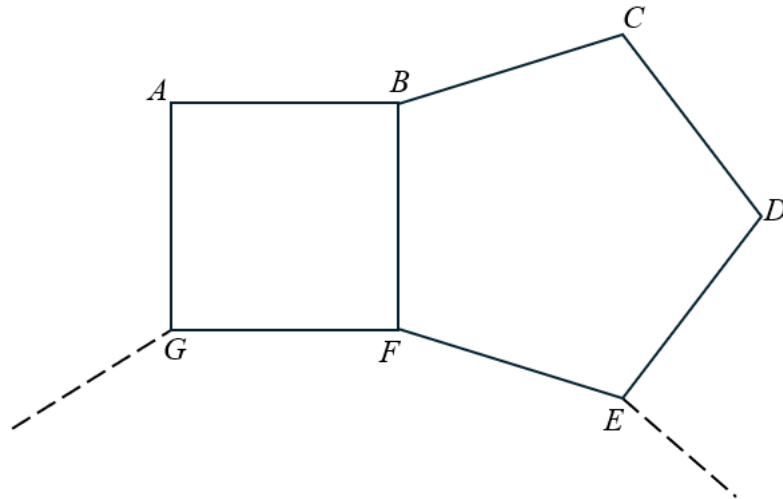
.....

[2]

- (ii) The ratio area of triangle ADE : area of triangle ABC is 4 : 25.
If the area of triangle ABC is 200 cm^2 , find the height of the trapezium $DECB$.

Answer cm [3]

(b)



The diagram shows a square, $ABFG$, a regular pentagon, $BCDEF$, and two sides of a third regular polygon, GF and FE .

Find the number of sides for the third regular polygon.

Answer [3]

- 5 (a) Write $\frac{4^{0.5} + 4^{0.5}}{4^{211} \times 4^{212}}$ as a single power of 2.

Answer [2]

- (b) A bank which offers an annual simple interest rate, r %, advertises the following.
“Double your investment with us in 20 years!”

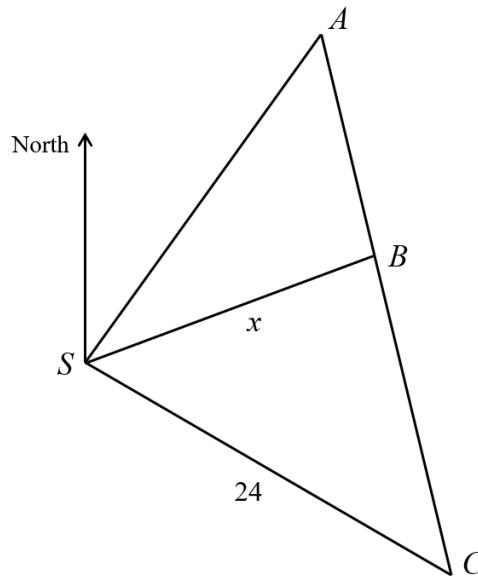
- (i) Find the value of r if the bank’s advertisement is true.

Answer $r =$ [2]

- (ii) Using the value of r in (b)(i), calculate the amount of interest earned at the end of 10 years if \$28 000 was invested.

Answer \$ [2]

6



Triangular plot of land, SAC , is a playground on horizontal ground with a walking path, SB .

$SC = 24$ m and $SB = x$ m.

The bearing of B from S is 070° .

The bearing of C from S is 120° .

The point B lies on AC such that $AB : BC = 2 : 3$.

(a) Show that the area of triangle SAB is $8x \sin 50^\circ$.

Answer

[4]

(b) Hence, find the value of x given that the area of triangle SAB is 110 m^2 .

Answer

[1]

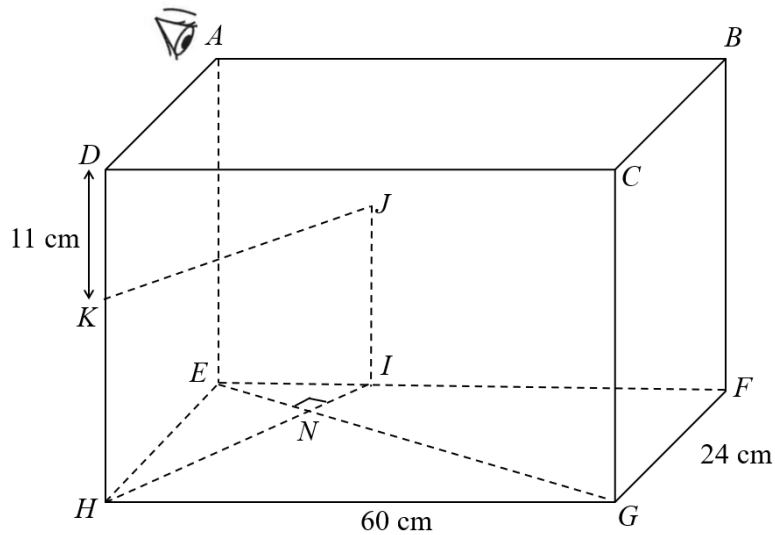
(c) Find the length of BC .

Answer m [2]

(d) Find the bearing of B from C .

Answer [3]

7



The diagram shows a rectangular box, $ABCDEFGH$.

The box has a length of 60 cm and breadth of 24 cm.

The angle of elevation of A from G is 54.32° .

A rectangular card $HIJK$ is placed against edge DH and face $ABFE$ of the box as shown.

The top edge of the card is 11 cm below the top of the box. The edge, HNI , of the card is perpendicular to the diagonal, EG , of the base of the box.

(a) Find AE .

Answer cm [2]

(b) Show that $EN = 8.91$ cm, correct to 2 decimal places. [3]

- (c) By showing your calculations clearly, determine if point G can be seen by a person looking straight from point A .

[2]

- 8 (a) $\varepsilon = \{\text{integers } x: -5 < x \leq k, \text{ where } k > 0\}$
 $A = \{\text{even integers}\}$
 $B = \{\text{first 5 prime numbers}\}$

(i) Find $n(\varepsilon)$ in terms of k .

Answer [1]

(ii) Find the minimum value of k .

Answer [1]

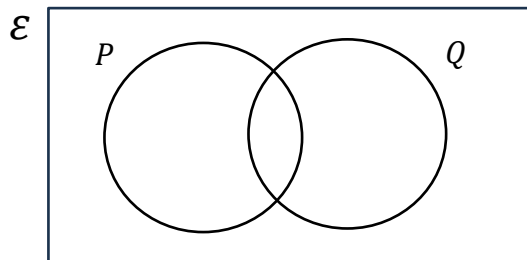
(iii) Hence, list the elements in the set $A' \cap B$.

Answer [2]

(b) Set P , set Q and set R are such that $R \subset Q$ and $R \cap P = \emptyset$.

(i) On the Venn Diagram, draw set R . [1]

(ii) Hence, shade the region which represents $(R \cup Q)' \cap P$. [1]



- (c) In a group of 50 students, some are enrolled in the Mathematics Talent Programme only, some are enrolled in the Science Talent Programme only, some are enrolled in both programmes, while the rest are enrolled in neither programme.

One of the students from the Science Talent Programme is selected at random.

The probability that it is a student who is also in the Math Talent Programme is $\frac{3}{5}$.

Complete the table of information about the 50 students in the group.

	Science Talent Programme	Not Science Talent Programme
Math Talent Programme		15
Not Math Talent Programme		5

[2]

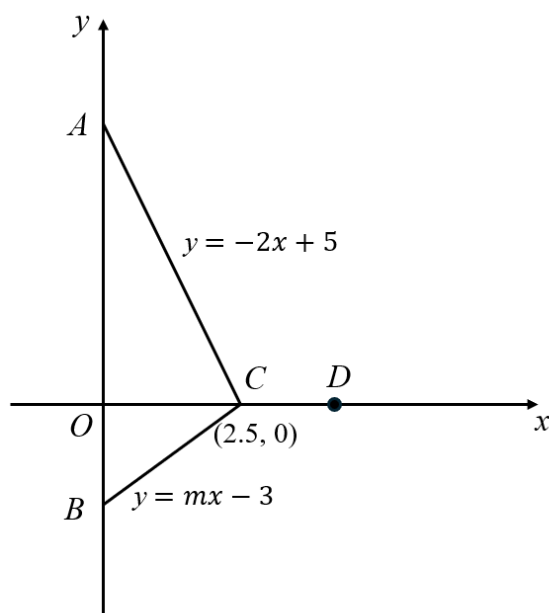
Three students are selected at random from the whole group.

Find the probability that at least one of them is enrolled in a Talent Programme.

Answer

[2]

- 9 (a) The line $y = -2x + 5$ cuts the y -axis at A while the line $y = mx - 3$ cuts the y -axis at B . Both the lines cut the x -axis at $C(2.5, 0)$.



- (i) Find the value of m .

Answer $m = \dots\dots\dots$ [2]

- (ii) “When point C shifts horizontally to the right by k units to point D , the area of triangle ABD is k units² more than the area of triangle ABC . ”

Using calculations, explain, in terms of k , whether the statement is correct.

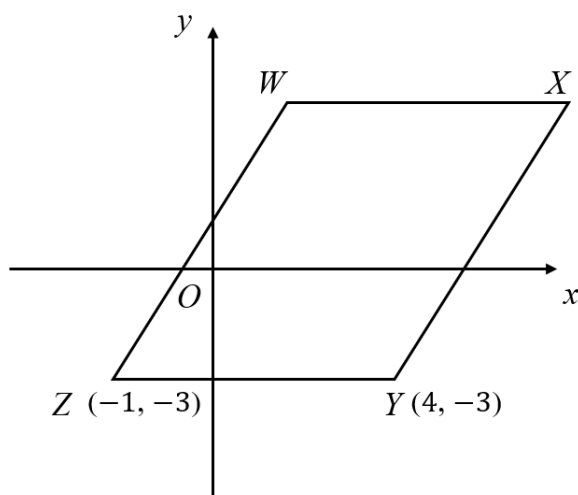
Answer

[2]

- (iii) Given that AD^2 is 45.25 units², find the value of k .

Answer $k = \dots\dots\dots$ [3]

- (b) The diagram shows a parallelogram $WXYZ$. W lies on the perpendicular bisector of ZY .



Given that the area of the parallelogram is 45 square units, find the equation of line XY .

Answer $\dots\dots\dots$ [4]

10 In Singapore, commercial developments must comply with planning requirements that ensure adequate separation between buildings and roads while promoting a greener and more livable environment. These requirements include

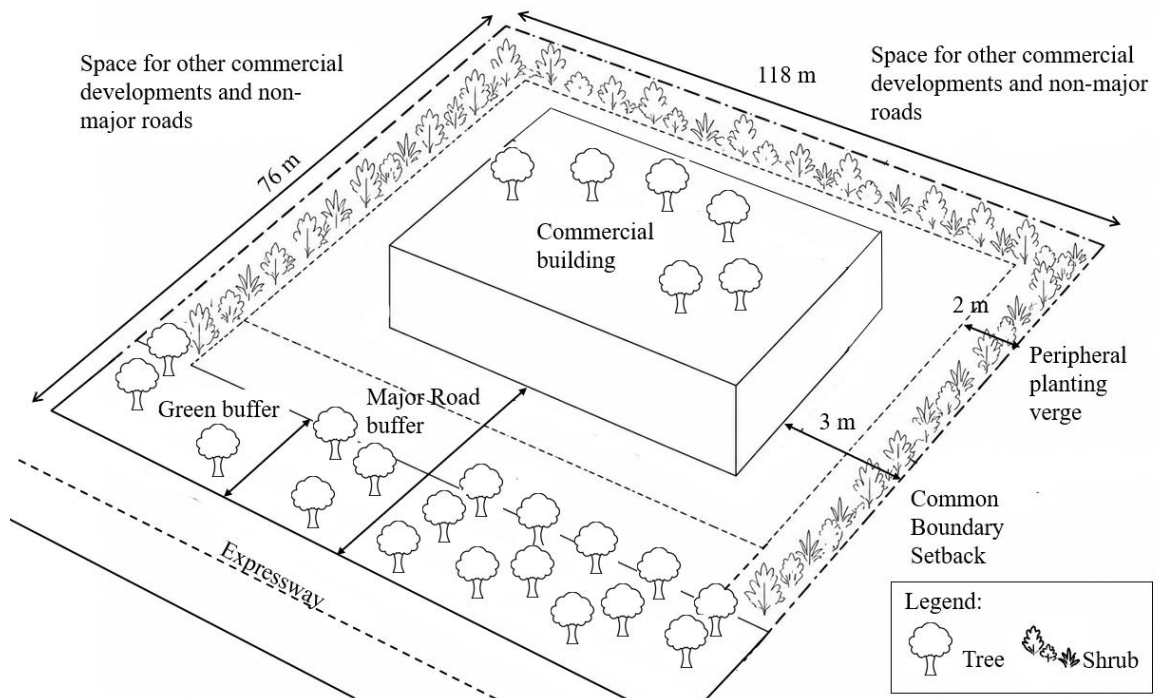
- common boundary setback to maintain appropriate building clearances from other developments and non-major roads, and peripheral planting verges (stretch of shrubs) to enhance landscaping,
- green buffers (stretch of trees) and road buffers along major roads such as expressways, major or minor arterials.

The government also encourages tree planting at the rooftop of buildings to enhance environmental quality.

The dimensions of the requirements can be found in the tables below.

Road Category	Major Road Buffer (inclusive of green buffer indicated in brackets)
Expressway	15 m (3 m)
Major arterial	7.5 m (3 m)
Minor arterial	5 m (3 m)

Boundary	Minimum setback distance
Common boundary setback to maintain clearance from other commercial developments and non-major roads.	3 m (including 2 m peripheral planting verge)



Adrian bought a rectangular plot of land for commercial development as shown in the diagram on page 20 (not drawn to scale). The land measures 118 m by 76 m, where the **longer side faces the expressway**. The other three sides are next to other commercial developments and non-major roads.

- (a) Show that the maximum floor area of a cuboid commercial building to be built on the rectangular plot of land, in compliance with Singapore's planning requirements is 6496 m^2 .

Answer

[2]

- (b) The monthly maintenance cost (C) in dollars and the number of trees (x) are modelled by different functions for two companies.

Company A's maintenance cost is represented as a linear function, shown on the graph on the next page.

Company B's maintenance cost and the number of trees are connected by the equation, $C = 0.005x^2 - x + 250$. Some corresponding values of x and C are given in the table below.

x	0	100	200	300	400	500
C	250	200	p	400	650	1000

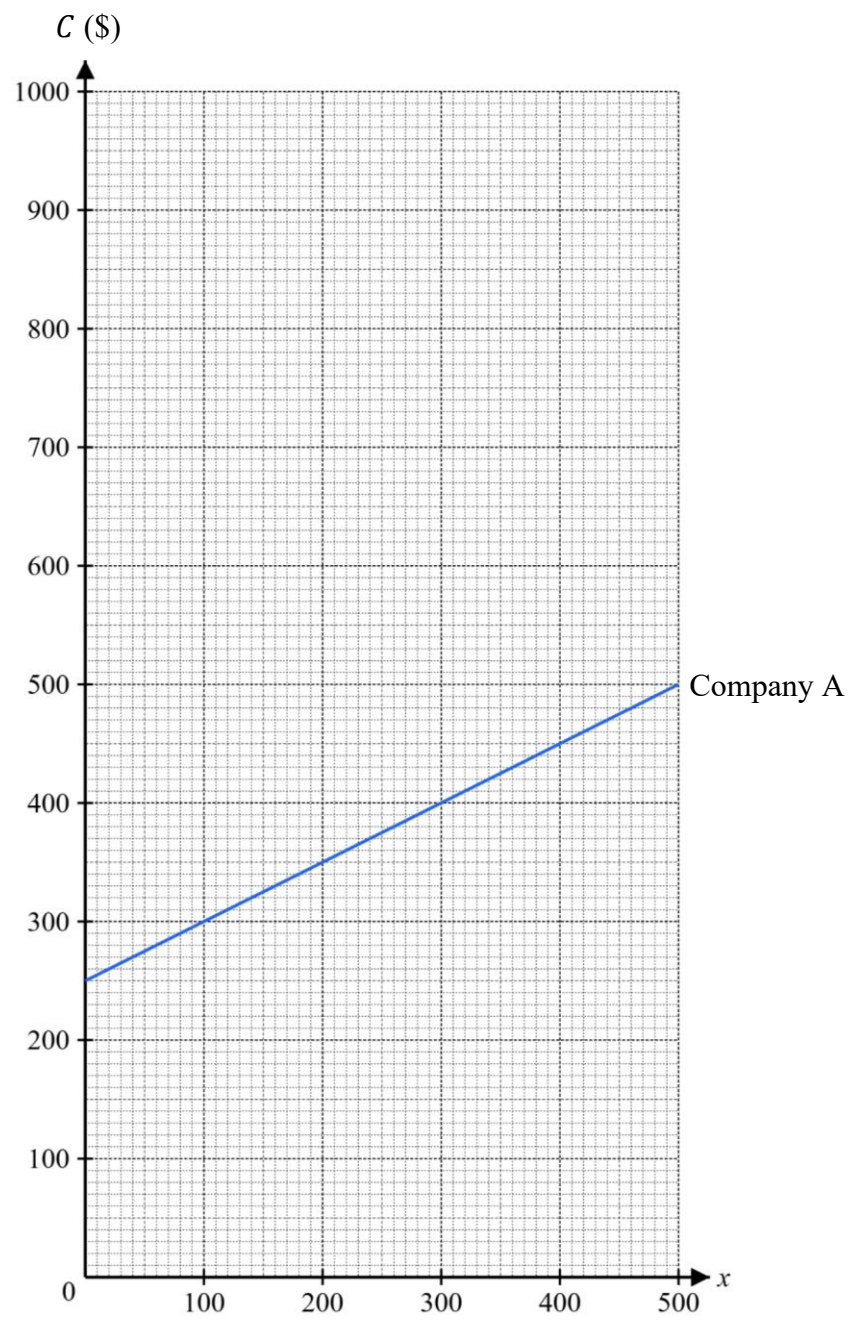
- (i) Find the value of p .

Answer $p = \dots\dots\dots$

[1]

- (ii) Draw the graph of C against x for Company B for $0 \leq x \leq 500$ on the next page.

[2]



- (c) Adrian researched on more information to help with his commercial development plan.

Formula to estimate the minimum number of trees and shrubs per dedicated area

$\text{Minimum number of trees} = \frac{\text{Area of green buffer} + \text{Area of rooftop dedicated for tree planting}}{20}$	
$\text{Minimum number of shrubs} = \frac{\text{Area of peripheral planting verge}}{2}$	
* All units for area are in square metre	

Cost of installations for trees and shrubs

\$180 per tree
\$30 per shrub

Cost of monthly maintenance for trees and shrubs

For trees: refer to the graph on previous page.
For shrubs: The cost of maintaining one tree is the cost of maintaining 5 shrubs.
* Note —No maintenance is required for all trees and shrubs during the first two months following installation. Maintenance shall begin from the third month after installation.

Government sustainability grants

Percentage, x , of rooftop area dedicated for tree planting	Grant awarded
$< 40 \%$	\$0
$40 \% \leq x < 60 \%$	\$20 000
$60 \% \leq x < 80 \%$	\$47 000
$x \geq 80 \%$	\$62 500

The building within the development shall be constructed based on the maximum floor area obtained in (a).

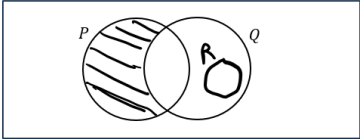
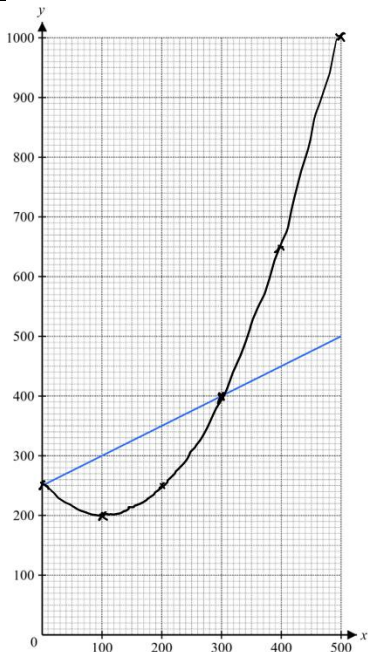
Adrian's business partner says that if 60% of the rooftop area is dedicated for tree planting, the grant of \$47 000 will be able to cover the trees and shrubs installation and maintenance costs within the first year of installation.

However, Adrian says that only by dedicating more area for rooftop tree planting, the higher grant of \$62 500 will be able to cover the trees and shrubs installation and maintenance costs within the first year of installation.

Do you agree with Adrian or his business partner?
Justify the decision you made and show your calculations clearly.

Answer

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1a	$\frac{2}{7}$	7c	Point G cannot be seen by a man at point A.
1b	$(2a - 3c)(5 - 2b)$	8ai	$k+5$
1c	$x = -\frac{22}{37}, y = \frac{28}{37}$	8aii	11
1d	$\frac{-2x - 55}{(x - 7)(x + 7)}$	8aiii	3,5,7,11
2ai	38 min	8b	ε 
2aii	22 min	8ci	18, 12
2aiii	49 min	8cii	$\frac{1959}{1960}$
2b	MRT on Tuesday Median = 45 min IQR = $55 - 23 = 32$ min 2 Comparisons 1) The travelling time of the adults on Monday is shorter than that on Tuesday as the median is lower on Monday. (Also accept travelling time of adults on Tuesday is longer as median is higher than Monday.) 2) The travelling time of the adults on Monday are more consistent as the interquartile range on Monday is smaller. (Also accept travelling time on Tuesday are less consistent as IQR is larger)	9ai 9aii 9aiii 9b	$m = 1.2$ area increases by $4k$ $k = 2$ $y = 3.6x - 17.4$
2c	3.41×10^6	10a	As shown
3ai	$M = \binom{49}{34}$	10bi	250
3aii	$\begin{pmatrix} 758 \\ 1184 \\ 886 \end{pmatrix}$	10bii	
3aiii	(2828)	10c	Adrian is correct.

	The matrix P represents the total amount of entrance fees that the recreational club paid for all 3 groups OR total entrance fees for all the 3 groups.														
3bi	1.32 cm	10c	<table><tr><th>Adrian</th><th>Adrian's business partner</th></tr><tr><td>$\text{number of trees} = \frac{(118 \times 3) + \frac{80}{100} \times 6496}{20}$$= 277.54 = 278 \text{ trees}$</td><td>$\text{number of trees} = \frac{(118 \times 3) + \frac{60}{100} \times 6496}{20}$$= 212.58 = 213 \text{ trees}$</td></tr><tr><td>$\text{number of shrubs} = \frac{2 \times (76 - 3) \times 2 + 2 \times (118 - 2 - 2)}{2}$$= 260 \text{ shrubs}$</td><td>$\text{number of shrubs} = \frac{2 \times (76 - 3) \times 2 + 2 \times (118 - 2 - 2)}{2}$$= 260 \text{ shrubs}$</td></tr><tr><td>$\text{plant installation costs} = 278 \times 180 + 260 \times 30$$= \\57840</td><td>$\text{plant installation costs} = 213 \times 180 + 260 \times 30 = \\46140</td></tr><tr><td>$\text{number of trees equivalent} = 278 + \frac{260}{5}$$= 330$</td><td>$\text{number of trees equivalent} = 213 + \frac{260}{5}$$= 265$</td></tr><tr><td>$\text{from graph (line), monthly expense is \\$415.}$$\text{Yearly cost} = 415 \times 10 = 4150$$62500 - 57840 - 4150 = 510$$\text{Can cover}$</td><td>$\text{from graph (curve), monthly expense is \\$325}$$\text{Yearly cost} = 325 \times 10 = 3250$$47000 - 46140 - 3250 = -2390$$\text{Cannot cover}$</td></tr></table> Adrian is correct	Adrian	Adrian's business partner	$\text{number of trees} = \frac{(118 \times 3) + \frac{80}{100} \times 6496}{20}$ $= 277.54 = 278 \text{ trees}$	$\text{number of trees} = \frac{(118 \times 3) + \frac{60}{100} \times 6496}{20}$ $= 212.58 = 213 \text{ trees}$	$\text{number of shrubs} = \frac{2 \times (76 - 3) \times 2 + 2 \times (118 - 2 - 2)}{2}$ $= 260 \text{ shrubs}$	$\text{number of shrubs} = \frac{2 \times (76 - 3) \times 2 + 2 \times (118 - 2 - 2)}{2}$ $= 260 \text{ shrubs}$	$\text{plant installation costs} = 278 \times 180 + 260 \times 30$ $= \$57840$	$\text{plant installation costs} = 213 \times 180 + 260 \times 30 = \46140	$\text{number of trees equivalent} = 278 + \frac{260}{5}$ $= 330$	$\text{number of trees equivalent} = 213 + \frac{260}{5}$ $= 265$	$\text{from graph (line), monthly expense is \$415.}$ $\text{Yearly cost} = 415 \times 10 = 4150$ $62500 - 57840 - 4150 = 510$ Can cover	$\text{from graph (curve), monthly expense is \$325}$ $\text{Yearly cost} = 325 \times 10 = 3250$ $47000 - 46140 - 3250 = -2390$ Cannot cover
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3bii	50km ²														
3c	30: 39: 52														
4ai	$\angle DAE = \angle BAC$ (common $\angle$) $\angle ADE = \angle ABC$ (corresponding $\angle$ s, $DE \parallel BC$) $\triangle ADE$ is similar to $\triangle ABC$ (AA Similarity test)														
4aii	$x = 9.6 \text{ cm}$														
4b	20														
5a	2^{-844}														
5bi	5														
5bii	14000														
6a	As shown														
6b	17.9														
6c	347.8°														
7a	90.0cm														
7b	8.91														

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