

NORTHBROOKS SECONDARY SCHOOL
Preliminary Examination 2026
Secondary 4 and 5



CANDIDATE
NAME

CLASS

REGISTER
NUMBER

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MATHEMATICS

4052/02

Paper 2

18 August 2026

2 hours 15 minutes

Additional Materials: Nil

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

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

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

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									
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	90

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

This document consists of **24** printed pages.

[Turn over

Mathematical Formulae*Compound interest*

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

Mensuration

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

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

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

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

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

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

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

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** the questions.

1 (a) Solve $\frac{2}{x+2} = \frac{1}{3x-4}$.

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

(b) Factorise completely $3x^2 - 48y^2$.

Answer $\dots\dots\dots$ [2]

(c) Write $\frac{3^{85} \times 3^{15}}{3^{15} + 3^{15} + 3^{15}}$ as a single power of 3.

Answer $\dots\dots\dots$ [2]

(d) Solve these simultaneous equations.

$$3x - 2y = 2$$

$$7x + 3y = 43$$

You must show your working.

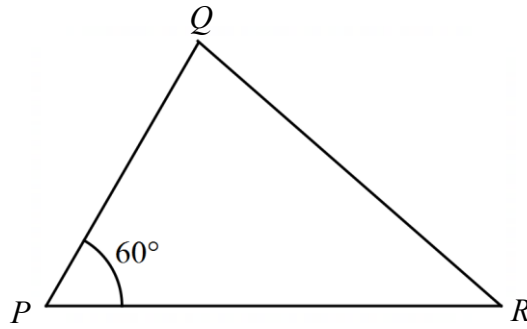
Answer $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

(e) Write $\frac{y^2}{(x+y)(x-3y)} - \frac{x-y}{3y-x}$ as a single fraction in its simplest form.

Answer $\dots\dots\dots$ [3]

2 (a)



In the diagram, angle $QPR = 60^\circ$ and $PR:PQ = 3:2$.

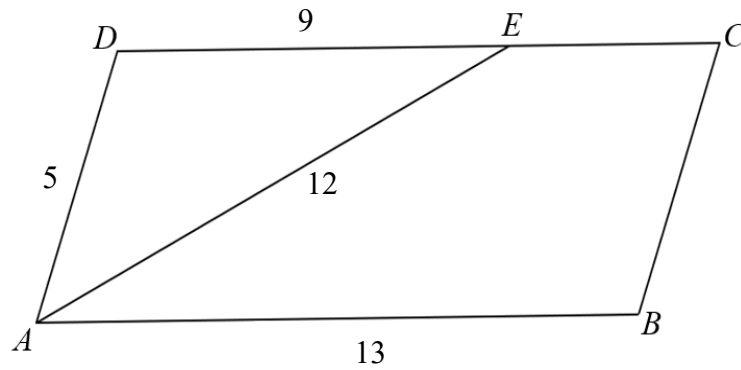
Show that $PR^2:RQ^2 = 9:7$.

Answer

[3]

(b) $ABCD$ is a parallelogram.

$AB = 13$ cm, $AD = 5$ cm, $AE = 12$ cm and $DE = 9$ cm.



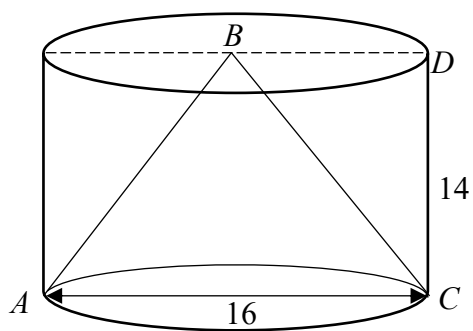
(i) Find angle DAB .

Answer Angle $DAB = \dots\dots\dots$ [3]

(ii) Find the area of the parallelogram $ABCD$.

Answer $\dots\dots\dots$ cm² [2]

(c)



The diagram shows a solid cylinder of diameter 16 cm and height 14 cm.

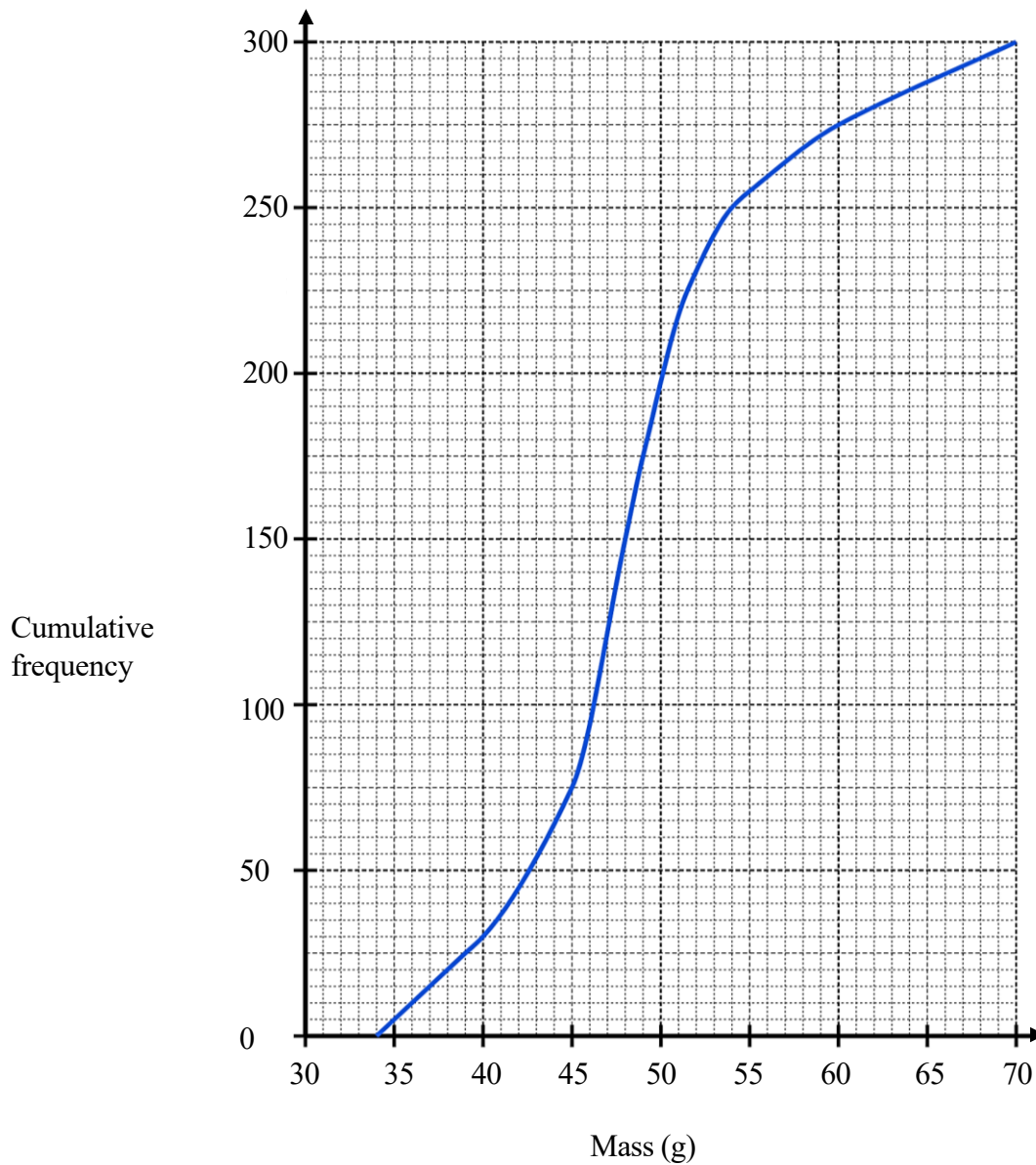
A cone, ABC that touches both ends of the cylinder is removed from the cylinder.

The remaining solid is melted and made into exactly 7 identical solid spheres with radius r cm.

Find the value of r .

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

- 3 A bakery recorded the masses of a batch of 300 cookies.
The cumulative frequency diagram represents the distribution of the masses of the cookies.



(a) Use the curve to estimate

(i) the median mass,

Answer g [1]

(ii) the interquartile range,

Answer g [2]

- (iii) the 10th percentile of the cookies.

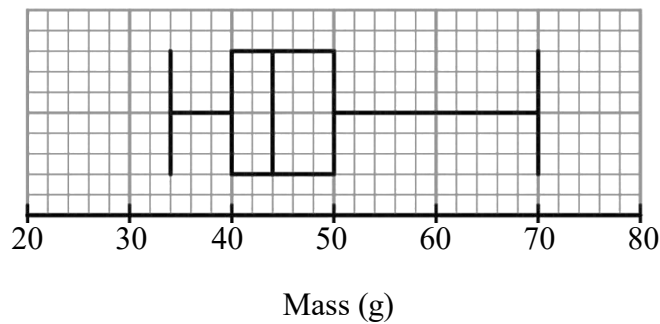
Answer g [1]

- (b) A cookie is labelled as 'Medium' if its mass is greater than or equal to 50 g but less than 56 g. Two cookies are chosen at random.

Calculate the probability that both are 'Medium' cookies.

Answer [2]

- (c) The masses of a second batch of 300 cookies were also recorded. The box-and-whisker diagram shows the distribution of the mass.



Make two comments comparing the masses of the cookies in the two batches. Use figures to support your answer.

Answer

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.....

.....

..... [2]

- 4 (a) Sophia pays a monthly rent of \$3174.20.
This is 18% more than her monthly rent last year.

Calculate her monthly rent last year.

Answer \$ [2]

- (b) A new building is drawn on two maps of different scales.
The area of the building drawn on the first map with a scale of 1:50 000 is 16 cm^2 .

Given that the area of the same building drawn on the second map is 25 cm^2 , find the scale of the second map in the form of 1 : n .

Answer 1 : [4]

- (c) In a Secondary 3 cohort, students join one of three activities: Dance, Music or Art.
The ratio of the number of students in Dance to the number of students in Music is 4 : 7.
The ratio of the number of students in Music to the number of students in Art is 3 : 5.
 $\frac{1}{5}$ of students from Art transfer to Dance.
There are now 95 students in Dance.

Find the total number of students in the cohort.

Answer [3]

- (d) A bakery sells 3 types of whole pies, Apple Pie, Nutella Pie and Strawberry Pie. The table shows the number of each type of pie sold on a particular Saturday and Sunday, along with the price of each type of pie.

	Apple Pie	Nutella Pie	Strawberry Pie
Saturday	13	15	18
Sunday	10	20	22
Price of each pie	\$50	\$40	\$75

It is given that $\mathbf{Q} = \begin{pmatrix} 13 & 15 & 18 \\ 10 & 20 & 22 \end{pmatrix}$ and $\mathbf{P} = \begin{pmatrix} 50 \\ 40 \\ 75 \end{pmatrix}$.

- (i) The bakery had a promotion over the weekend, offering a 10% discount on Apple Pies and a 20% discount on Strawberry Pies.

Represent this information in a 3×3 matrix $\mathbf{D}$.

Answer $\mathbf{D} =$ [1]

- (ii) Evaluate the matrix $\mathbf{T} = \mathbf{DP}$.

Answer $\mathbf{T} =$ [1]

- (iii) State what each element of matrix $\mathbf{T}$ represents.

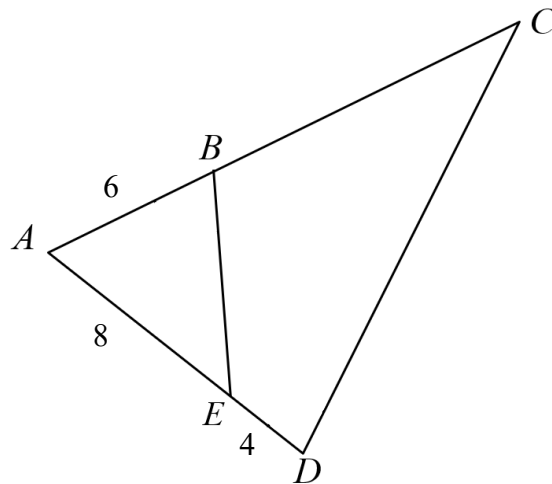
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[1]

- (iv) Using matrix multiplication, find the total amount of money collected by the bakery over the weekend from selling the pies at discounted prices.

Answer \$ [3]

5 (a)



In the diagram, angle $ABE = \text{angle } ADC$.
 $AB = 6 \text{ cm}$, $AE = 8 \text{ cm}$ and $ED = 4 \text{ cm}$.

- (i) Show that triangles ABE and ADC are geometrically similar.

Answer

[2]

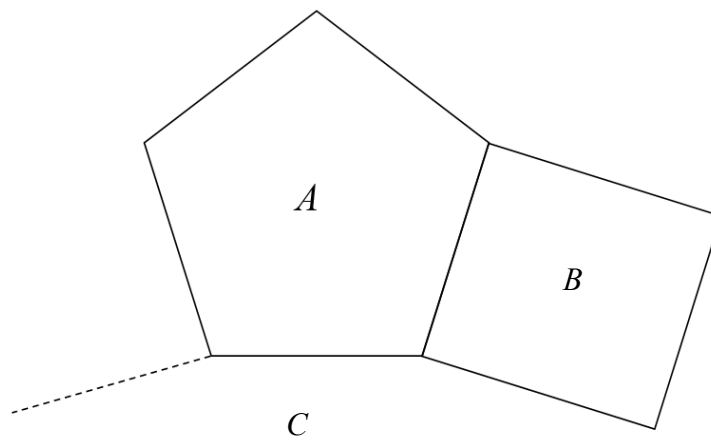
- (ii) Calculate BC .

Answer cm [2]

- (iii) Find the ratio of area of quadrilateral $BCDE$: area of triangle ACD .

Answer : [1]

(b)



The diagram shows a regular pentagon A , a square B and two sides of a regular polygon C . Find the number of sides of regular polygon C .

Answer [4]

[Turn over

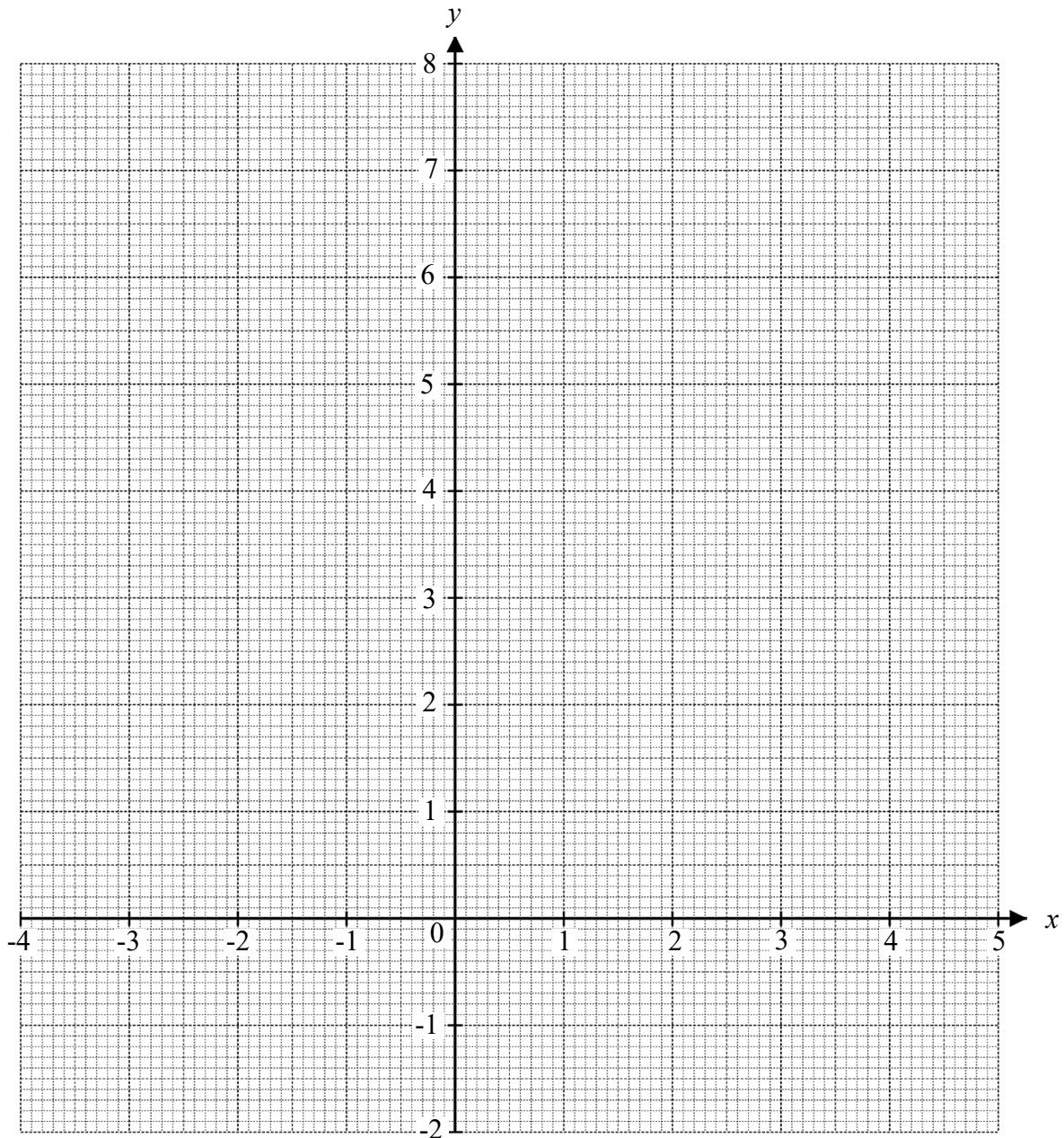
- 6 (a) Complete the table of values for $y = \frac{x^3}{4} - 3x + 2$.

Values are given to one decimal place where appropriate.

x	-4	-3	-2	-1	0	1	2	3	4
y	-2	4.3	6	4.8	2	-0.8	-2		6

[1]

- (b) On the grid, draw the graph of $y = \frac{x^3}{4} - 3x + 2$ for $-4 \leq x \leq 4$.



[3]

- (c) By drawing a tangent, find the gradient of the curve at $x = -1$.

Answer [1]

- (d) The equation $\frac{x^3}{4} - 3x = k$ has two solutions.

Use your graph to find the two possible values of k .

Answer $k = \dots\dots\dots$ or $\dots\dots\dots$ [2]

- (e) By drawing a suitable straight line on the grid, solve the inequality $x^3 - 16x - 4 > 0$.

Answer $\dots\dots\dots$ [3]

- 7 (a) $\xi = \{\text{even integers } x : 5 \leq x \leq 20\}$
 $A = \{\text{multiples of 3}\}$
 $B = \{\text{factors of 120}\}$

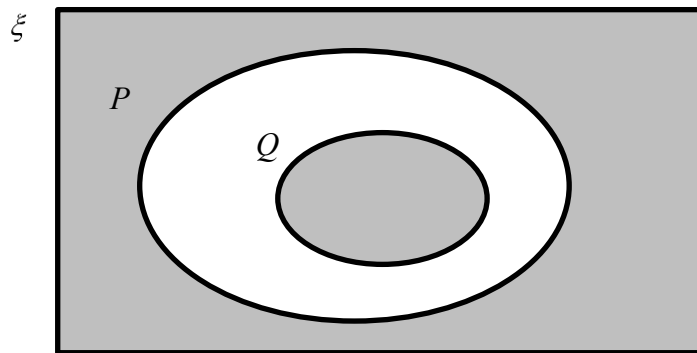
(i) List the elements in $A \cap B$.

Answer [1]

(ii) State a possible element, x , such that $x \in A$ and $x \in B'$.

Answer $x =$ [1]

(b) Use set notation to describe the shaded region.



Answer [1]

(c) The sets ξ, S and T satisfy the conditions $n(\xi) = 41$, $n(S) = 25$ and $n(T) = 7$.

Find

(i) the largest possible value of $n(S \cup T)'$,

Answer [1]

(ii) the smallest possible value of $n(S \cup T)'$.

Answer [1]

- (d) A company has 28 employees.

One of the 28 employees is selected at random.

The probability that it is a woman working full-time is $\frac{2}{7}$.

Two of the 28 employees are selected at random.

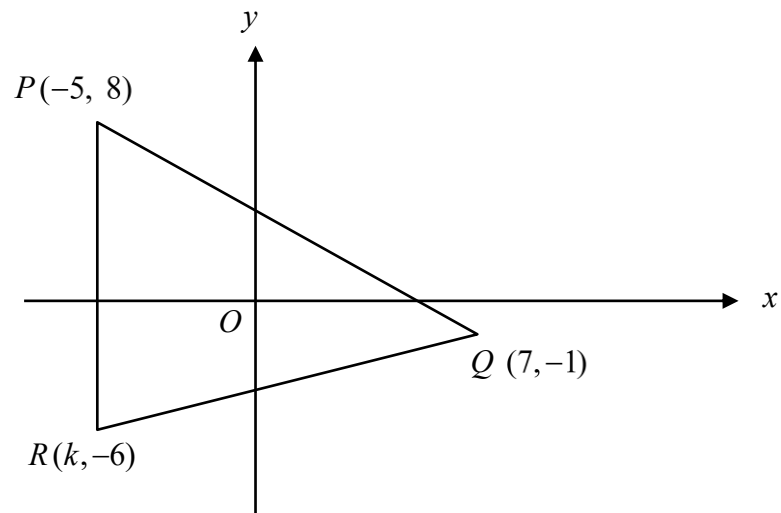
The probability that both are men working part-time is $\frac{2}{27}$.

Complete the table of information about the 28 employees of the company.
You must show your calculations.

	Part-time employees	Full-time employees
Women	6	
Men		

[4]

8



In the diagram, P , Q and R are vertices of a triangle with coordinates of $P(-5, 8)$, $Q(7, -1)$ and $R(k, -6)$. The length of line QR is 13 units.

(a) Find the value of k .

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

(b) Find the area of triangle PQR .

Answer $\dots\dots\dots$ units² [2]

- (c) Find the equation of the line PQ .

Answer [3]

- 9 Daniel started work on 1 January 2021 with a monthly salary of \$4300. His salary increases by 3% annually.

(a) Show that Daniel's current monthly salary, in January 2026, is \$5000, correct to the nearest hundred dollars.

Answer

[1]

Daniel has savings of \$100 000.

With his savings and monthly income, he intends to buy a car in January 2026.

Daniel wishes to maintain savings equivalent to at least 5 months of his current monthly salary after purchasing the car.

(b) Find the maximum amount Daniel can use from his savings.

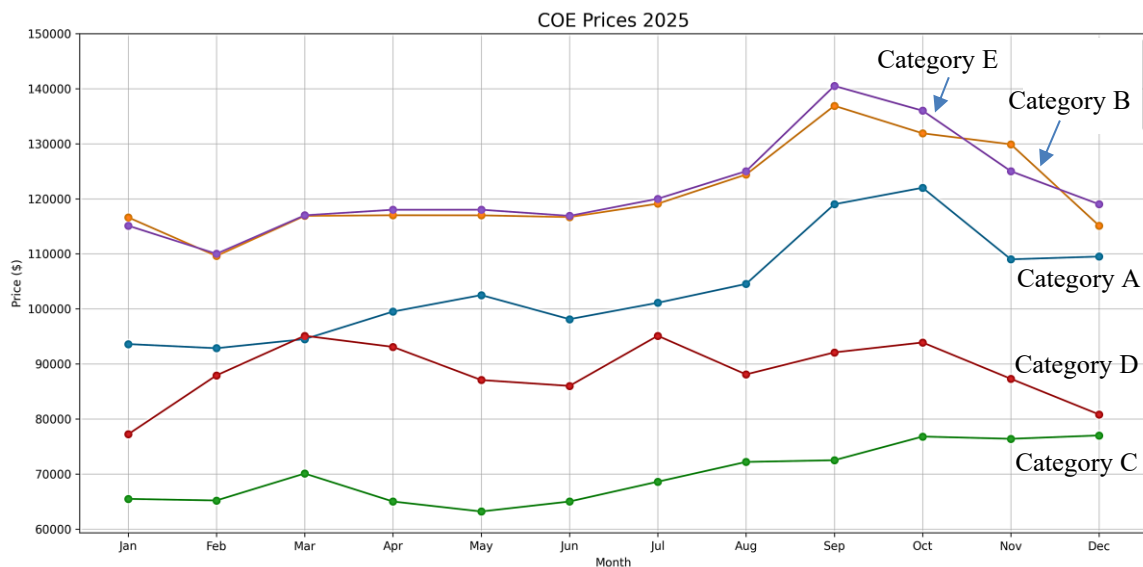
Answer \$ [1]

Daniel is deciding between buying a 1598cc petrol car or a 208kW electric car.

The table below is used to calculate the cost price of the car:

	Car Type	1598cc petrol car	208kW electric car
a.	Base cost	\$120 000	\$130 000
b.	COE	Refer to Table (COE Prices)	
c.	Rebates	Not Applicable	\$30 000
Total cost price of car = a + b – c			

A Certificate of Entitlement (COE) in Singapore represents the right to vehicle ownership in Singapore for a period of **10 years**. Every car owner in Singapore must purchase a COE for the car. The COE prices for the year 2025 can be seen below.



Category A (Cars up to 1600 cc or 110kW)
Category C (Goods vehicle and bus)
Category E (Open)

Category B (Cars above 1600 cc or 110kW)
Category D (Motorcycle)

Daniel intends to make a down payment using his savings and take a bank loan for the remaining amount.

He wishes to borrow the maximum amount possible. The loan amount can be calculated using the information below.

Car Type	1598cc petrol car	208kW electric car
Maximum loan amount	70% of cost price of car	60% of cost price of car
Maximum loan period	7 years	
Interest Rate (simple interest)	2.48% per annum	

Assume that the COE price in January 2026 will not exceed the maximum COE price recorded in 2025.

- (c) Based on the information given, determine which car Daniel can afford to purchase. Hence, calculate the total amount he needs to pay for the chosen car.

Justify the decision you make and show your calculation clearly.