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YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Express / 5 Normal Academic

NAME

CLASS

REG. NO

MATHEMATICS

4052/01

Paper 1

20 August 2025

2 hours 15 minutes

Candidates answer on the Question Paper.

Setter : Mdm Lathamagesh
Vetter : Ms June Ho

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

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

Answer **all** 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 **23** printed pages.

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 Jason and Annie shared a sum of money in the ratio of 3 : 6. Annie received \$150 more than Jason. Calculate the total sum of money Jason and Annie shared.

Answer \$..... [2]

- 2 (a) Simplify $\sqrt[3]{64y^6}$

Answer [1]

- (b) Given $3^{1-2x} = \frac{1}{3}$, find the value of x .

Answer $x =$ [2]

- 3 (a) Given that $0 < \theta < 180^\circ$, find the values of θ for $\sin \theta = 0.6453$.

Answer or [2]

- (b) Express 240° in radians, in terms of π

Answer [1]

- 4 Justin invested \$10 000 in a bank that pays a compound interest of $x\%$ per annum. Find the value of x if Justin's accumulated amount after 2 years is \$10 506.25.

Answer% [3]

- 5 The numbers 720 and 700 are written as products of their prime factors.

$$720 = 2^4 \times 3^2 \times 5,$$

$$700 = 2^2 \times 5^2 \times 7.$$

Find

- (a) the lowest common multiple of 720 and 700,

Answer [1]

- (b) the smallest positive integer value of k for which $\sqrt[3]{720 \times 700 \times k}$ is a whole number.

Answer $k =$ [1]

- 6 Mabel currently earns a monthly salary of \$3500.
 She was offered an increase in her salary calculated according to either Scheme *A* or Scheme *B*. Scheme *A* gives an increase of 7% of her present monthly salary. Scheme *B* gives an increase of 6% of her present monthly salary plus a bonus of \$250 every 4 months.

- (a) Calculate her annual salary under
 (i) Scheme *A*,

Answer \$..... [1]

- (ii) Scheme *B*.

Answer \$..... [2]

- (b) Express Mabel's increase in annual salary under Scheme *B* as a percentage of her current annual salary, giving your answer correct to 1 decimal place.

Answer% [2]

- 7 (a) Given that $x^2 + 8x + k$ is a perfect square, find the value of k .

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

- (b) Using the value of k from **part (a)**, a graph is drawn for $x^2 + 8x + k$.
State the coordinates of the turning point of the graph.

Answer $(\dots\dots\dots, \dots\dots\dots)$ [1]

-
- 8 Express $\frac{4}{7p-1} - \frac{1}{2(p+1)}$ as a single fraction in its simplest form.

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

- 9 In June, Tammy travelled to Australia from Singapore.
 Before her trip to Australia, she exchanged S\$2500 for Australian dollars at a rate of S\$1 = A\$1.20.
 In Australia, Tammy spent A\$1400.
 On her return to Singapore, she exchanged her remaining Australian dollars back to Singapore dollars at the rate of A\$1 = S\$0.84.
 Calculate the amount of Singapore dollars Tammy received after her trip.

Answer S\$..... [2]

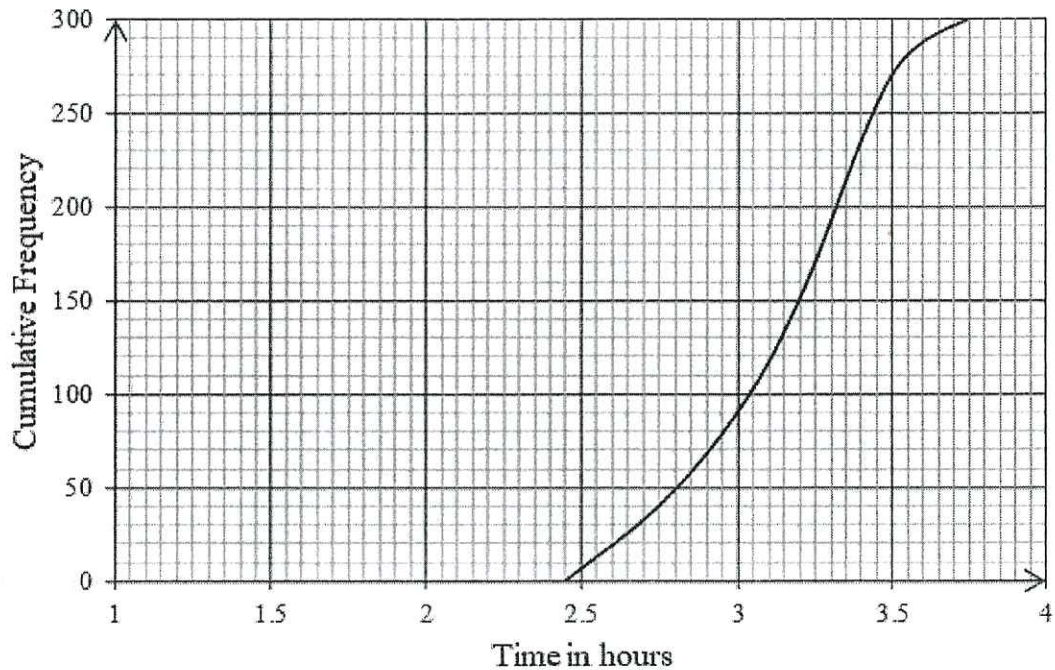
- 10 There are 88 marbles in a bag, some of which are blue, and the rest are red.
 The probability of drawing a blue marble is $\frac{1}{8}$.
 Find the number of blue marbles that need to be placed in the bag to change the given probability to $\frac{4}{15}$.

Answer [2]

[Turn Over

YYSS_PRELIM_2025

- 11 The cumulative frequency curve shows the distribution of the time taken by 300 competitors in a men's marathon race.



- (a) The marathon was won by Peter. Write down his winning time, giving your answer in hours and minutes.

Cumulative Frequency

Answer hours minutes [1]

- (b) Use the curve to find, in hours and minutes,

- (i) the median time,

Answer hours minutes [1]

- (ii) the 85th percentile.

Answer hours minutes [1]

- (c) The qualifying time for the Olympic Games was achieved by 30% of the runners. The marathon started at 07 00 hours. At what time did the last qualifying athlete finish the marathon?

Answer [1]

- (d) The 300 men who took part in the marathon and their years of experience in running marathons are shown in the table below.

Years of experience (t)	$0 \leq t < 2$	$2 \leq t < 4$	$4 \leq t < 6$	$6 \leq t < 8$	$8 \leq t < 10$
Frequency	66	80	61	53	40

- (i) Calculate an estimate of the mean number of years of experience athletes have in running marathons.

Answer [1]

- (ii) Explain why the calculation in d (i) is an estimate.

Answer

..... [1]

- 12 (a) Expand and simplify $(5p - q)(2q + 3p)$.

Answer [2]

- (b) Factorise each of the following completely.

(i) $\frac{1}{2}a^2b - 3ab^2$,

Answer [1]

(ii) $7a - 3ab - 6bk + 14k$.

Answer [2]

-
- 13 The equation of a line is $3y = 2x + 1$.

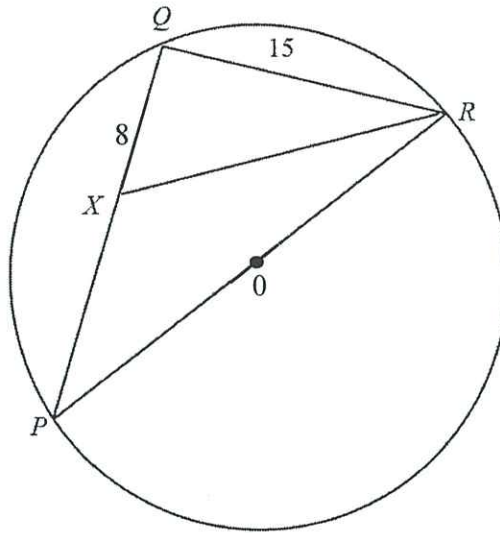
- (a) Find the gradient of this line.

Answer [1]

- (b) Given that $D(10, y)$ is a point on the line, find the value of y .

Answer $y =$ [1]

- 14 The diagram shows a circle with centre O and PR is the diameter.
 X is a point on PQ .
 It is also given that $QX = 8$ cm and $QR = 15$ cm.



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

Answer

..... [1]

- (b) Find, in fraction, the value of $\cos \angle PXR$.

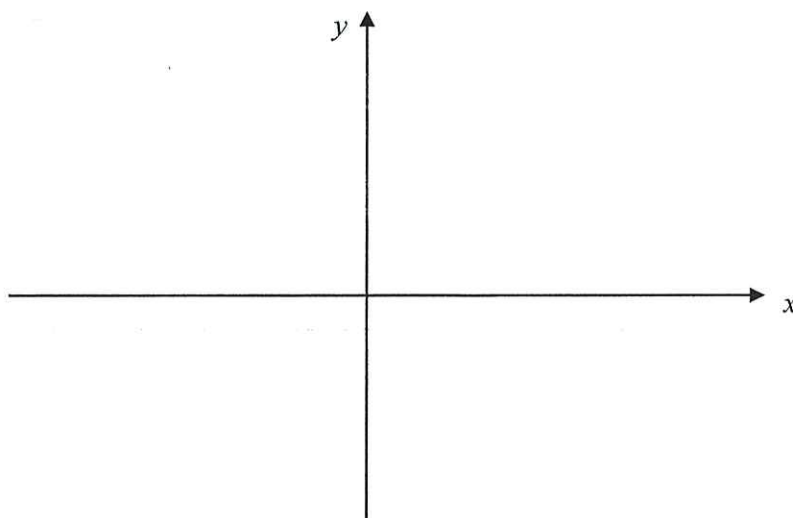
Answer $\cos \angle PXR = \dots\dots\dots$ [2]

15 Simplify $\frac{49x^2 - 16}{7x^2 + 3x - 4}$.

Answer [3]

- 16 Sketch the graph of $y = 2(x+1)(x-3)$ on the axes below.
Indicate clearly the points where the graph crosses the axes and its turning point.

Answer [2]



- 17 Figure 1 shows a solid cone P .
 The solid cone P is divided into two solids X and Y , as shown in Figure 2.
 Solid cone X is similar to cone P and the volumes of solid X and Y are 67.5 cm^3 and 245 cm^3 respectively.

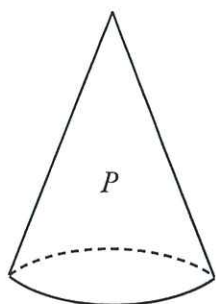


Figure 1

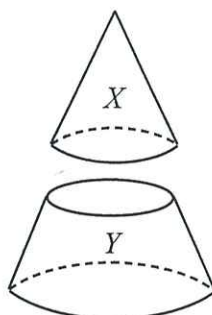


Figure 2

- (a) Show that the ratio of the height of solid X to that of solid Y is $3 : 2$.

Answer

[2]

- (b) If the base area of solid X is 30 cm^2 , calculate the base area of solid cone P .

Answer cm^2 [2]

18 Given that $(a-b)^2 = 64$, $ab = 11$ and $a > b$, find the value of

(a) $a-b$,

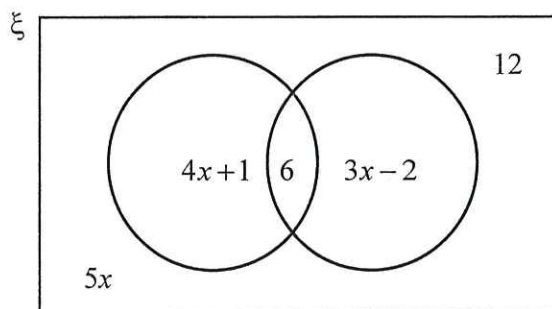
Answer [1]

(b) $2(a^2 + b^2)$.

Answer [2]

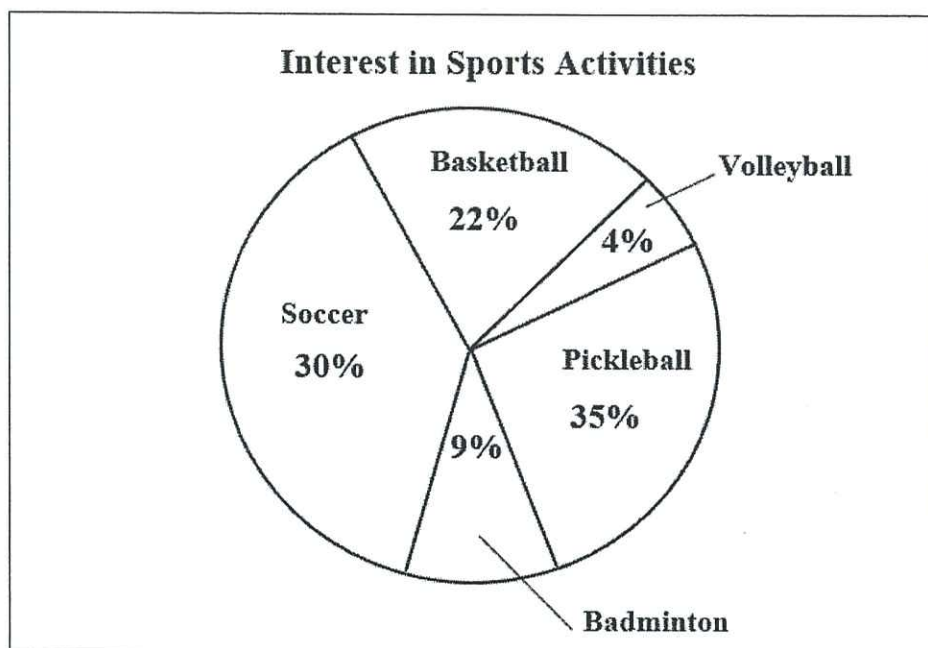
19 A and B are two sets and the number of elements in each set is shown in the Venn diagram below.

Given that $n(A \cup B) = 89$, find the value of x .



Answer $x =$ [2]

- 20 (a) The pie chart below presents the results of a survey conducted to explore students' interest in sports activities.



State one aspect of the pie chart which is misleading and explain why.

Answer

..... [1]

- (b) In a sequence, the difference between consecutive terms is constant.
The second term of this sequence is 40. The fifth term of this sequence is 19.

(i) Find an expression, in terms of n , for the n th term of this sequence.

Answer [1]

(ii) Explain why -88 is not a term of this sequence.

Answer

.....[1]

[Turn Over

YYSS_PRELIM_2025

- 21 A bakery sells 3 different types of buns.
The number of each type of bun sold during a particular weekend in May is given in the table below.

	Number of buns sold during a weekend	
	Saturday	Sunday
Cream bun	x	27
Potato bun	19	18
Kaya bun	23	21

This information can be represented by the matrix $\mathbf{N} = \begin{pmatrix} x & 27 \\ 19 & 18 \\ 23 & 21 \end{pmatrix}$.

- (a) The cost of a cream bun, potato bun and a kaya bun is \$3, \$2.70 and \$ 4.10 respectively.
Represent this information in a 1×3 matrix $\mathbf{C}$.

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

- (b) Find, in terms of x , the matrix $\mathbf{P} = \mathbf{CN}$.

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

- (c) Explain what the elements in $\mathbf{P}$ represent.

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

- (d) That weekend, the bakery decided to give a 5% discount on the cost of buns on Saturday and 10% discount on the cost of buns on Sunday.
The total cost of buns sold on both days was \$360.95.
Find the value of x .

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

- 22 y is inversely proportional to $(x-1)^2$. If the sum of the values of y when $x=3$ and when $x=5$ is 20, find

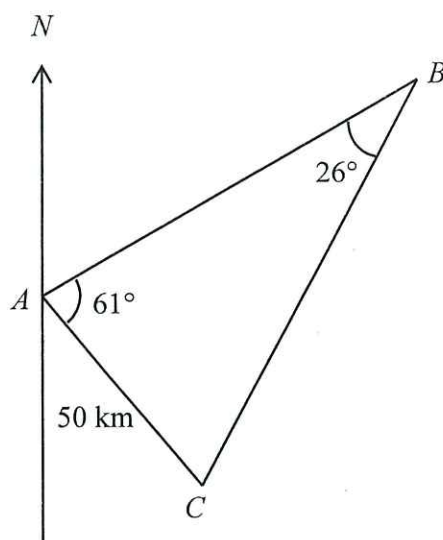
(a) an equation connecting x and y ,

Answer [2]

(b) the values of x when $y=16$.

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

- 23 The diagram shows the positions of three shopping malls, A , B and C . The bearing of C from A is 130° . $\angle ABC$ is 26° and $\angle BAC$ is 61° .



- (a) How far apart are shopping malls B and C ?

Answer km [2]

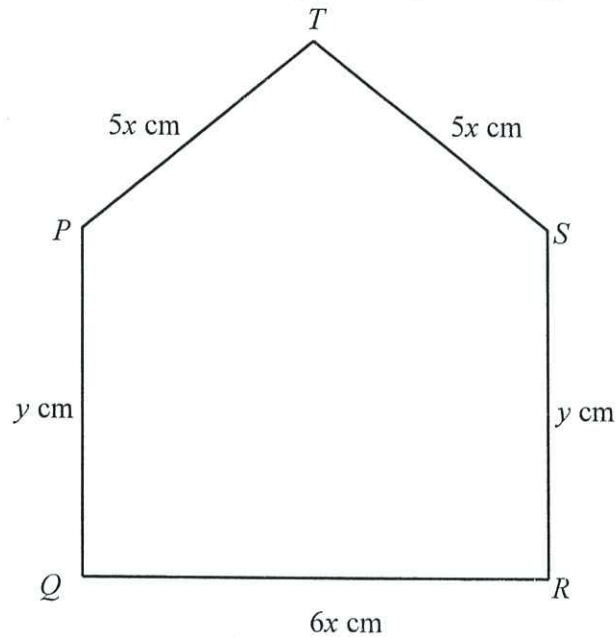
- (b) Peter wants to travel from shopping mall B to shopping mall C .
On what bearing should he travel from shopping mall B so that he will be able to reach shopping mall C ?

Answer $^\circ$ [2]

- 24 A shape of a model house was created using a piece of wire which was bent to form the shape $PQRST$ as shown in the diagram below.

PQ and RS are perpendicular to QR .

It is given that $PT = ST = 5x$ cm, $PQ = RS = y$ cm and $QR = 6x$ cm.



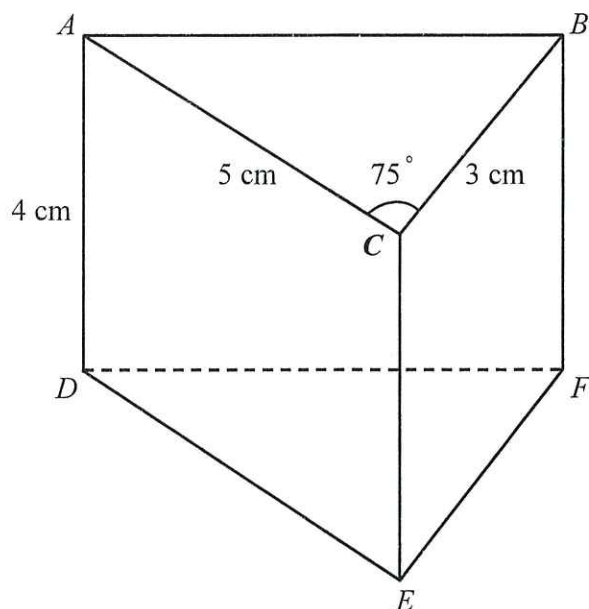
- (a) Given that the total length of the wire used is 150 cm, express y in terms of x .

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

- (b) Hence, show that the area of $PQRST$ is $450x - 36x^2$.

Answer [3]

- 25 The figure shows a triangular prism in which $AC = 5$ cm, $BC = 3$ cm, $AD = 4$ cm and $\angle ACB = 75^\circ$.



Find

- (a) the length of AB ,

Answer cm [2]

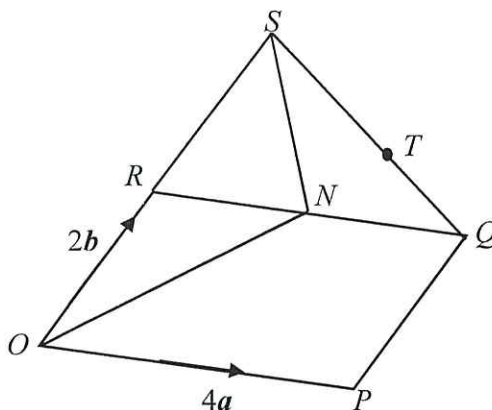
- (b) the volume of the prism,

Answer cm³ [1]

- (c) the shortest distance from C to AB .

Answer cm [2]

- 26 In a diagram, $PQRO$ is a parallelogram, and N is the midpoint of QR . ORS is a straight line. T is a point on QS such that $QT = \frac{1}{3}QS$. $2OR = OS$, $\overrightarrow{OP} = 4\mathbf{a}$ and $\overrightarrow{OR} = 2\mathbf{b}$.



- (a) Express, as simply as possible, in terms of $\mathbf{a}$ and/or $\mathbf{b}$,

(i) $\overrightarrow{PR}$,

Answer [1]

(ii) $\overrightarrow{QS}$,

Answer [1]

(iii) $\overrightarrow{ON}$,

Answer [1]

(iv) $\overline{OT}$.

Answer [2]

(b) Explain why O , N and T lie on the same straight line.

Answer
 [2]

The End



YUYING SECONDARY SCHOOL
PRELIMINARY EXAMINATION
Secondary 4 Express/ 5 Normal Academic

NAME

CLASS

REG. NO

MATHEMATICS

4052/02

Paper 2

22 August 2025

2 hours 15 minutes

Setter: Ms June Ho

Vetter: Mdm Lathamagesh

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.

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

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

Answer **all** questions.

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 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, unless the question requires the answer in terms of π .

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

The total number of marks for this paper is 90.

For Examiner's Use									
Qn	1	2	3	4	5	6	7	8	9
Marks									

For Examiner's Use	
Total	90

This document consists of **25** printed pages and **1** blank page.

[Turn over

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

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

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

TURN OVER FOR QUESTION 1

[Turn over

YYSS_PRELIM_2025

SEC 4E/5N_EM_P2

Answer **all** the questions.

- 1 (a) Solve $6 - 5x = 4(1 - 3x)$.

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

- (b) Solve the inequalities $3 < 8 - y \leq 11$.

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

- (c) Rearrange $b = \frac{1}{a} - \frac{c}{2 - c}$ to make c the subject.

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

(d) Solve the equation $\frac{5}{x+4} = 4 + \frac{x}{1-2x}$.

Give your solutions correct to two decimal places.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [5]

[Turn over

YYSS_PRELIM_2025

- 2 (a) The average space between 2 oxygen atoms in solid ice is 2.76×10^{-10} metres.

(i) Express 2.76×10^{-10} metres in picometre. (pico = 10^{-12})

Answer picometre [1]

- (ii) When ice changes to water, the atom spacing of oxygen decreases by 65%.
Calculate the atom spacing of oxygen in water in picometre.

Answer picometre [2]

- (iii) The atom spacing of oxygen in air is 3.4×10^{-9} metres.
Estimate, in standard form, the number of oxygen atoms in a
1 cm by 1 cm by 1 cm cubic enclosure.

Answer [2]

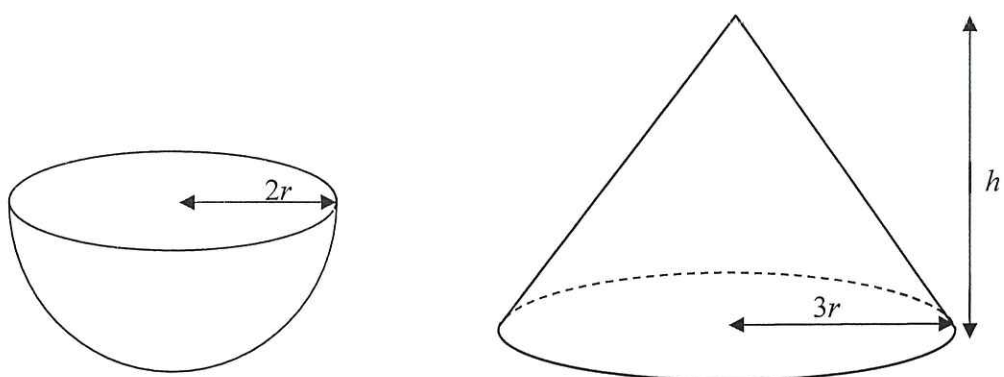
- (b) (i) The actual area of a nature reserve is 84 km^2 while it measures 21 cm^2 on a map.
Find the scale of the map.

Answer 1 : [2]

- (ii) Another map has a scale of 1 : 50 000.
The length of a stream on the map is 6.5 cm long.
Calculate, in metres, the actual length of the stream.

Answer m [2]

[Turn over



The diagram shows a solid hemisphere and a solid cone.
The hemisphere has radius $2r$ cm.
The cone has radius $3r$ cm and height h cm.

- (a) Show that the volume of hemisphere is $\frac{16}{3}\pi r^3$ cm³.

Answer

[2]

- (b) The volume of the cone is twice the volume of the hemisphere.

Find h in terms of r .

Answer [3]

- (c) The total surface area of the hemisphere is 600 cm^2 .

Calculate the total surface area of the cone.

Answer cm^2 [4]

[Turn over

- 4 (a) Complete the table of values for $y = 2x + \frac{5}{x} - 8$.

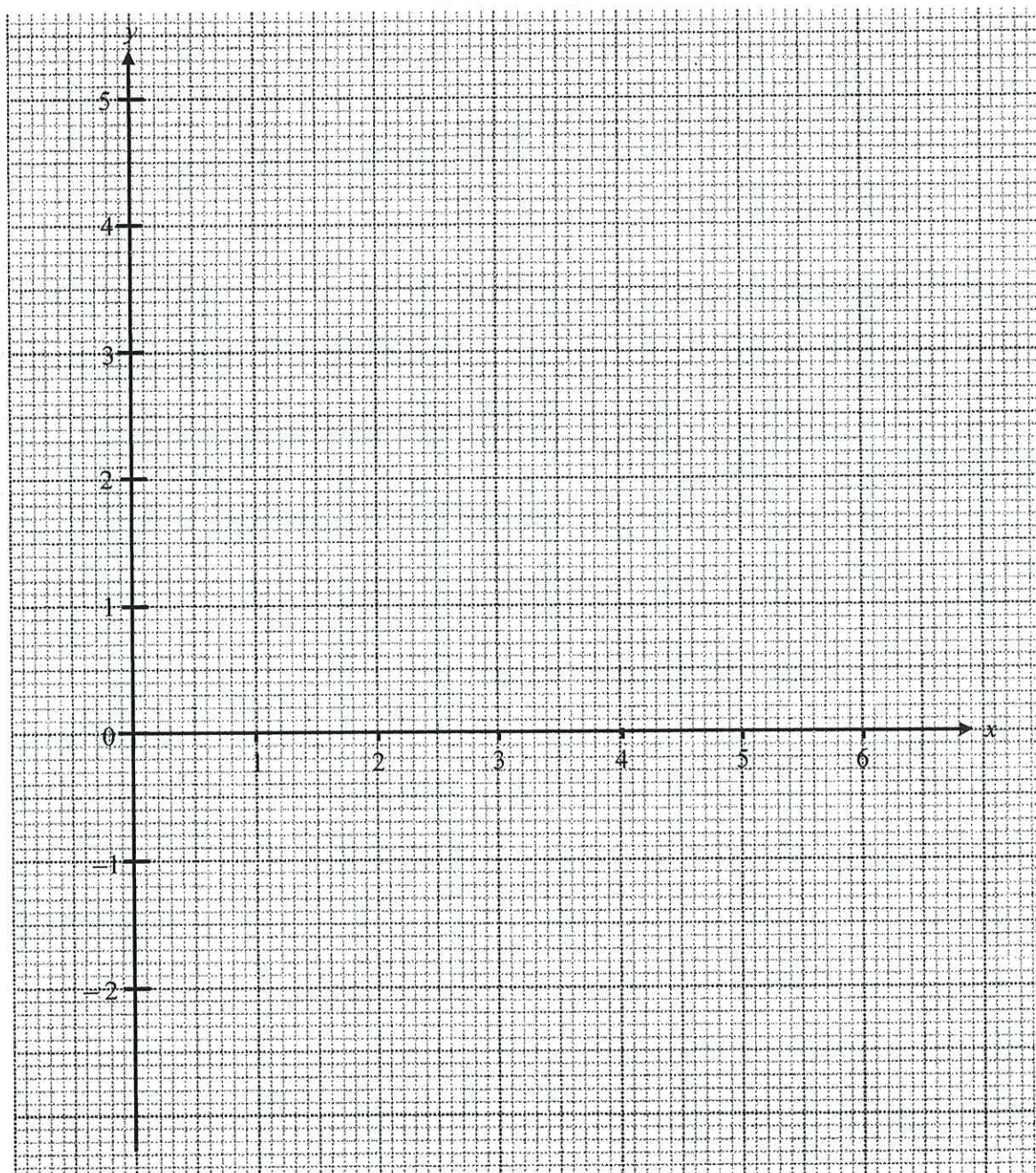
Give your answer correct to 1 decimal place.

[1]

x	0.5	1	2	2.5	3	4	5	6
y	3	-1	-1.5	-1	-0.3	1.3	3	

- (b) On the grid, draw the graph of $y = 2x + \frac{5}{x} - 8$ for $0.5 \leq x \leq 6$.

[3]



- (c) Explain how you determine the number of solutions of the equation $2x + \frac{5}{x} = 10$ using your graph.

.....

 [2]

- (d) (i) On the grid in part (b), draw the line $y = 2x + 1$ for $0 \leq x \leq 6$.

[1]

- (ii) Write down the x -coordinate of the point where this line intersects the curve.

Answer $x = \dots\dots\dots$ [1]

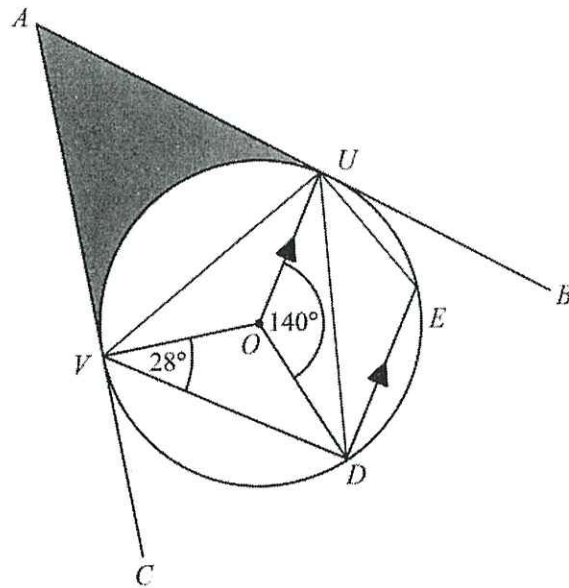
- (iii) The value of x in (d)(ii) is the solution of the equation $Ax + B = 0$.
 Find the value of A and the value of B .

Answer $A = \dots\dots\dots$

$B = \dots\dots\dots$ [3]

[Turn over

YYSS_PRELIM_2025



$DEUV$ are points on the circle, centre O .

AB and AC are tangents to the circle at point U and V respectively.

Angle $UOD = 140^\circ$, angle $OVD = 28^\circ$ and OU is parallel to DE .

(a) Explain why UD bisects angle ODE , stating your reasons clearly.

Answer

[2]

(b) Calculate, giving reasons for each step of your working,

(i) angle UED ,

Answer ° [2]

(ii) angle EUD ,

Answer ° [1]

(iii) angle AOU .

Answer ° [2]

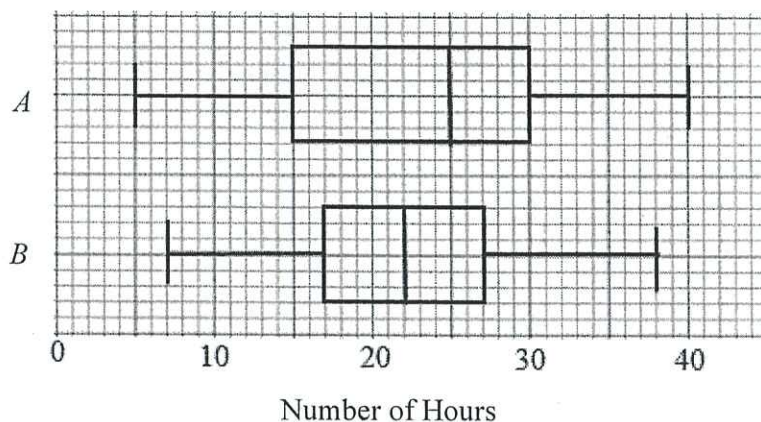
[Turn over

YYSS_PRELIM_2025

-
- (c) Given that the radius of the circle is 6 cm, find the perimeter of the shaded segment.

Answer cm [3]

- 6 (a) The box and whisker plots below show the distribution of revision hours in a week by 40 students in Class A and Class B respectively.



- (i) Find the interquartile range for Class A.

Answer hours [1]

- (ii) For each statement below, write down whether you **agree** or **disagree** with the statement, explaining clearly what evidence you have used to make your decision.
Use figures to support your answers.

Statement 1: Students in Class A spend more time on revising than Class B.

.....
..... [1]

Statement 2: Students in Class A have more consistent revision hours than Class B.

.....
..... [1]

Statement 3: The number of students who revised more than 15 hours in a week in Class A is more than in Class B.

.....
..... [1]

[Turn over

- (b) In a survey, the number of passengers in each car passing a particular traffic light in the morning was recorded in the table shown below.

Number of passengers	0	1	2	3	4
Number of cars	26	9	15	13	7

- (i) One of the cars is selected at random.

Find the probability that it has no passengers.

Answer [1]

- (ii) Two of the cars are selected at random.

Find, as a fraction in its simplest form, the probability that

- (a) both cars have 3 passengers,

Answer [2]

- (b) one has more than two passengers and the other has fewer than two passengers.

Answer [2]

7 (a) $\overrightarrow{AB} = \begin{pmatrix} -8 \\ a \end{pmatrix}$ and $|\overrightarrow{BA}| = 17$ units.

(i) Given that $a > 0$, find the value of a .

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

C is a point $(2, 5)$ and $\overrightarrow{AB} = \overrightarrow{DC}$.

(ii) Show that the coordinates of D is $(10, -10)$.

[2]

[Turn over

YYSS_PRELIM_2025

(iii) Find the equation of the line CD .

Answer [3]

O is the origin.

E lies on OD such that $OD : ED = 5 : 3$.

(iv) Find the coordinates of E .

Answer E (....., ...) [1]

- (b) The points $(-1, 8)$ and $(2, 5)$ lie on the curve given by the equation $y = ax^2 + bx + 3$.

Find the values of a and b .

Answer $a = \dots\dots\dots, b = \dots\dots\dots$ [4]

[Turn over

- 8 (a) Study the number pattern shown below.

```

          1
        2 3 4
      5 6 7 8 9
    10 11 12 13 14 15 16
  ...  ...  ...  ...  ...  ...  ...

```

Some characteristics of the number pattern are as shown in the table below.

Row number (n)	Number of terms (T_n)	1 st term in the row (F_n)	Last term in the row (L_n)
1	1	1	1
2	3	2	4
3	5	5	9
4	7	10	16
...	...	...	...

- (i) Find the values of L_5 , F_6 and T_7 .

Answer $L_5 = \dots\dots\dots$ [1]

Answer $F_6 = \dots\dots\dots$ [1]

Answer $T_7 = \dots\dots\dots$ [1]

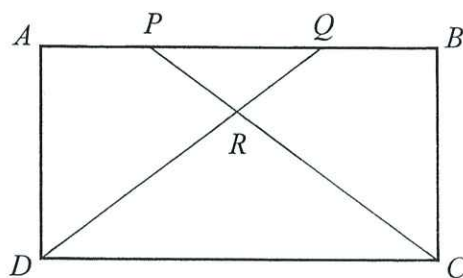
- (ii) Express L_n in terms of n .

Answer $L_n = \dots\dots\dots$ [1]

(iii) Express F_n in terms of n .

Answer $F_n = \dots\dots\dots$ [1]

(b) In the diagram, $ABCD$ is a rectangle. P and Q are points on AB such that $PC = QD$.



Show that triangles AQD and BPC are congruent.

Answer

.....

 [2]

[Turn over

- 9 Sam drives GoRide during his free time.
He works from 4pm to 8pm as a GoRide driver every day in a month.

Information for GoRide drivers is given below.

Total Daily Earnings = GoRider Fare (including surge pricing) – GoRide Fees
– fuel charges (including 9% GST) – car rental fees

Local GoRide Charges

On Average from 4pm – 8pm

Each Trip	Distance	Time Taken
	24.5 km	30 mins

GoRide Fares

Base fare	\$4.60
Per Minute	\$0.20
Per km	\$0.80
Cancellation Fee	\$6
Minimum Fare	\$3

Fare breakdown

GoRider Fare = Base Fare + (cost per minute × ride time)
+ (cost per km × ride distance)

Surge Pricing (6pm – 8pm)	× 1.6 of GoRide fare
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GoRide Fees

15% of GoRide Fare

(To be paid to GoRide Company for every trip)

- (a) Calculate the average GoRide fare for one trip from 4pm to 6pm on a particular day.

Answer \$ [1]

- (b) Sam drives non-stop between 4pm to 8pm with a new trip coming in after the previous trip has ended.

Calculate the total average GoRide fare that Sam will receive on a particular day after deducting the GoRide fees for each trip.

Answer \$ [3]

[Turn over

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(c)

<u>Car Rental</u>		
Pricing	\$ 118 nett /day	
Contract	4 weeks	

<u>Fuel Grade</u>	<u>Pump Price/ litre (excludes 9% GST)</u>	<u>GoRide Fuel card</u>
Fuelstar 98	\$3.12	25% Discount and Additional \$3 off for \$60 minimum spent on fuel
Fuelstar 95	\$2.65	
Fuel Star 92	\$2.62	

Sam's rental car runs at an estimate of 8 litres per 100 kilometres.

The full tank capacity of his rental car is 65 litres.

He tops up his petrol tank to full tank capacity whenever it is 25% full.

Sam uses Fuelstar 95 for his petrol.

He has a GoRide fuel card.

Sam expects a monthly income of \$4000, assuming he has a continuous flow of customers from 4pm to 8pm.

Determine if Sam can earn his expected income of \$4000 as a GoRide driver in a month of 30 days.

Show your calculations clearly.

Continuation of working space for question 9(c)

Answer
.....[7]

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**[Turn over**

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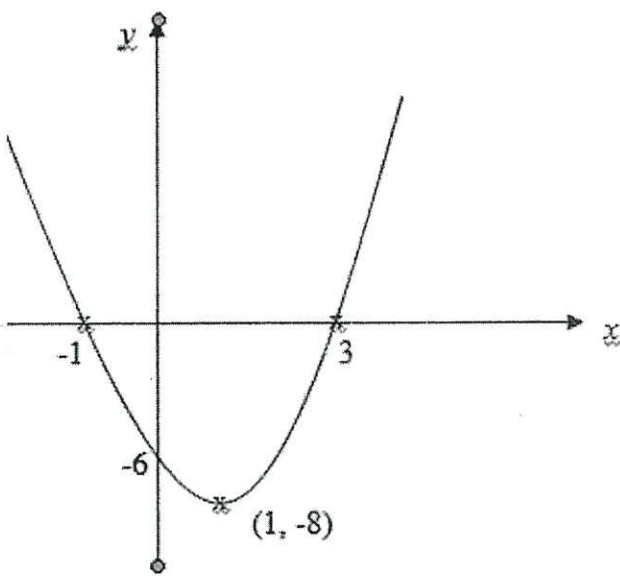
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**Mathematics Department**  
**Sec 4/5 Preliminary Examination 2025**  
**Marking Scheme**  
**Paper 1**

|       |                                                                                                                                                                                                                                                      |                            |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 1     | $3 \text{ units} = \$150$<br>$1 \text{ unit} = \$50$<br>$9 \text{ units} = 9 \times 50$<br>$= \$450$                                                                                                                                                 | M1<br>A1                   |
| 2 (a) | $\sqrt[3]{64y^6} = 4y^2$                                                                                                                                                                                                                             | B1                         |
| 2(b)  | $3^{1-2x} = 3^{-1}$<br>$\therefore 1-2x = -1$<br>$-2x = -2$<br>$x = 1$                                                                                                                                                                               | M1<br><br><br>A1           |
| 3(a)  | $40.2^\circ (1\text{dp}) \text{ or } 139.8^\circ (1\text{dp})$                                                                                                                                                                                       | B2                         |
| 3(b)  | $\frac{\pi}{180} \times 240$<br>$= \frac{4\pi}{3} \text{ rad}$                                                                                                                                                                                       | A1                         |
| 4     | $10506.25 = 10000 \left(1 + \frac{x}{100}\right)^2$<br>$\left(1 + \frac{x}{100}\right)^2 = \frac{10506.25}{10000}$<br>$\frac{x}{100} = \sqrt{\frac{10506.25}{10000}} - 1$<br>$x = 100 \left(\sqrt{\frac{10506.25}{10000}} - 1\right)$<br>$x = 2.5\%$ | M1<br><br><br>M1<br><br>A1 |
| 5(a)  | 25200                                                                                                                                                                                                                                                | B1                         |
| 5(b)  | $\sqrt{2^6 \times 3^2 \times 5^3 \times 7 \times k}$<br>$\therefore k = 3 \times 7^2$<br>$k = 147$                                                                                                                                                   | A1                         |

|          |                                                                                                                                                                                       |              |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 6(a)(i)  | $\frac{107}{100} \times 3500 \times 12$ $= \$44940$                                                                                                                                   | A1           |
| 6(a)(ii) | $\frac{106}{100} \times 3500 \times 12 + 250 \times 3$ $= \$45270$                                                                                                                    | M1<br>A1     |
| 6(b)     | $\frac{45270}{3500 \times 12} \times 100$ $= 107.7857143$ $\approx 107.8\%(\text{1d.p})$                                                                                              | M1<br>A1     |
| 7(a)     | $x^2 + 8x + k$ $= x^2 + 8x + (4)^2 + k - (4)^2$ $= (x + 4)^2 + k - 16$ <p>If <math>x^2 + 8x + k</math> is a perfect square,<br/> <math>k - 16 = 0</math><br/> <math>k = 16</math></p> | M1<br><br>A1 |
| 7(b)     | $(-4, 0)$                                                                                                                                                                             | B1           |
| 8        | $\frac{4}{7p-1} - \frac{1}{2(p+1)}$ $= \frac{8(p+1) - 1(7p-1)}{2(p+1)(7p-1)}$ $= \frac{8p+8-7p+1}{2(p+1)(7p-1)}$ $= \frac{p+9}{2(p+1)(7p-1)}$                                         | M1<br><br>A1 |
| 9        | $2500 \times 1.20 = \text{A\$}3000$ $\text{A\$}3000 - \text{A\$}1400 = \text{A\$}1600$<br>$1600 \times 0.84$ $= \text{S\$}1344$                                                       | M1<br>A1     |

|           |                                                                                                                                                                                    |                                  |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 10        | Currently there are 11 blue marbles.<br>Let $x$ be the additional blue marbles added to the bag.<br>$\frac{11+x}{88+x} = \frac{4}{15}$ $165 + 15x = 352 + 4x$ $11x = 187$ $x = 17$ | M1<br><br><br><br><br><br><br>A1 |
| 11(a)     | 2 hours 27 minutes                                                                                                                                                                 | B1                               |
| 11(b)(i)  | 3 hours 12 minutes                                                                                                                                                                 | B1                               |
| 11(b)(ii) | 3 hours 27 minutes                                                                                                                                                                 | B1                               |
| 11(c)     | 10 00                                                                                                                                                                              | B1                               |
| 11(d)(i)  | $\frac{1 \times 66 + 3 \times 80 + 5 \times 61 + 7 \times 53 + 9 \times 40}{300}$ $= 4.473333...$ $\approx 4.47 \text{ years (3s.f)}$                                              | <br><br><br><br><br><br><br>A1   |
| 11(d)(ii) | <b>Mid-value</b> of each cluster interval was used in the calculation of mean.                                                                                                     | B1                               |
| 12 (a)    | $(5p - q)(2q + 3p)$ $= 10pq + 15p^2 - 2q^2 - 3pq$ $= 15p^2 - 2q^2 + 7pq$                                                                                                           | M1<br>A1                         |
| 12(b)(i)  | $\frac{1}{2}ab(a - 6b)$                                                                                                                                                            | B1                               |
| 12(b)(ii) | $7a - 3ab - 6bk + 14k$ $= a(7 - 3b) - 2k(3b - 7)$ $= a(7 - 3b) + 2k(7 - 3b)$ $= (7 - 3b)(a + 2k)$                                                                                  | M1<br><br><br><br>A1             |
| 13(a)     | $\frac{2}{3}$                                                                                                                                                                      | B1                               |
| 13(b)     | $3y = 2(10) + 1$ $y = 7$                                                                                                                                                           | <br><br>A1                       |
| 14(a)     | $PR$ is the diameter of the circle, hence triangle $PQR$ is a right-angled triangle                                                                                                | B1                               |
| 14(b)     | Using Pythagoras' Theorem,<br>$XR^2 = 8^2 + 15^2$ $XR = 17 \text{ cm}$ $\cos \angle PXR = -\frac{8}{17}$                                                                           | M1<br><br><br>A1                 |

|    |                                                                                                                                                     |                                                                                                            |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 15 | $\frac{49x^2 - 16}{7x^2 + 3x - 4}$ $= \frac{(7x)^2 - (4)^2}{(7x - 4)(x + 1)}$ $= \frac{(7x + 4)(7x - 4)}{(7x - 4)(x + 1)}$ $= \frac{7x + 4}{x + 1}$ | <p>M2: 1m each for each correct factorisation (numerator &amp; denominator)</p> <p>A1</p>                  |
| 16 |                                                                   | <p>Correct shape: B1</p> <p>Correct <math>x</math> and <math>y</math> intercepts and turning point: B1</p> |



|           |                                                                                                                                                                |                   |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| 20(a)     | The sizes of the sectors representing each purchase are not proportional to the relative percentages.                                                          | B1                |
| 20(b)(i)  | $\frac{40-19}{3} = 7$ $-7n+54$                                                                                                                                 | A1                |
| 20(b)(ii) | $-7n+54 = -88$ $-7n = -142$ $n = 20\frac{2}{7}$ <p>Since n is not a positive integer, it is not possible for the sequence to have -88 as one of the terms.</p> | A1/follow-through |
| 21(a)     | $C = (3 \quad 2.10 \quad 4.30)$                                                                                                                                | B1                |
| 21(b)     | $P = (3 \quad 2.70 \quad 4.10) \begin{pmatrix} x & 27 \\ 19 & 18 \\ 23 & 21 \end{pmatrix}$ $= (3x+145.60 \quad 215.70)$                                        | A1                |
| 21(c)     | The elements in P represents the <u>total amount of money collected for the sale of all 3 types of buns on a particular Saturday and Sunday respectively.</u>  | B1                |
| 21(d)     | $0.95(3x+145.60) + 0.9(215.70) = 360.95$ $2.85x = 28.5$ $x = 10$                                                                                               | M1<br><br>A1      |

|       |                                                                                                                                                                                                |                                              |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 22(a) | $\frac{k}{(3-1)^2} + \frac{k}{(5-1)^2} = 20$ $\frac{k}{4} + \frac{k}{16} = 20$ $\frac{4k+k}{16} = 20$ $5k = 320$ $k = 64$ $\therefore y = \frac{64}{(x-1)^2}$                                  | M1<br><br><br><br><br><br><br><br><br><br>A1 |
| 22(b) | $16 = \frac{64}{(x-1)^2}$ $16(x-1)^2 = 64$ $(x-1)^2 = 4$ $x-1 = \pm 2$ $x = 3 \text{ or } x = -1$                                                                                              | M1<br><br><br><br><br><br><br>A1 (both)      |
| 23(a) | <p>Using sine rule,</p> $\frac{BC}{\sin 61^\circ} = \frac{50}{\sin 26^\circ}$ $BC = \frac{50}{\sin 26^\circ} \times \sin 61^\circ$ $BC = 99.75790076$ $BC \approx 99.8\text{km}(3 \text{ sf})$ | M1<br><br><br><br><br><br>A1                 |
| 23(b) | $\angle NAB = 130^\circ - 61^\circ$ $= 69^\circ$ $180^\circ - 69^\circ = 111^\circ$ $\text{Bearing of C from B} = 360^\circ - 26^\circ - 111^\circ$ $= 223^\circ$                              | M1<br>A1                                     |

|       |                                                                                                                                                                                                                                                                                |                                                    |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 24(a) | $5x + 5x + y + y + 6x = 150$<br>$16x + 2y = 150$<br>$8x + y = 75$<br>$y = 75 - 8x$                                                                                                                                                                                             | M1<br><br><br><br>A1                               |
| 24(b) | <p>Using Pythagoras' theorem,<br/>Height of triangle PTS</p> $= \sqrt{(5x)^2 - (3x)^2}$<br>$= \sqrt{16x^2}$<br>$= 4x \text{ cm}$<br><br><p>Area of PQRST</p> $= \frac{1}{2} \times 6x \times 4x + 6x(75 - 8x)$<br>$= 12x^2 + 450x - 48x^2$<br>$= 450x - 36x^2 \text{ (shown)}$ | M1<br><br><br><br><br><br><br>M1<br><br><br><br>A1 |
| 25(a) | <p>Using cosine rule,</p> $AB^2 = 5^2 + 3^2 - 2(5)(3)\cos 75^\circ$<br>$AB = 5.122053167$<br>$AB \approx 5.12 \text{ cm (3 sf)}$                                                                                                                                               | M1<br><br><br>A1                                   |
| 25(b) | <p>Volume of prism</p> $= \frac{1}{2} \times 5 \times 3 \times \sin 75^\circ \times 4$<br>$= 28.97777479$<br>$\approx 29.0 \text{ cm}^3 \text{ (3sf)}$                                                                                                                         | <br><br><br><br>A1                                 |
| 25(c) | <p>Let <math>x</math> be the shortest distance from <math>C</math> to <math>AB</math>.</p> $\frac{1}{2} \times 5.122053167 \times x \times 4 = 28.97777479$<br>$x = \frac{28.97777479}{10.24410633}$<br>$x \approx 2.83 \text{ cm (3 sf)}$                                     | M1<br><br><br>A1                                   |

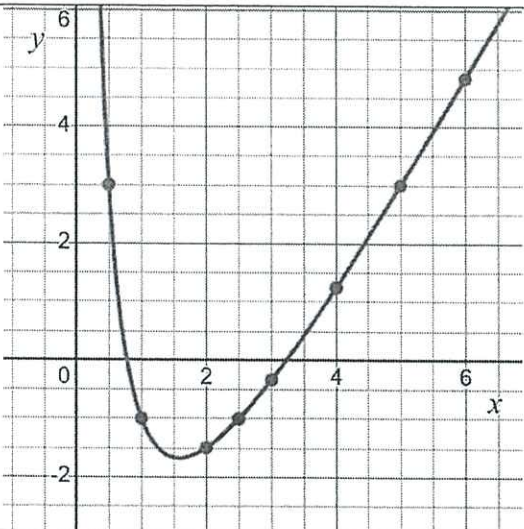
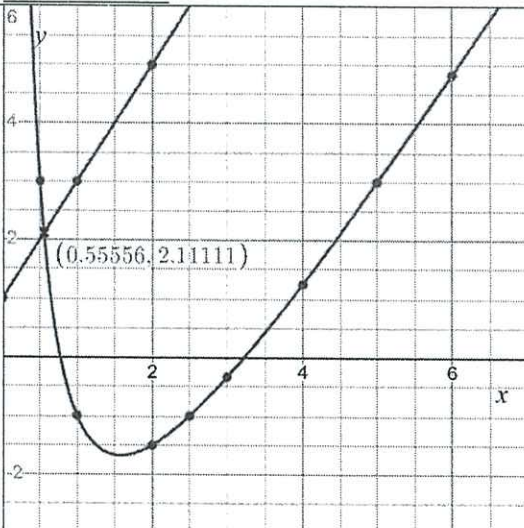
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|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 26(a) | $\overrightarrow{PR} = -4\mathbf{a} + 2\mathbf{b}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | B1       |
| 26(b) | $\overrightarrow{QS} = \overrightarrow{QR} + \overrightarrow{RS}$<br>$= -4\mathbf{a} + 2\mathbf{b}$                                                                                                                                                                                                                                                                                                                                                                                                                                            | B1       |
| 26(c) | $\overrightarrow{ON} = \overrightarrow{OR} + \overrightarrow{RN}$<br>$\overrightarrow{ON} = \overrightarrow{OR} + \frac{1}{2}\overrightarrow{RQ}$<br>$= 2\mathbf{b} + 2\mathbf{a} / \text{OR}$<br>$= 2(\mathbf{b} + \mathbf{a})$                                                                                                                                                                                                                                                                                                               | B1       |
| 26(d) | $\overrightarrow{OT} = \overrightarrow{OS} + \overrightarrow{ST}$<br>$= 4\mathbf{b} + \frac{2}{3}(4\mathbf{a} - 2\mathbf{b})$<br>$= \frac{8}{3}(\mathbf{a} + \mathbf{b}) \text{ OR } \frac{8}{3}\mathbf{a} + \frac{8}{3}\mathbf{b}$                                                                                                                                                                                                                                                                                                            | M1<br>A1 |
| 26(e) | $\overrightarrow{OT} = \frac{4}{3}(2\mathbf{a} + 2\mathbf{b})$<br>$\therefore \overrightarrow{OT} = \frac{4}{3}\overrightarrow{ON}$<br><p>Since <math>OT</math> and <math>ON</math> are <i>parallel</i> and <math>O</math> is a common point,<br/> <math>O, N</math> and <math>T</math> lie on the same straight line.</p> <p>Or</p> <p>Since, <math>\overrightarrow{OT} = \frac{8}{3}(\mathbf{a} + \mathbf{b})</math> and <math>\overrightarrow{ON} = 2(\mathbf{b} + \mathbf{a})</math>, <math>OT</math> and <math>ON</math> are parallel</p> | M1<br>A1 |



| 4E5N 2025 Prelim Math Paper 2 Mark Scheme |                                                                                                                                                                                                                                            |                                                                                                        |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Qn                                        | Solutions                                                                                                                                                                                                                                  | Marks                                                                                                  |
| 1(a)                                      | $6 - 5x = 4(1 - 3x)$<br>$6 - 5x = 4 - 12x$<br>$7x = -2$<br>$x = \frac{-2}{7}$                                                                                                                                                              | M1<br><br><br><br>A1                                                                                   |
| (b)                                       | $3 < 8 - y \leq 11$<br>$3 < 8 - y$ and $8 - y \leq 11$<br>$-5 < -y$ and $-y \leq 3$<br>$y < 5$ and $y \geq -3$<br>$-3 \leq y < 5$                                                                                                          | M1<br><br><br><br>A1                                                                                   |
| (c)                                       | $b = \frac{1}{a} - \frac{c}{2-c}$<br>$\frac{c}{2-c} = \frac{1}{a} - b$<br>$\frac{c}{2-c} = \frac{1-ab}{a}$<br>$ac = (1-ab)(2-c)$<br>$ac = 2 - c - 2ab + abc$<br>$ac + c - abc = 2 - 2ab$<br>$c = \frac{2-2ab}{a+1-ab}$                     | M1<br><br><br>M1 – cross multiply<br><br><br>A1                                                        |
| (d)                                       | $\frac{5}{x+4} = 4 + \frac{x}{1-2x}$<br>$\frac{5}{x+4} = \frac{4-8x+x}{1-2x}$<br>$5(1-2x) = (x+4)(4-7x)$<br>$5-10x = 4x-7x^2+16-28x$<br>$7x^2+14x-11=0$<br>$x = \frac{-14 \pm \sqrt{14^2 - 4(7)(-11)}}{2(7)}$<br>$x = 0.60$ or $x = -2.60$ | M1 – simplifying algebraic fraction<br><br>M1 – cross multiply<br><br><br>M1 – using formula<br><br>A2 |
| 2(ai)                                     | $2.76 \times 10^{-10}$<br>$= \frac{2.76 \times 10^{-10} \times 10^{-2}}{10^{-2}}$<br>$= 276 \text{ picometre}$                                                                                                                             | <br><br><br>B1                                                                                         |
| (aii)                                     | $276 \times \left(\frac{100-65}{100}\right)$<br>$= 96.6 \text{ picometre}$                                                                                                                                                                 | M1<br><br>A1                                                                                           |

|        |                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                             |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| (aiii) | $\frac{0.01}{3.4 \times 10^{-9}}$ $= 2.94117 \times 10^6$ $(2.94117 \times 10^6)^3$ $= 2.54 \times 10^{19}$                                                                                                                                                                                                                                                                                                                    | M1<br><br><br><br><br><br><br><br><br><br>A1                                                                                                |
| (bi)   | $21 \text{ cm}^2 : 84 \text{ km}^2$ $1 \text{ cm}^2 : 4 \text{ km}^2$ $1 \text{ cm} : 2 \text{ km}$ $1 : 200000$                                                                                                                                                                                                                                                                                                               | M1<br><br><br><br>A1                                                                                                                        |
| (bii)  | $1 : 50000$ $1 \text{ cm} : 500 \text{ m}$ $6.5 \text{ cm} : 3250 \text{ m}$                                                                                                                                                                                                                                                                                                                                                   | M1<br><br><br>A1                                                                                                                            |
| 3(a)   | $\frac{2}{3} \pi (2r)^3$ $= \frac{16}{3} \pi r^3$                                                                                                                                                                                                                                                                                                                                                                              | M1<br><br>AG1                                                                                                                               |
| (b)    | $\frac{1}{3} \pi (3r)^2 h = 2 \times \frac{16}{3} \pi r^3$ $h = \frac{32 \pi r^3}{9 \pi r^2}$ $= \frac{32}{9} r$                                                                                                                                                                                                                                                                                                               | M1<br><br>M1<br><br>A1                                                                                                                      |
| (c)    | $3\pi(2r)^2 = 600$ $12\pi r^2 = 600$ $r = \sqrt{\frac{50}{\pi}}$ <p>Surface Area of Cone</p> $= \pi(3r)^2 + \pi(3r) \left( \sqrt{h^2 + (3r)^2} \right)$ $= \pi(3r)^2 + \pi(3r) \left( \sqrt{\left( \frac{32}{9} r \right)^2 + (3r)^2} \right)$ $= 9\pi r^2 + 3\pi r^2 \frac{\sqrt{1753}}{9}$ $= \left( 9 + \frac{\sqrt{1753}}{3} \right) \pi \left( \frac{50}{\pi} \right)$ $= 1147.81$ $= 1150 \text{ cm}^2 \text{ (to 3sf)}$ | M1<br><br><br><br><br><br><br>M1 – using $\pi r l$<br><br>M1 – sub $h$ in terms of $r$<br>Or<br>sub $r$ in terms of $\pi$<br><br><br><br>A1 |

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|          |                                                                                                                                                                            |                                                                                                                        |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 4(a)     | $y = 4.8$                                                                                                                                                                  | B1                                                                                                                     |
| (b)      |                                                                                           | <p>Points correctly plotted:<br/>-B1 for 4 to 7 points correct<br/>-B2 for all correct</p> <p>Smooth curve<br/>-B1</p> |
| (c)      | $2x + \frac{5}{x} = 10$ $2x + \frac{5}{x} - 8 = 2$ <p>Draw <math>y = 2</math>,<br/>the <u>number of solutions</u> = the <u>number of points of intersections</u>.</p>      | <p>M1</p> <p>B1</p>                                                                                                    |
| (d)(i)   |                                                                                         | B1 – blue line drawn correctly                                                                                         |
| (d)(ii)  | $x = 0.5 \pm 0.1$                                                                                                                                                          | B1                                                                                                                     |
| (d)(iii) | $2x + \frac{5}{x} - 8 = 2x + 1$ $\frac{5}{x} = 9$ $9x - 5 = 0 \quad \text{or} \quad -9x + 5 = 0$ $A = 9 \quad ; \quad B = -5 \quad \quad \quad A = -9 \quad ; \quad B = 5$ | <p>M1</p> <p>B1, B1</p>                                                                                                |

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|        |                                                                                                                                                                                                                                                                  |                             |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 5(a)   | $\angle OUD = \angle ODU$<br>$= \frac{180-140}{2}$ (base of isosceles $\Delta$ )<br>$= 20^\circ$<br>$\angle UDE = \angle OUD$ (alt $\angle$ , $OU \parallel DE$ )<br>$= 20^\circ$<br>Since $\angle ODU = \angle UDE$ , $UD$ bisects $\angle ODE$ . (explained)   | B1 – either seen<br><br>AG1 |
| (bi)   | Reflex $\angle OUD = 360 - 140$ ( $\angle$ s at a point)<br>$= 220^\circ$<br>$\angle UED = \frac{220}{2}$ ( $\angle$ at centre = 2 $\angle$ at circumference)<br>$= 110^\circ$                                                                                   | M1<br><br>A1                |
| (bii)  | $\angle EUD = 180 - 20 - 110$ ( $\angle$ sum of $\Delta$ )<br>$= 50^\circ$                                                                                                                                                                                       | A1                          |
| (biii) | $\angle VOD = 180 - 2 \times 28$ (base of isosceles $\Delta$ )<br>$= 124^\circ$<br>$\angle VOU = 360 - 124 - 140$ ( $\angle$ s at a point)<br>$= 96^\circ$<br>$\angle AOU = \frac{96^\circ}{2}$ (tangent from an external point)<br>$= 48^\circ$                 | M1 – either seen<br><br>A1  |
| (c)    | In $\Delta OAU$ ,<br>$\tan 48 = \frac{AU}{6}$<br>$AU = 6 \tan 48$<br>Minor Arc length $VU = \frac{96}{360} \times 2 \times \pi \times 6$<br>Perimeter $= 2 \times 6 \tan 48 + \frac{96}{360} \times 2 \times \pi \times 6$<br>$= 23.3804$<br>$= 23.4 \text{ cm}$ | M1<br><br>M1<br><br>A1      |
| 6(ai)  | IQR of Class A = $30 - 15$<br>$= 15$ hours                                                                                                                                                                                                                       | B1                          |
| (a ii) | Agree. The median of Class A (25 hrs) > the median of Class B (22 hrs).                                                                                                                                                                                          | B1                          |
|        | Disagree. The IQR of Class A (15 hours) > the IQR of Class B (10 hrs).                                                                                                                                                                                           | B1                          |
|        | Disagree. <u>30 students (75%) worked more than 15 hrs in Class A, while <math>\geq 30</math> students (&gt;75%) worked more than 15 hrs in Class B.</u>                                                                                                         | B1                          |
| (bi)   | $\frac{26}{26+9+15+13+7} = \frac{13}{35}$                                                                                                                                                                                                                        | B1                          |

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|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| (bii)(a) | $\frac{13}{70} \times \frac{12}{69}$ $= \frac{26}{805}$                                                                                                                                                                                                                                                                                                                                                                                                            | M1<br>A1                  |
| (bii)(b) | $\frac{35}{70} \times \frac{20}{69} \times 2$ $= \frac{20}{69}$                                                                                                                                                                                                                                                                                                                                                                                                    | M1<br>A1                  |
| 7(a)(i)  | $\sqrt{8^2 + a^2} = 17$ $a = -15 \text{ (rej) or } a = 15$                                                                                                                                                                                                                                                                                                                                                                                                         | M1<br>A1                  |
| (a)(ii)  | <p>Let <math>\overrightarrow{OD} = \begin{pmatrix} x \\ y \end{pmatrix}</math></p> $\begin{pmatrix} -8 \\ 15 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \end{pmatrix} - \begin{pmatrix} x \\ y \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2+8 \\ 5-15 \end{pmatrix} = \begin{pmatrix} 10 \\ -10 \end{pmatrix}$ $D = (10, -10)$                                                                                                             | M1 cao<br>A1              |
| (a)(iii) | <p><math>C = (2, 5)</math><br/> <math>D = (10, -10)</math></p> <p>gradient of <math>CE = \frac{-10-5}{10-2}</math><br/> <math display="block">= \frac{-15}{8}</math></p> <p>sub <math>(2, 5)</math> into <math>y = \frac{-15}{8}x + c</math><br/> <math display="block">5 = \frac{-15}{8}(2) + c</math> <math display="block">c = \frac{35}{4}</math></p> <p>Equation of <math>CE</math> :<br/> <math display="block">y = -\frac{15}{8}x + \frac{35}{4}</math></p> | M1<br>M1 – find $c$<br>A1 |
| (a)(iv)  | $E = (4, -4)$                                                                                                                                                                                                                                                                                                                                                                                                                                                      | B1                        |

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|        |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                          |       |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
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| 7(b)   | when $x = -1, y = 8,$<br>$8 = a - b + 3$<br>$5 + b = a$ ----- (1)<br>when $x = 2, y = 5,$<br>$5 = 4a + 2b + 3$<br>$2 = 4a + 2b$<br>$1 = 2a + b$ ----- (2)<br>Sub (1) into (2),<br>$1 = 2(5 + b) + b$<br>$3b = -9$<br>$b = -3$<br>$a = 2$                                                                                                                    | M1 for sub $(-1, 8)$<br><br>M1 for sub $(2, 5)$<br><br>M1 for substitution or elimination<br><br>A1 – correct $a$ and $b$                |       |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| 8(ai)  | <table><tr><td><math>n</math></td><td><math>T_n</math></td><td><math>F_n</math></td><td><math>L_n</math></td></tr><tr><td>5</td><td>9</td><td>17</td><td>25</td></tr><tr><td>6</td><td>11</td><td>26</td><td>36</td></tr><tr><td>7</td><td>13</td><td>37</td><td>49</td></tr></table><br>$L_5 = 25$<br>$F_6 = 26$<br>$T_7 = 13$                             | $n$                                                                                                                                      | $T_n$ | $F_n$ | $L_n$ | 5 | 9 | 17 | 25 | 6 | 11 | 26 | 36 | 7 | 13 | 37 | 49 | B1<br>B1<br>B1 |
| $n$    | $T_n$                                                                                                                                                                                                                                                                                                                                                       | $F_n$                                                                                                                                    | $L_n$ |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| 5      | 9                                                                                                                                                                                                                                                                                                                                                           | 17                                                                                                                                       | 25    |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| 6      | 11                                                                                                                                                                                                                                                                                                                                                          | 26                                                                                                                                       | 36    |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| 7      | 13                                                                                                                                                                                                                                                                                                                                                          | 37                                                                                                                                       | 49    |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| (aii)  | $L_n = n^2$                                                                                                                                                                                                                                                                                                                                                 | B1                                                                                                                                       |       |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| (aiii) | $F_n = (n - 1)^2 + 1$<br>or<br>$F_n = n^2 - 2n + 2$                                                                                                                                                                                                                                                                                                         | B1                                                                                                                                       |       |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |
| (b)    | $\angle QAD = \angle PBC = 90^\circ$ (1)<br>$QD = PC$ (given)<br>$AD = BC$ (opp sides of rectangle are equal) (2)<br>$\triangle AQD \equiv \triangle BPC$ (RHS congruence)<br><br>Or<br>$QD = PC$ (given)<br>$AD = BC$ (opp sides of rectangle are equal) (1)<br>$AQ = BP$ (By Pythagoras Thm) (2)<br>$\triangle AQD \equiv \triangle BPC$ (SSS congruence) | B1 [for one correct reason (1) and or (2)]<br><br>B1 stating RHS<br><br>B1 [for one correct reason (1) and or (2)]<br><br>B1 stating SSS |       |       |       |   |   |    |    |   |    |    |    |   |    |    |    |                |

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|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9(a) | $\text{Average fare} = 4.60 + (0.20 \times 30) + (0.80 \times 24.5)$ $= \$30.20$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | B1                                                                                                                                                                                                                                                                                                           |
| (b)  | <p>From 4 to 6 pm :</p> $\text{No of 30-min trips each day} = 2 \div 0.5$ $= 4$ $\text{Total Fare} = \$30.20 \times 4 \times 0.85$ $= \$102.68$ <p>From 6 to 8 pm</p> $\text{No of 30-min trips each day} = 2 \div 0.5$ $= 4$ $\text{Total Fare} = \$30.20 \times 4 \times 1.6 \times 0.85$ $= \$164.288$ $\text{Total Fare} = \$102.68 + \$164.288$ $= \$266.968$ $= \$266.97$                                                                                                                                                                                                                                                                                                                                                                                                        | <p>M1</p> <p>M1</p> <p>A1</p>                                                                                                                                                                                                                                                                                |
| (c)  | $\text{Total Earnings} = \$266.968 \times 30 = \$8009.04$ $\text{Car rental} = \$118 \times 30 = \$3540$<br>$\text{Total distance travelled in a day} = 24.5 \times 8 = 196 \text{ km}$<br>$\text{Number of litres used per day} = \frac{196}{100} \times 8 = 15.68$<br>$75\% \text{ full tank} = \frac{75}{100} \times 65 = 48.75 \text{ litres}$<br>$\text{Number of days per petrol top-up} = \frac{48.75}{15.68} = 3.10905 = 3$<br>$\text{Fuel cost per 3 days}$ $= \left[ \left( 48.75 \times 2.65 \times \frac{75}{100} \right) - 3 \right] \times 1.09 = \$102.3407$<br>$\text{Fuel cost in a month} = 102.3407 \times 10 = \$1023.407$ $\text{Monthly Income}$ $= 8009.04 - 1023.407 - 3540 = \$3445.633 (< \$4000)$ $\text{No, Sam cannot earn his expected monthly income.}$ | <p>B1 (either seen)<br/>Accept 3304 rental for 28 days</p> <p>B1 (distance/day)<br/>Accept 5580 km (distance/month)</p> <p>M1 (No. of litres)</p> <p>M1 (either seen)</p> <p>M1 (rebate or GST seen)<br/>(no mark awarded for 25% discount only)</p> <p>M1 (Fuel cost in a month)</p> <p>A1 (conclusion)</p> |

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