FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2023
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

MATHEMATICS 4052/01

Paper 1

Date: 22 August 2023 **Duration: 2 hours 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index 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.

For Examiner's Use

Table of Penalties		Question Number		
Presentation	□1			
	□2		Parent's / Guardian's Signature	
Rounding off	□1			90

Setters: Ms Shamsiah and Mr Kua KT

This question paper consists of 23 printed pages.

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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.

L1 **1** **(a)** Express 540 as a product of its prime factors.

Answer ..... [1]

L2 **(b)** The number $\frac{540m}{n}$ is a perfect cube.

m and n are prime numbers.

Find the value of m and the value of n.

Answer $m =$ .....

$n =$ ..... [1]

L1 **2** **(a)** Calculate $\frac{13.4^3}{7.56 - 4.89}$.

Write your answer correct to 5 significant figures.

Answer ..... [1]

L1 **(b)** Write your answer to **part (a)** in standard form.

Answer ..... [1]

3 The first four terms of a sequence are 13, 17, 21, 25.

L1 **(a)** Write down the 7th term of the sequence.

Answer ..... [1]

L1 **(b)** Write down an expression for the nth term of the sequence.

Answer ..... [1]

L1 **(c)** Explain why 318 is not a term of this sequence.

Answer

.....

..... [1]

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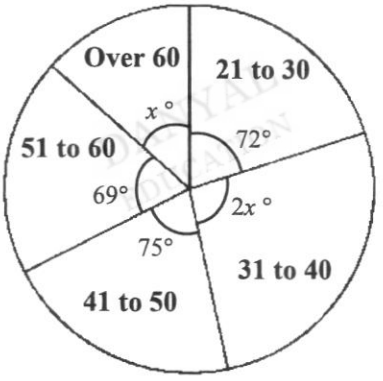
4 The pie chart below shows the age groups (in years) of 240 adults who took part in a triathlon.



L1 **(a)** Find the value of x.

Answer $x =$ ..... [1]

L1 **(b)** Calculate the number of adults aged 41 to 50 years old who took part in the triathlon.

Answer ..... adults [1]

L1 **5** L is a line with a negative gradient and it has positive x- and y-intercepts. The value of y-intercept is five times the value of x-intercept. Given that the x-intercept is $\frac{2}{5}$, find the equation of L.

Answer ..... [3]

L2 **6** An empty fuel tank is filled using a cylindrical pipe with diameter 8 cm. Fuel flows along this pipe at a rate of 2 metres per second. It takes 24 minutes to fill the tank. Calculate the capacity of the tank. Give your answer in litres.

Answer ..... *l* [3]

L1 7 **(a)** Simplify $\left(81x^4\right)^{-\frac{3}{4}}$.

Answer ..... [2]

L2 **(b)** Solve $32^{\frac{1}{5}} \times 2^x = 8^{\frac{1}{4}}$.

Answer $x =$ ..... [2]

8 **(a)** $\xi = \{\text{integers } x : 2 \leq x < 24\}$

$P = \{\text{multiples of 3}\}$

$Q = \{\text{prime numbers}\}$

List the elements in

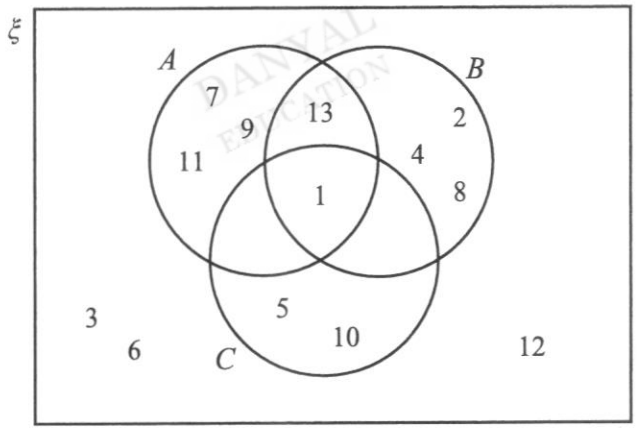
L1 **(i)** P,

Answer ..... [1]

L1 **(ii)** $(P \cup Q)'$.

Answer ..... [1]

(b) The Venn diagram below shows the elements of $\xi = \{\text{integers } x: 1 \leq x \leq 13\}$ and three sets A, B and C.



L1 **(i)** Circle the correct statement(s) from the list below.

$n(A) = 3$ $\quad A \cup B = \{1, 13\}$ $\quad A' \cap (B \cap C) = \varnothing$

$5 \in A' \cap C$ $\quad B' \subset C$

[2]

L1 **(ii)** Find the value of $n[B' \cap (A \cup C)]$.

Answer ..... [1]

L1 **9** Simplify $\dfrac{4m^2 - 20mn + 16n^2}{3m - 12n}$.

Answer ..... [3]

L2 **10** Ching and Lex each have a savings account.
The ratio Ching's savings : Lex's savings = 3 : 5.

They each spent \$60 from their savings.
The new ratio Ching's savings : Lex's savings = 4 : 7.

Find the **total** amount of money Ching and Lex have in their accounts now.

Answer \$ ..... [4]

L1 **11** **(a)** Solve $\cos x = -\cos 65°$, where $0° \leq x \leq 180°$.

Answer $x =$ ..... ° [1]

L1 **(b)** The area of a triangle PQR is 15 cm^2, $PQ = 10$ cm and $PR = 6$ cm.
Find the possible values of $\angle QPR$.

Answer $\angle QPR =$ .....° or .....° [3]

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12 Given that $\mathbf{A} = \begin{pmatrix} 4 & 6 \\ 0 & -2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & k \\ 0 & -1 \end{pmatrix}$, find

L1 **(a)** $\mathbf{A}^2$,

Answer ..... [1]

L1 **(b)** the value of k if $\mathbf{A} = 2\mathbf{B}$.

Answer $k =$ ..... [1]

13 The sales of the IMic and Lovono laptops, in dollars, made by PC Enterprise in the years 2021 and 2022 are summarised below.

	Sales	
Year	**IMic**	**Lovono**
2021	34 000	20 100
2022	14 500	30 000

L1 **(a)** Represent the information in a 2×2 matrix **S**.

Answer **S** = ... [1]

L1 **(b)** Evaluate the matrix $\mathbf{R} = (1 \quad 1)\,\mathbf{S}$.

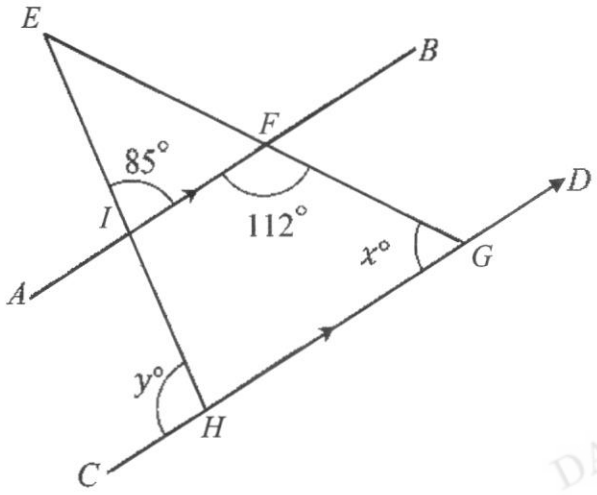
Answer ..... [1]

L1 **(c)** State what each element in matrix **R** represents.

Answer .....

..... [1]

14 In the diagram below, the lines AB and CD are parallel.



By stating your reasons clearly, find the values of

L1 **(a)** x,

Answer $x =$ ..... [1]

L1 **(b)** y.

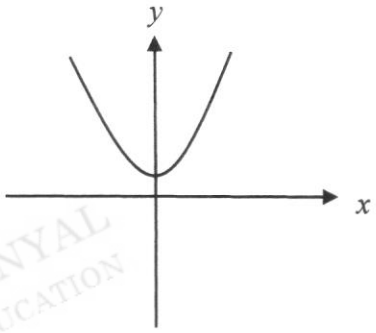
Answer $y =$ ..... [2]

L1 **15** Write down a possible equation for each of the graph below.

In each case, select one of the equations from the table below.

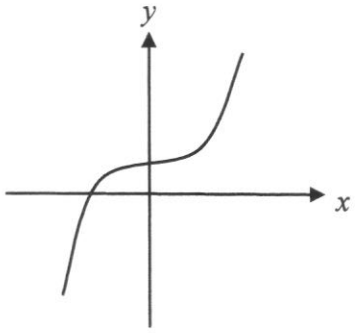
$y = x^3 + 3$	$y = x^2 + 3$	$y = 3x^{-2}$	$y = 3x + 2$
$y = 3 - x^2$	$y = -\frac{3}{x^2}$	$y = x^3 - 3$	$y = 3^x + 3$

(a)



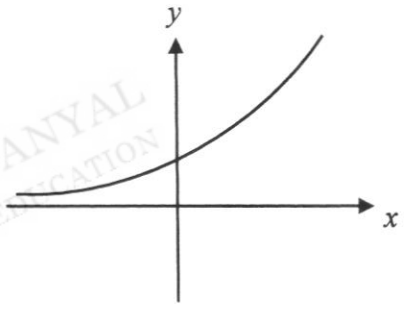
Answer ..... [1]

(b)



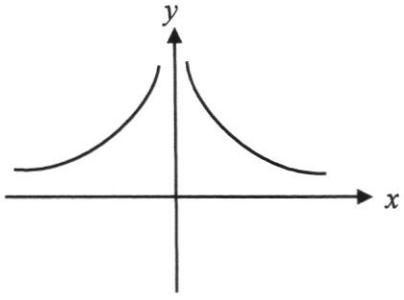
Answer ..... [1]

(c)



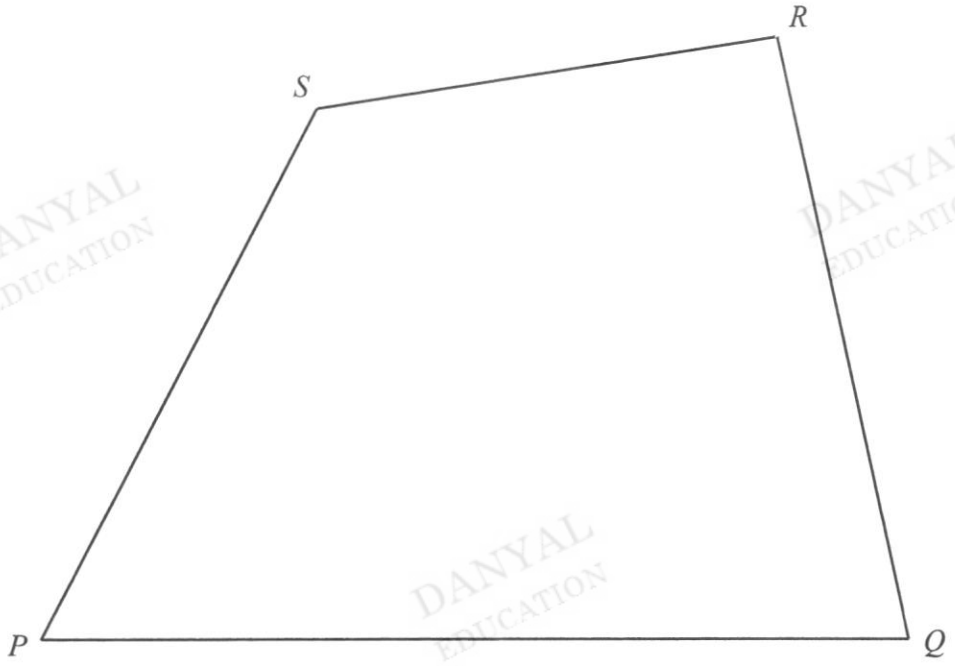
Answer ..... [1]

(d)



Answer ..... [1]

L1 **16** The diagram below represents a plot of land, *PQRS*, which is to be used for a park.



(a) Construct the perpendicular bisector of *PQ*. [1]

(b) Construct the bisector of angle *PSR*. [1]

(c) A children's playground is to be built in the park. The planned location of the playground is nearer to *Q* than to *P*, and nearer to *PS* than to *RS*.
Shade the region where the playground can be built. [1]

17 Factorise completely

L1 **(a)** $3ax + 16by - 12ay - 4bx$,

Answer ..... [2]

L1 **(b)** $3mn - 243mn^5$.

Answer ..... [3]

L1 **18** **(a)** Express $x^2+16x-30$ in the form of $(x+h)^2-k$.

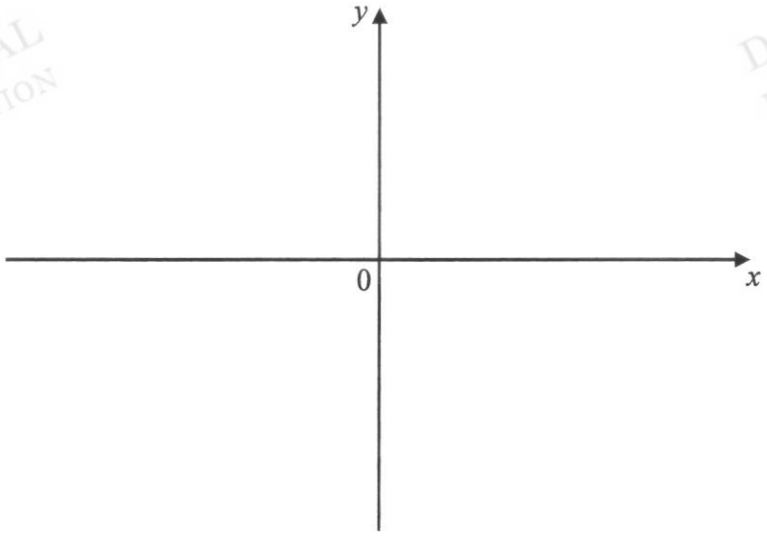
Answer ..... [1]

L1 **(b)** Hence, solve the equation $x^2+16x-30=0$, giving your answers correct to 2 decimal places.

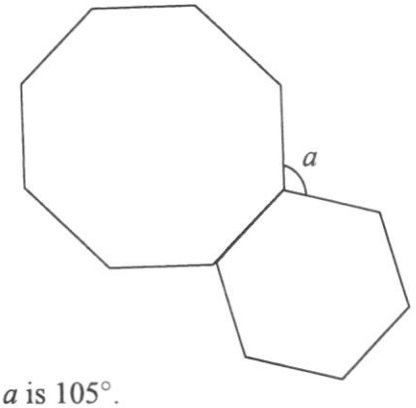
Answer $x=$ ..... or ..... [2]

L1 **(c)** Sketch the graph of $y=x^2+16x-30$, showing the turning point and y-intercept clearly.

Answer [2]



19 Ryan joins two tiles together as shown below. One tile is a regular hexagon and the other tile is a regular octagon.



L1 **(a)** Show that the angle a is $105°$.

Answer [3]

L2 **(b)** Ryan claims that there is another tile in the shape of a regular polygon with interior angle a. Is Ryan correct? Show your reasoning.

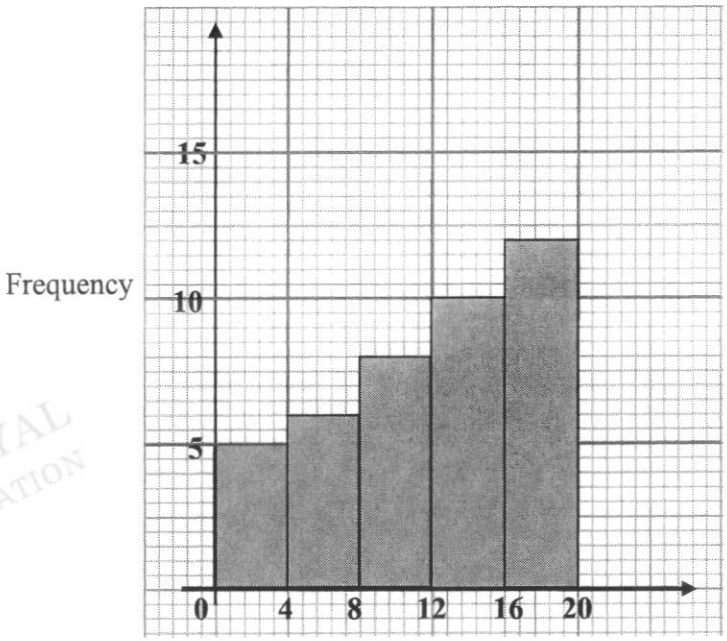
Answer Ryan is correct / incorrect* (**Circle the correct answer*) because

.....

.....

.....[3]

20 The histogram below shows the distribution of the time spent in hours by 41 students on revision in a week.



L1 **(a)** Find the percentage of students who spent more than 12 hours in a week for revision.

Answer ..... % [1]

L1 **(b)** State the class interval which the median lies.

Answer ..... h [1]

L1 **20** **(c)** Calculate

(i) the estimated mean and

Answer ..... h [1]

(ii) the standard deviation of time spent for revision.

Answer ..... h [1]

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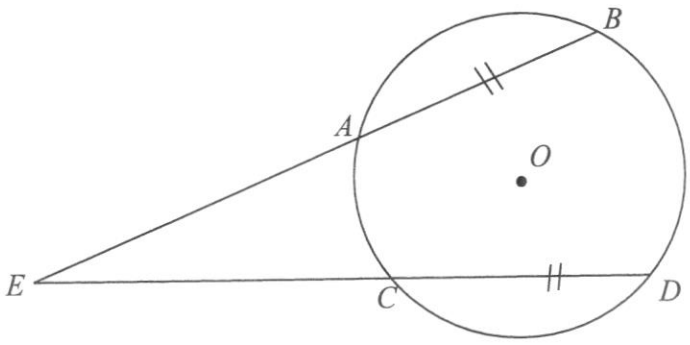
21 In the diagram below, AB and CD are two equal chords of the circle with centre O and radius 25 cm. The chords are extended and meet at the point E.



L3 **(a)** Prove that $EA = EC$.

Answer [4]

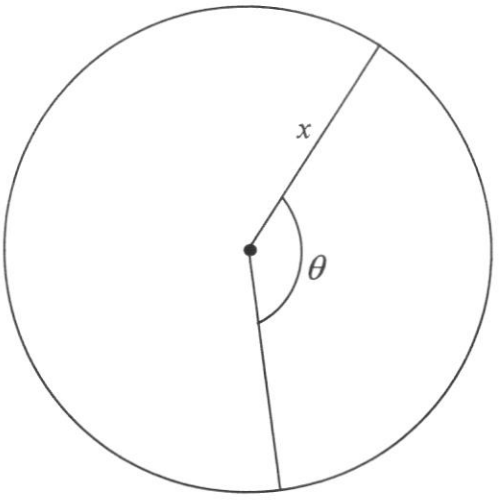
L2 **(b)** Given that $AB = 40$ cm and angle $BED = 30°$, find the length of AE.

Answer ..... cm [3]

L2 **22** The diagram below shows a circle with radius x cm. The circle is divided into two sectors. The angle of the minor sector is θ radians.

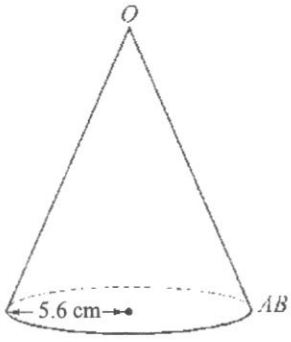
The perimeter of the major sector is thrice the perimeter of the minor sector.

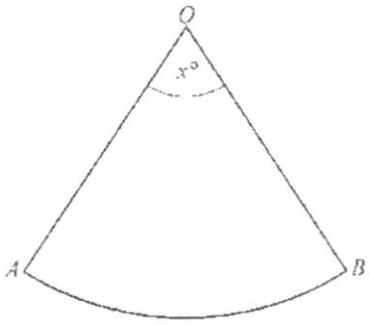
Find the value of θ. Give your answer correct to 3 decimal places.



Answer ..... radians [4]

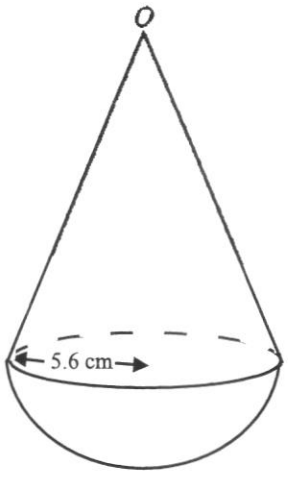
L2 **23** **(a)** The diagram below is a hollow cone of radius 5.6 cm and its volume is 259.44 cm^3. The cone is cut along the slant height from O to AB and is opened to form a sector OAB of a circle with centre O. Calculate the sector angle $x°$.





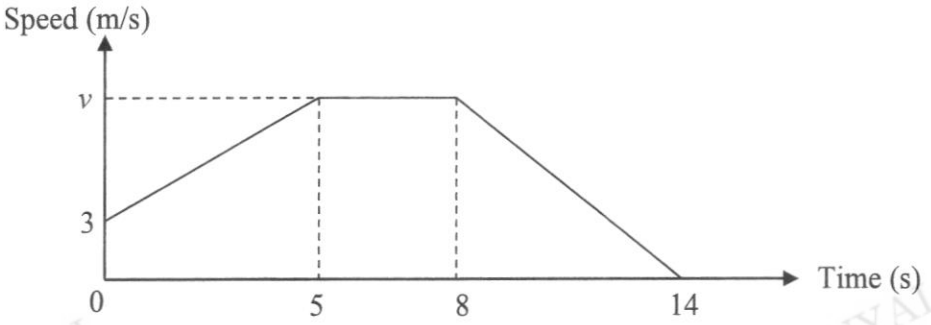
Answer $x =$ ..... [3]

L1 **23** **(b)** Another cone in part **(a)** is joined to a solid hemisphere to form an ornament as shown below. Calculate the volume of the ornament.



Answer ..... cm^3 [3]

24 A particle starts moving at 3m/s and accelerates uniformly at 2 m/s^2 for the first 5 seconds. It then moves with constant speed for 3 seconds, and takes another 6 seconds to slow down uniformly to rest. The speed time graph is shown below.



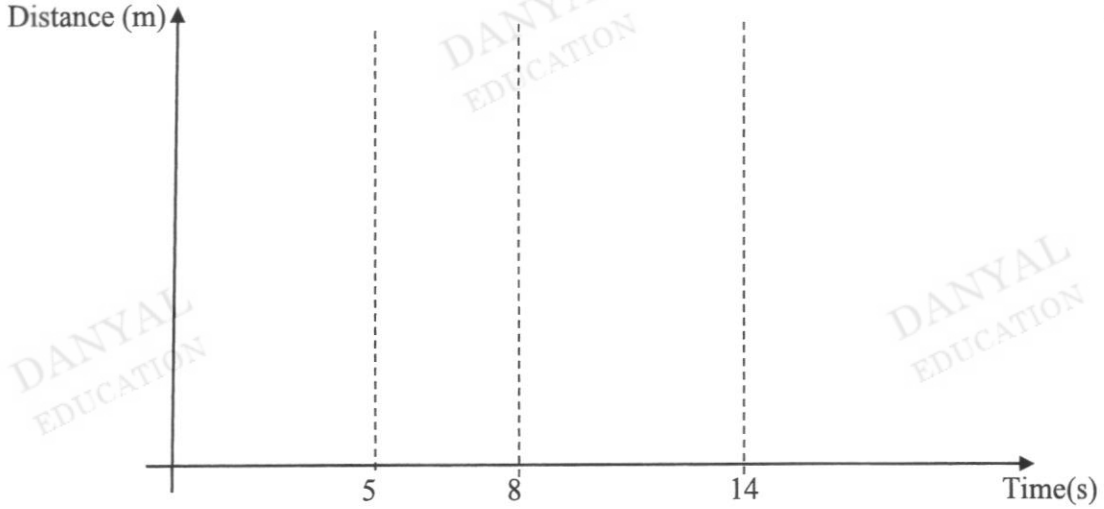
L1 **(a)** State the value of v.

Answer $v =$ ..... [1]

L2 **(b)** Sketch the distance time graph for the motion of the particle.

Answer

[2]



End of paper

FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2023
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

MATHEMATICS 4052/02

Paper 2

Date: 23 August 2023 **Duration: 2 hours 15 minutes**

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	□ 2			
Rounding Off	□ 1		Parent's/Guardian's Signature	90

Setter: Mr James Quek

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Mathematical Formulae

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

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

Arc length = $r\theta$, where θ is in radians

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

Trigonometry

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

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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.

L1 **1** **(a)** $p = \dfrac{2+f}{4f-1}$

(i) Find p when $f = -6$.

Answer $p =$ ..... [1]

L1 **(ii)** Rearrange the formula to make f the subject.

Answer $f =$ ..... [2]

L1 **(b)** Write as a single fraction in its simplest form $\dfrac{3}{x-2} - \dfrac{4}{2x+3}$.

Answer ..... [2]

L1 **1** **(c)** Solve these simultaneous equations.

$$3x - 2y = 56$$

$$3y + 5x = 1.5$$

You must show your working.

Answer $x =$ .....

$y =$ ..... [3]

L1 **1** **(d)** Solve the equation $\frac{y+2}{2} - \frac{10}{3y+2} = 0$.

Answer y = ... or y = ... [3]

L1 **2** **(a)** Jeremy earns $7500 each month.
Jeremy contributes 20% of his first $6000 into his CPF funds.
21% of his CPF funds are distributed to Medi-Save account.
16% of his CPF funds are distributed to Special account.
The remaining of his CPF funds are distributed to Ordinary account.

Calculate the amount of Jeremy's CPF that is distributed to Ordinary account.

Answer $ ..... [2]

L1 **(b)** Jeremy drives a car that consumes 12.5 litres of petrol for every 100 km.
The cost of petrol is $2.50 per litre and there is an additional petrol levy of 20 cents for every litre.
Jeremy drives 440 km to a town in Malaysia.

Calculate the cost of the petrol used for this journey.

Answer $ ..... [2]

L2 2 (c) Jeremy invested $10 000 of his savings for 2 years. The interest from his investment is deposited back to his investment account at the end of each year. The rate of interest for the first year is 2.5%. At the end of the second year, the overall percentage increase of his investment is 8.65%.

Find the rate of interest for the second year.

Answer ..... % [2]

L2 (d) Jeremy is in Japan and decides to buy a jacket for ¥50 000 using a credit card. The cashier offers him 2 options to pay for the jacket;

- Option A: pay in Singapore dollars ($) $468.16 or
- Option B: pay in Japanese yen (¥) ¥50 000.

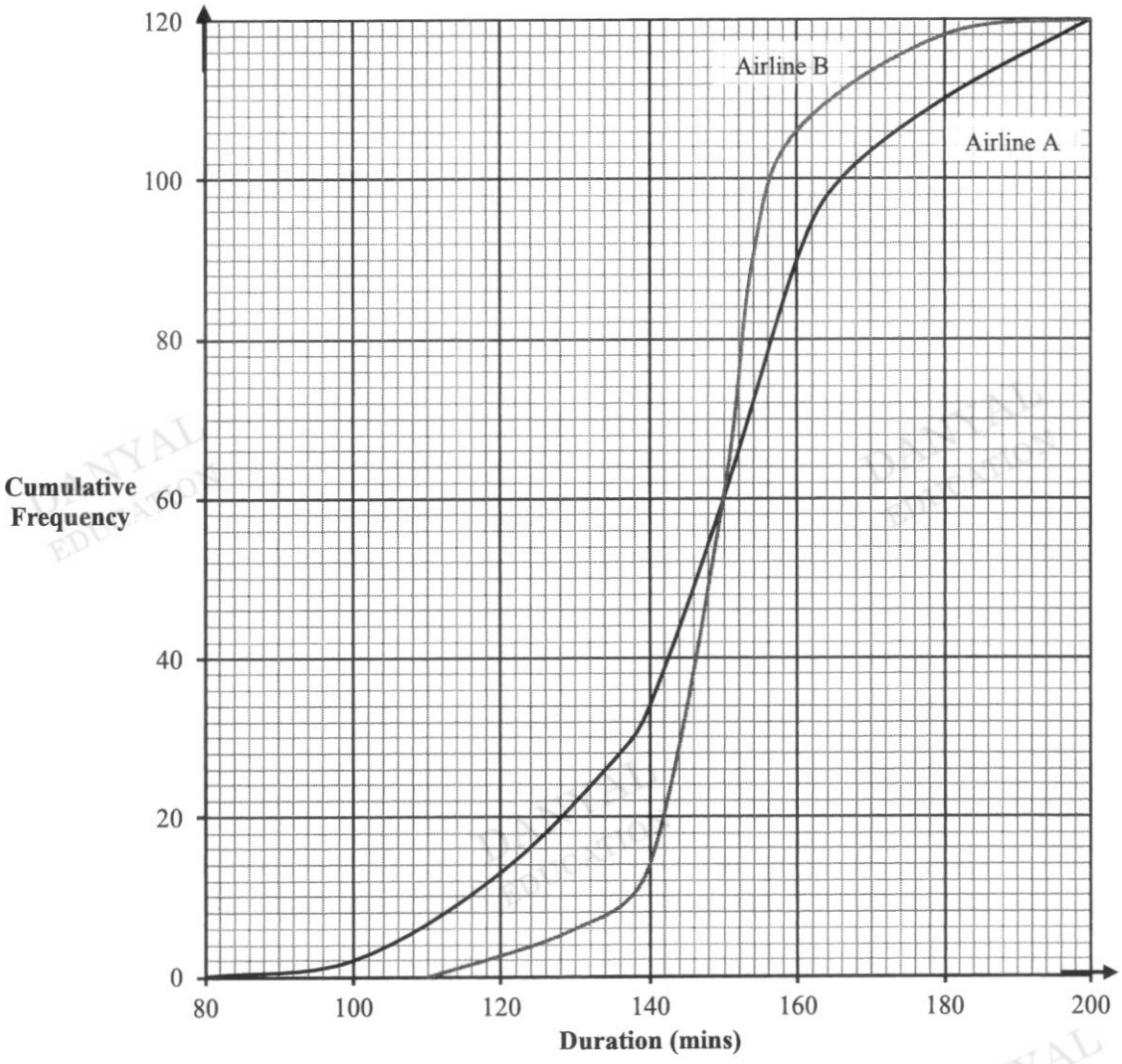
When paying in Japanese yen, the credit card company will convert the amount to Singapore dollars and there is a currency conversion fee of 1.5%.
The exchange rate between Singapore dollars and Japanese yen is $1 = ¥108.

Which option should Jeremy choose? Show your working clearly.

Option ..... because .....

.....[3]

3 The cumulative frequency graph for the duration of 120 movies on Airline A and Airline B is shown below.



L1 **(a)** Use the graph to find

(i) the median duration of movies for Airline B,

Answer ..... mins [1]

(ii) the interquartile range of duration of movies for Airline A.

Answer ..... mins [2]

L1 **3** **(b)** Ali flies with Airline A and he watched 2 different movies with no break between them. What is the maximum possible duration of the 2 movies?

Answer .....hours..... mins [1]

L2 **(c)** Ali prefers to watch movies with a duration between 140 minutes and 160 minutes. Which airlines would be a better choice for Ali?
Justify your answer using appropriate figures.

Airline ..... because .....

..... [2]

L1 **(d)** Meals on Airline A are served 2 hours into the flight. Ali starts to watch a movie as the plane takes off. What is the probability that the movie is still playing when his meal is served? Leave your answer as a fraction in its simplest form.

Answer ..... [1]

L1 **(e)** There are 50 Action movies, 10 Romance movies and 60 Comedy movies.
Ali chose 3 different movies at random to watch on the plane.
Find, as a fraction in its simplest form, the probability that he chose at least 2 Comedy movies.

Answer ..... [2]

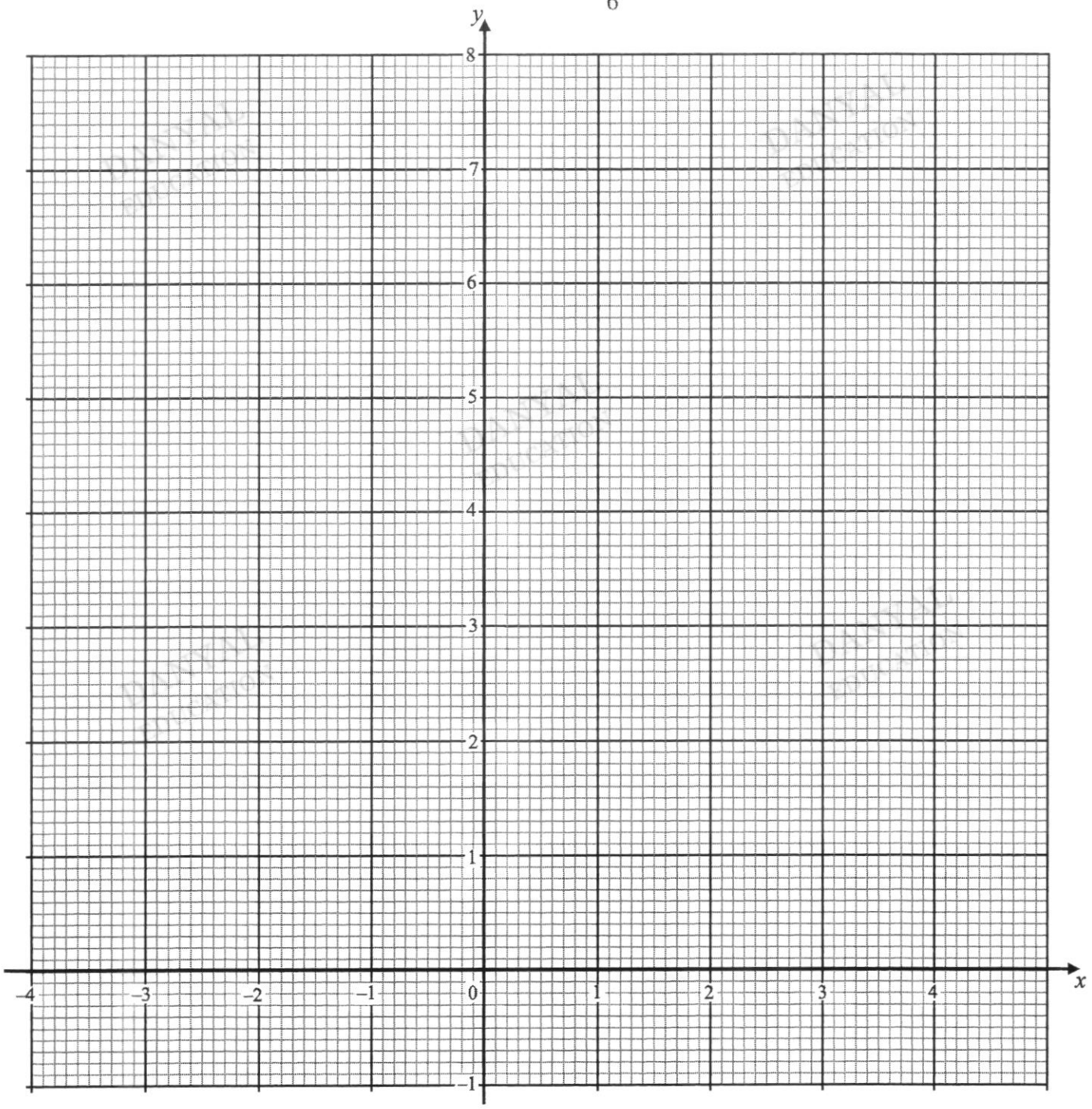
4 The table below shows some values of x and corresponding values of y for $y = -\frac{x^3}{6} + 2x + 4$.

L1 **(a)** Complete the table of values, giving your answer correct to 1 decimal place.

x	–4	–3	–2	–1	0	1	2	3	4
y	6.7	2.5	1.3	2.2	4		6.7	5.5	1.3

[1]

On the grid below, draw the graph of $y = -\frac{x^3}{6} + 2x + 4$ for $-4 \leq x \leq 4$. [3]



L1 **4** **(b)** The equation $-\frac{x^3}{6}+2x+4=k$ has three solutions.
Use your graph to find the range of values for k.

Answer ..... [1]

L2 **(c)** The equation $x^3-15x+3=0$ can be solved by finding the points of intersection of the straight line $y=ax+b$ and the curve $y=-\frac{x^3}{6}+2x+4$.

(i) Find the values of a and the value of b.

Answer a = ...

b = ... [2]

(ii) By drawing the line $y=ax+b$, solve the equation $x^3-15x+3=0$.

Answer x = ... or ..... or ..... [3]

5 **(a)** The position vector of the point P is $\begin{pmatrix} 8 \\ -4 \end{pmatrix}$.

The position vector of the point Q is $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$.

L1 **(i)** Find the vector that represent the translation from P to Q.

Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

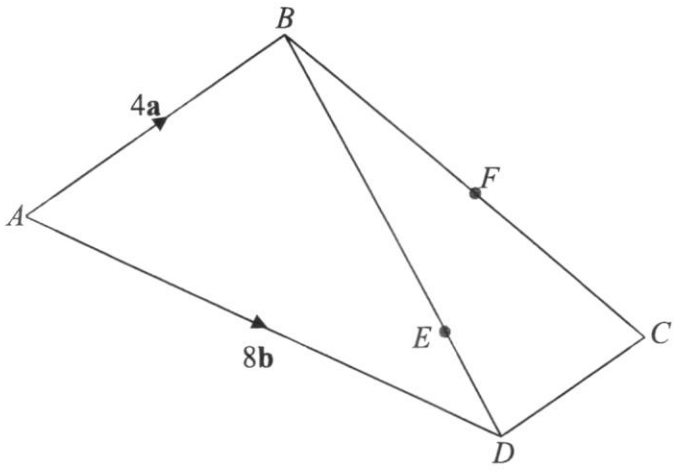
L1 **(ii)** Find the magnitude of $\overrightarrow{PQ}$.

Answer ..... units[1]

L2 **(iii)** R is the point on the line PQ with the coordinates $(2, k)$.
Find the position vector of R.

Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

5 (b)



In the diagram, $\overrightarrow{AB} = 4\mathbf{a}$, $\overrightarrow{AD} = 8\mathbf{b}$ and $\overrightarrow{EF} = 2(\mathbf{a} - \mathbf{b})$.
E is the point on BD such that $BE : BD = 3 : 4$.
F is the midpoint of BC.

L1 **(i)** Express $\overrightarrow{BE}$ in terms of **a** and **b**, as simply as possible.

Answer ..... [2]

L1 **(ii)** Express $\overrightarrow{BC}$ in terms of **a** and **b**, as simply as possible.

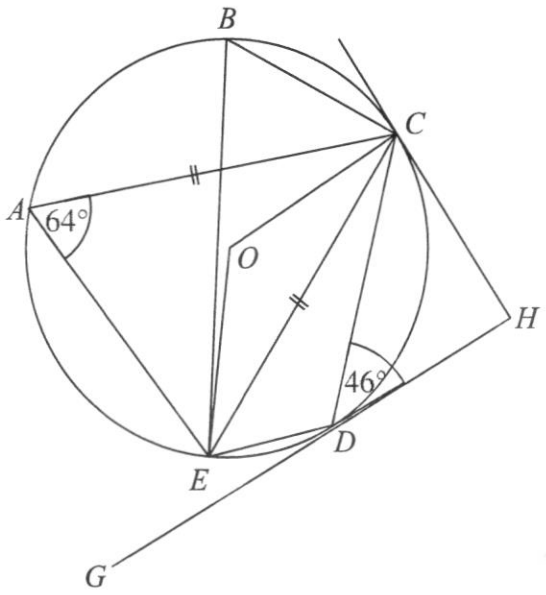
Answer ..... [2]

L3 **(iii)** What type of quadrilateral is $ABCD$?
Justify your answer using vectors.

$ABCD$ is a ..... because .....

..... [3]

6 (a)



A, B, C, D and E are points on the circumference of a circle with centre O.
GH and CH are tangent to the circle at D and C respectively. Triangle ACE is an isosceles triangle. Angle $EAC = 64°$ and angle $CDH = 46°$.

(i) Find, stating your reasons clearly,

L1 **(a)** angle EBC,

Answer .....° [1]

L1 **(b)** reflex angle EOC,

Answer .....° [1]

L1 **(c)** angle EDG.

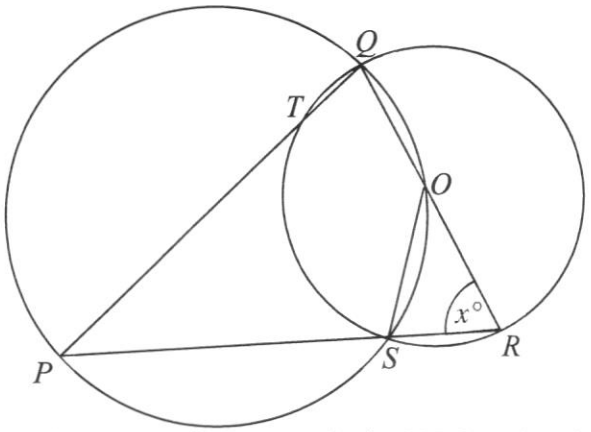
Answer .....° [2]

L2 **(ii)** Explain why a semicircle with CD as diameter, does not past through H.

.....

..... [2]

6 (b)



Circle *RSTQ* with centre *O*, intersects circle *OSPQ* at *Q* and *S*. *PTQ*, *PSR* and *QOR* are straight lines and angle $QRS = x°$.

L2 **(i)** Show that triangles *ORS* and *PRQ* are similar.

.....

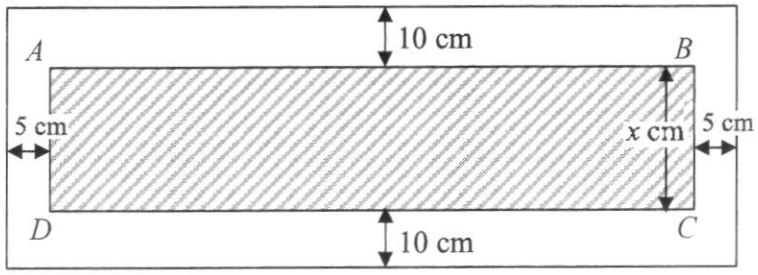
.....

..... [2]

L1 **(ii)** Given $x° = 60°$, find the ratio of the area of triangle *ORS* and quadrilateral *PQOS*.

Answer ..... : ..... [2]

7 A rectangular Chinese painting, $ABCD$, is placed inside a rectangular frame.



The length, AB, of the painting is four times its width, x cm. The dimensions of the frame are shown in the diagram above.

L1 **(a)** The total area of the painting and the frame is 13550 cm^2.
Form an equation in x and show that it simplifies to $2x^2 + 45x - 6675 = 0$.

[3]

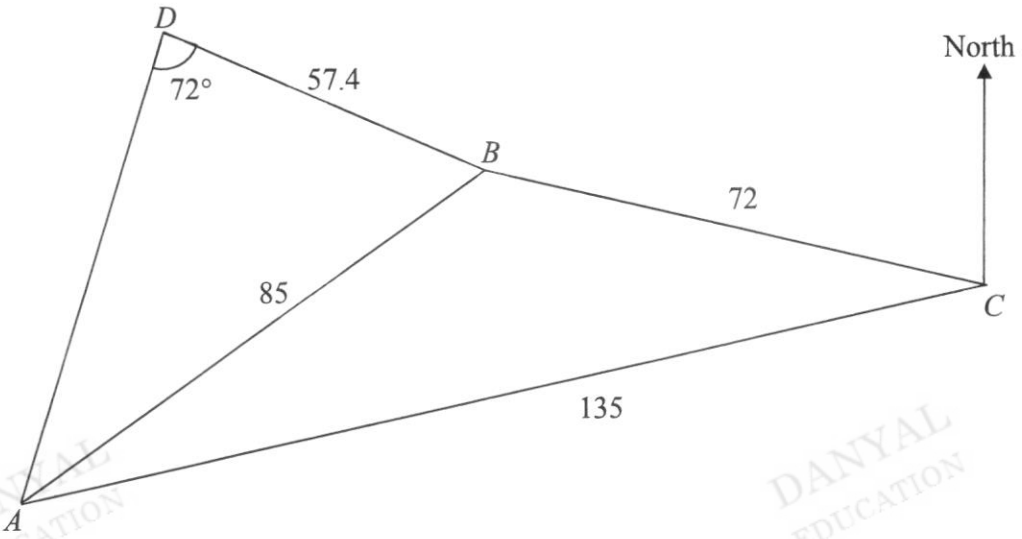
L1 **(b)** Solve the equation $2x^2 + 45x - 6675 = 0$.
Give your solutions correct to two decimal places.

Answer $x =$ ..... or $x =$ ..... [3]

L1 **7** **(c)** The painting is painted on premium rice paper. The cost of premium rice paper is \$63 per square metres. Calculate the cost of the premium rice paper that was used in the painting.

Answer \$ ..... [3]

8



ABC and *ADB* are two triangular plots of land.
AB = 85 m, *BC* = 72 m, *AC* = 135 and *BD* = 57.4 m.
The bearing of *B* from *C* is 290° and angle *ADB* = 72°.

L1 **(a)** Find the bearing of *A* from *B*.

Answer .....° [4]

L1 **8** **(b)** The plot of land *ADB* is to be filled with top soil. Calculate the area to be filled with top soil.

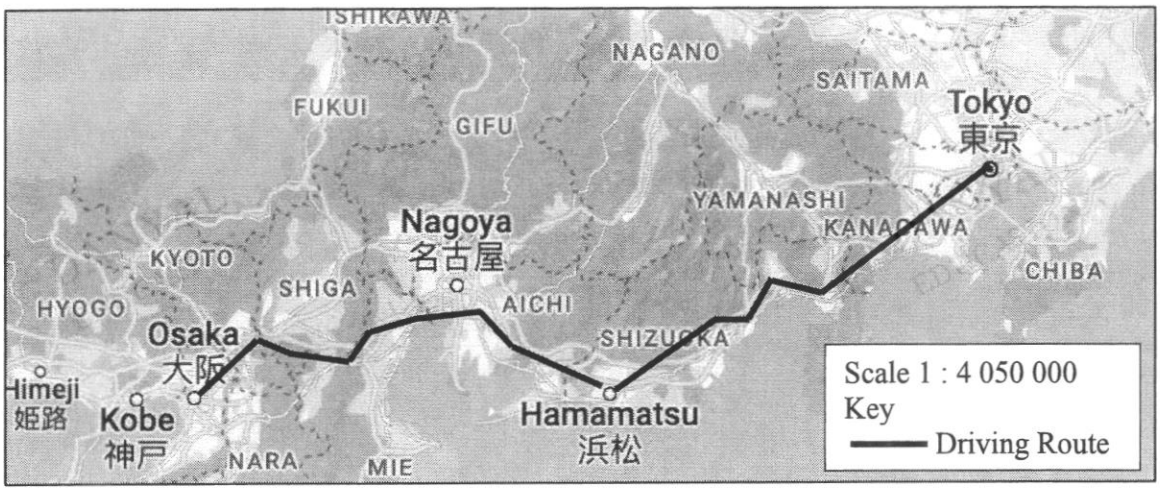
Answer .....m^2 [4]

L2 **(c)** A 40 m antenna mast is installed vertically at point *D*. Find the largest angle of depression from the top of the mast to a point along the path *AB*.

Answer .....° [3]

9 Three friends, Tan, Mei and Jaya are planning for an 8-day holiday trip to Japan in December 2023. They plan to travel from Osaka to Tokyo and then back to Osaka. Below is the itinerary.

Day	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Location	Singapore to Osaka	Osaka to Tokyo	Tokyo	Tokyo	Tokyo	Tokyo	Tokyo to Osaka	Osaka to Singapore



L1 **(a)** Estimate, correct to the nearest km, the driving distance between Osaka and Tokyo.

Answer .....km [2]

L1 **9** **(b)** There are 2 rest stops between Osaka and Tokyo. Jaya plans to drive for 2 hours to the first rest stop at an average speed of 90 km/h.
Mei will drive to the second rest stop 200 km away from the first rest stop at average speed of 100 km/h.
Lastly, Tan will drive to Tokyo at average speed of 110 km/h.
Tan, Mei and Jaya will take a 30-minutes break at each rest stop.

Calculate the total amount of time taken to reach Tokyo. Give your answer to the nearest hour.

Answer .....hours [2]

L3 **9 (c)**

	Small Car	Medium Car	Large Car	SUV	
Amount of fuel used (litres/100 km)	5.5	6.3	7.8	8.2	Car is filled fully with petrol for collection Pick up/return point: Osaka Return with full tank of petrol
Fuel Tank size	40 *l*	45 *l*	45 *l*	50 *l*	
Rental in Japanese Yen (¥) for 6 Days	58 000	60 000	65 000	90 000	
Other Information	Fit 1 luggage	Fit 1 luggage	Fit 2 luggage	Fit 3 luggage	
Fuel Prices	¥170 per litre				
Tokyo Hotel Parking Fees	• ¥6000 per day upon check-in • Free on check-out day				

Approximate toll fare (in ¥)			
	Fukuoka	**Hiroshima**	**Osaka**
Tokyo	25 000	18 000	13 500
Osaka	13 000	7 000	
Hiroshima	7 000		
Fukuoka			

Bullet Train Ticket Prices (in thousand ¥) Osaka Tokyo (One Way)		
Cabin	**Price per Pax***	*There is a 45% increment in price after 1st Oct 2023 Duration: 2 hr 30 min
Econ	16	
Econ with luggage	18	
1st Class	25	
1st Class with luggage	27	

Tan, Mei and Jaya plan to rent a car that can fit 3 luggage to drive to Tokyo and back to Osaka.
Mei collated some information (shown above) that she found on the Internet and suggested to her other 2 friends that taking the bullet train is a cheaper option to drive.

Do you agree with Mei?
Justify your answer and show your working clearly.

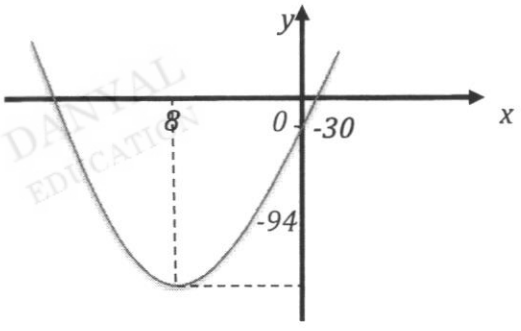
Fairfield Methodist School (Secondary)
Secondary 4 Express / 5 Normal (Academic)
Mathematics Paper 1
Marking Scheme
Preliminary Examinations 2023

Qn No.	Workings	Description	Mark Allocation	AO
1(a)	$540 = 2^2 \times 3^3 \times 5$		B1	AO1
1(b)	$m = 2$ $n = 5$		 B1	AO1
2(a)	901.16		B1	AO1
2(b)	9.0116×10^2 or 9.01×10^2 (3 s.f.)		B1	AO1
3(a)	37		B1	AO1
3(b)	$9 + 4n$		B1	AO1
3(c)	Let $318 = 9 + 4n$ $4n = 309$ $n = 77\frac{1}{4}$ Since n is not a positive integer, 318 is not a term of the sequence.		 B1	AO3
4(a)	$72 + 2x + 75 + 69 + x = 360$ $3x + 216 = 360$ $3x = 144$ $x = 48$		 B1	AO2
4(b)	No. of adults $= \frac{75}{360} \times 240$ $= 50$		 B1	AO1
5	y-intercept = $5(\frac{2}{5})=2$ Gradient of line graph $= -\frac{vert}{horizontal}$ $= -\frac{2}{\frac{2}{5}}$ $= -5$ Equation of line is y = - 5x + 2		M1 M1 A1	AO2

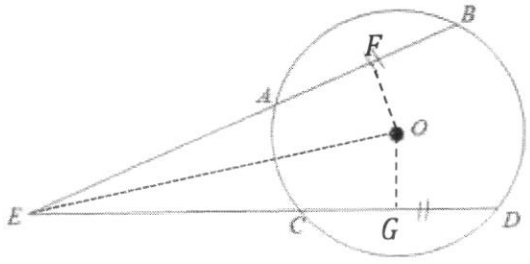
Qn No.	Workings	Description	Mark Allocation	AO
6	Distance travelled by fuel in 24 mins $=2\times24\times60=2880\text{m}$ Capacity of fuel tank $=2880\times\pi(\frac{8/2}{100})^2$ $=14.476$ $=14.5m^3(3sf)$ $=145000l(3sf)$		M1 M1 A1	AO2
7a	$\left(81x^4\right)^{-\frac{3}{4}}$ $=\frac{1}{81^{\frac{3}{4}}}(x)^{-3}$ $=\frac{1}{(3^4)^{\frac{3}{4}}}\times\frac{1}{x^3}$ $=\frac{1}{3^3}\times\frac{1}{x^3}$ $=\frac{1}{27x^3}$	Apply $(a^m)^n=a^{mn}$	M1 A1	AO1
7b	$32^{\frac{1}{5}}\times2^x=8^{\frac{1}{4}}$ $(2^5)^{\frac{1}{5}}\times2^x=(2^3)^{\frac{1}{4}}$ $2\times2^x=2^{\frac{3}{4}}$ $2^{1+x}=2^{\frac{3}{4}}$ $1+x=\frac{3}{4}$ $x=\frac{3}{4}-1$ $=-\frac{1}{4}$	Apply $(a^m)^n=a^{mn}$	M1 A1	AO1
8(a)(i)	{3, 6, 9, 12, 15, 18, 21}	No { } will result to no marks awarded	B1	AO1
8(a)(ii)	{4, 8, 10, 14, 16, 20, 22}		B1	AO1
8(b)(i)	$A'\cap(B\cap C)=\varnothing$ $5\in A'\cap C$	B1 for each correct answer	B1 B1	AO1
8(b)(ii)	$n[B'\cap(A\cup C)]=5$		B1	AO1

Qn No.	Workings	Description	Mark Allocation	AO
9	$\dfrac{4m^2-20mn+16n^2}{3m-12n}$ $=\dfrac{4(m^2-5mn+4n^2)}{3(m-4n)}$ $=\dfrac{4(m-4n)(m-n)}{3(m-4n)}$ $=\dfrac{4(m-n)}{3}$	M1 for factorising out either common factor correctly M1 for factorising $m^2 - 5mn + 4n^2$ correctly	M1 M1 A1	AO1
10	Let Ching's and Lex's original savings be $\$3u$ and $\$5u$ respectively. $\dfrac{3u-60}{5u-60}=\dfrac{4}{7}$ $7(3u-60)=4(5u-60)$ $21u-420=20u-240$ $21u-20u=420-240$ $u=180$ $\therefore$ Total amount of money now $=180(3+5)-2(60)$ $=\$1320$	M1 for converting to linear equation correctly M1 for expanding either side correctly M1 for simplifying either algebraic terms or constants correctly	M1 M1 M1 A1	AO2
11a	$\cos x=-\cos 65°$ $x=180°-65°=115°$		B1	AO1
11b	Area of $\triangle PQR=\dfrac{1}{2}(PQ)(PR)\sin\angle QPR$ $15=\dfrac{1}{2}(10)(6)\sin\angle QPR$ $15=30\sin\angle QPR$ $\sin\angle QPR=\dfrac{15}{30}$ $\angle QPR=\sin^{-1}(\dfrac{15}{30})$ $=30°$ or $150°$		M1 M1 A1 for both ans	AO1
12a	A^2 $=\begin{pmatrix}4 & 6\\ 0 & -2\end{pmatrix}\begin{pmatrix}4 & 6\\ 0 & -2\end{pmatrix}$ $=\begin{pmatrix}16 & 12\\ 0 & 4\end{pmatrix}$		B1	AO1

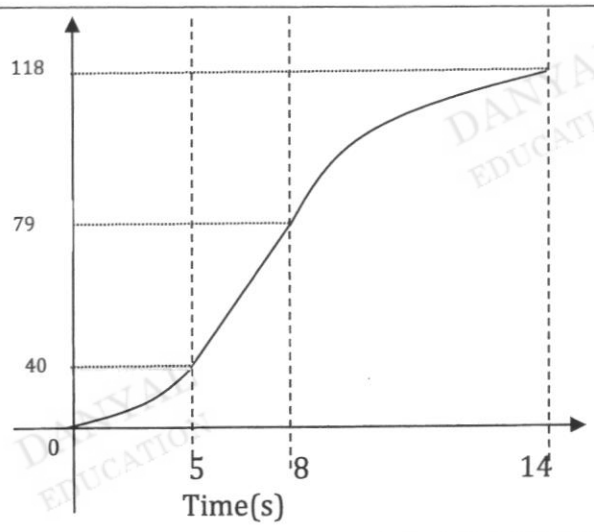
Qn No.	Workings	Description	Mark Allocation	AO
12b	$\mathbf{A} = 2\mathbf{B}$ $\begin{pmatrix} 4 & 6 \\ 0 & -2 \end{pmatrix} = 2\begin{pmatrix} 2 & k \\ 0 & -1 \end{pmatrix}$ $\begin{pmatrix} 4 & 6 \\ 0 & -2 \end{pmatrix} = \begin{pmatrix} 4 & 2k \\ 0 & -2 \end{pmatrix}$ $2k = 6$ $k = 3$		B1	AO1
13a	$S = \begin{pmatrix} 34000 & 20100 \\ 14500 & 30000 \end{pmatrix}$		B1	AO1
13b	$\begin{pmatrix} 1 & 1 \end{pmatrix}\begin{pmatrix} 34000 & 20100 \\ 14500 & 30000 \end{pmatrix}$ $= \begin{pmatrix} 48500 & 50100 \end{pmatrix}$		B1	AO1
13c	The total/combined sales in 2021 and 2022 (or for the 2 years) for IMic and Lenovo Laptops respectively	• Keywords: Total/Combined , respectively, • 2021 and 2022 or past 2 years	B1	AO2
14a	*Angle x* = 180° – 112°(int. angles, AB//CD) = 68°	Deduct 1 mark – wrong or missing reasons	B1	AO1
14b	*Angle z* = 85° (corr. angles, AB//CD) *Angle y* = 180° – 85°(adj. on a str. line) = 95°		M1 A1-	AO1
15a	$y = x^2 + 3$		B1	AO1
15b	$y = x^3 + 3$		B1	AO1
15c	$y = 3^x + 3$		B1	AO1
15d	$y = 3x^{-2}$		B1	AO1
16a	Refer to last page			AO1
16b	Refer to last page			AO1
16c	Refer to last page			AO2

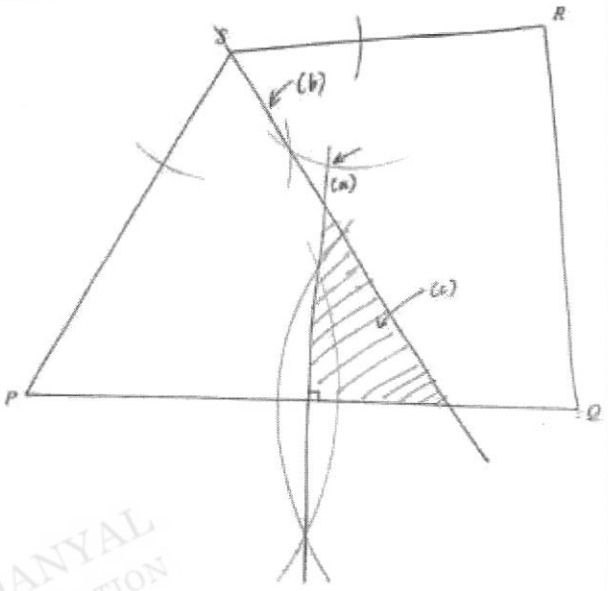
Qn No.	Workings	Description	Mark Allocation	AO
17(a)	$3ax + 16by - 12ay - 4bx$ $= 3ax - 12ay - 4bx + 16by$ $= 3a(x - 4y) - 4b(x - 4y)$ $= (3a - 4b)(x - 4y)$ or $(4b - 3a)(4y - x)$	M1 for factorising any 2 terms correctly	M1 A1	AO1
17(b)	$3mn - 243mn^5$ $= 3mn(1 - 81n^4)$ $= 3mn(1 + 9n^2)(1 - 9n^2)$ $= 3mn(1 + 9n^2)(1 + 3n)(1 - 3n)$	M1 for factorising out $3mn$ M1 for applying difference of squares to $1 - 81n^4$	M1 M1 A1	AO1
18a	$x^2 + 16x - 30$ $= x^2 + 16x + (\frac{16}{2})^2 - (\frac{16}{2})^2 - 30$ $= (x+8)^2 - 94$		B1	AO1
18b	$x^2 + 16x - 30 = 0$ $(x+8)^2 - 94 = 0$ $(x+8)^2 = 94$ $x + 8 = \pm\sqrt{94}$ $x = \sqrt{94} - 8$ or $-\sqrt{94} - 8$ $x = 1.70$(2d.p.) or -17.70(2d.p.)		M1 A1 for both ans	AO1
18c	 Turning Point = (-8, -94) When $x = 0$, $y = (0 + 8)^2 - 94 = -30$	Correct Shape Correct y-intercept and turning point	C1 P1	AO1

Qn No.	Workings	Description	Mark Allocation	AO
19a	Size of 1 int angle from octagon $=\frac{(8-2)\times 180°}{8}=135°$ Size of 1 int angle from Hexagon $=\frac{(6-2)\times 180°}{6}=120°$ $\angle a=360°-135°-120°$(sum of $\angle$s at a pt.) $=105°$		M1 M1 A1	AO1
19b	$\frac{(n-2)\times 180°}{n}=105°$ $n-2=\frac{105°n}{180°}$ $n-\frac{105°n}{180°}=2$ $0.41667n=2$ $n=4.8$ Since n is not a positive integer, that polygon does not exist.		M1 M1 A1	AO3
20a	% of student with revision > 12 hours $=\frac{10+12}{41}\times 100\%=53.7\%(3s.f)$		B1	AO1
20b	Median position = 21st position Median = 12 h – 16hr or 12 hr $\leq$ time $\leq$ 16 hr		B1	AO1
20ci	Est Mean $=\frac{5(2)+6(6)+8(10)+10(14)+12(18)}{41}$ $=11.756$h $=11.8$h		B1	AO1
20cii	Std Deviation = 5.4495h = 5.45 h		B1	AO1

Qn No.	Workings	Description	Mark Allocation	AO
21a	 Since AB=CD, OF = OE(equal chords) ---- S AF = FB = CG = GD (⊥ bisector of chord) $\angle AFO = \angle CGO = 90°$ ---------- R EO is shared side of $\triangle OFE$ and $\triangle OGE$ ----H By RHS Congruency Test, $\triangle OFE \equiv \triangle OGE$ As EF = CE, EA = EF – AF EC = EG – CG Since EF = CE and AF = CG, EA = EC (proven)		M2 for all Evidences M1 for 2 evidences M1 for RHS Test AG1	AO3
21a	Alternative Solution: $EA \times EB = EC \times ED$ (Intersecting Secant Theorem) $EA(EA + AB) = EC(EC + CD)$ $\frac{EA}{EC} = \frac{EA+AB}{EC+CD}$ $\frac{EA}{EC} = \frac{EA+AB}{EC+AB}$, given that $CD = AB$ $\therefore EA = EC$(proven)	State the theorem	M1 M1 M1 AG1	
21b	$\angle BEO = \angle DEO = \frac{30°}{2}$ (OE is ∠bisector of $\angle BED$) $= 15°$ $AF = \frac{40}{2} = 20cm$ $\tan \angle OEF = \frac{OF}{EF} = \frac{15}{EF}$ $\tan 15° = \frac{15}{EF}$ $EF = \frac{15}{\tan 15°} = 55.981cm$ $AE = EF - 20$ $= 55.981 - 20$ $= 36.0$cm (3 s.f)		M1 M1 A1	AO2

Qn No.	Workings	Description	Mark Allocation	AO
21b	Alternative solution: $\angle EBD = \frac{180° - 30°}{2}$ $= 75°$(base $\angle$s of an isos. Δ,EB=ED) $\angle ABO = \cos^{-1}\left(\frac{40^2 + 25^2 - 25^2}{2(40)(25)}\right)$ $= 36.870°(5sf)$ $\angle OBD = 75° - 36.870° = 38.13°$ $BD = \frac{25}{\sin 38.13°} \times \sin(180° - (38.13° \times 2))$ $= 39.331cm(3sf)$ $EB = \frac{39.331°}{\sin 30°} \times \sin 75°$ $= 75.982cm(3sf)$ $AE = 75.982 - 40$ $= 36.0cm(3sf)$		M1 M1 A1	
22	Perimeter of major sector = 3 × Perimeter of minor sector $x(2\pi - \theta) + 2x = 3(x\theta + 2x)$ $2x\pi - x\theta + 2x = 3x\theta + 6x$ $x(2\pi - \theta + 2) = x(3\theta + 6)$ $4\theta = 2\pi - 6 + 2$ $4\theta = 2\pi - 4$ $\theta = \frac{\pi - 2}{2} = 0.571radians(3dp)$		M1 for each correct perimeter M1 for making θ as the subject A1	AO2
23a	Volume of cone $= \frac{1}{3}$(Base area)($\perp$ height) $259.44 = \frac{1}{3}\pi(5.6)^2(\perp \text{height})$ $\perp \text{height} = \frac{259.44 \times 3}{(5.6)^2\pi}$ $= 7.9001cm$ By Pythagoras' Theorem, Slant height of cylinder $\sqrt{7.9001^2 + 5.6^2}$ $= 9.68357cm$ = radius of sector OAB Arc length AB = $2\pi(5.6)$		M1 M1	AO2

Qn No.	Workings	Description	Mark Allocation	AO
	$9.68357(x) = 2\pi(5.6)$ $x = \dfrac{2\pi(5.6)}{9.68357}$ $= 3.63$ radian $= 208.2°(1dp)$		A1	
23b	Volume of hemisphere $= \dfrac{1}{2}\left(\dfrac{4}{3}\pi r^3\right)$ $= \dfrac{2}{3}\pi(5.6)^3$ $= 367.809$ Total volume of ornament $= 367.809 + 259.44$ $= 627.249$ $= 627\ \text{cm}^3(3sf)$		M1 M1 A1	AO1
24a	$2 \times 5 = 10$ Hence $v = 3 + 10 = 13$ m/s		B1	AO1
24b			B1 for 2 parts drawn correctly. B2 for all 3 parts drawn correctly with correct distance	AO2

Qn No.	Workings	Description	Mark Allocation	AO
16		Minus 1 mark for missing construction lines, incomplete perpendicular bisector.	B1 for part (a), (b) and (c) respectively	

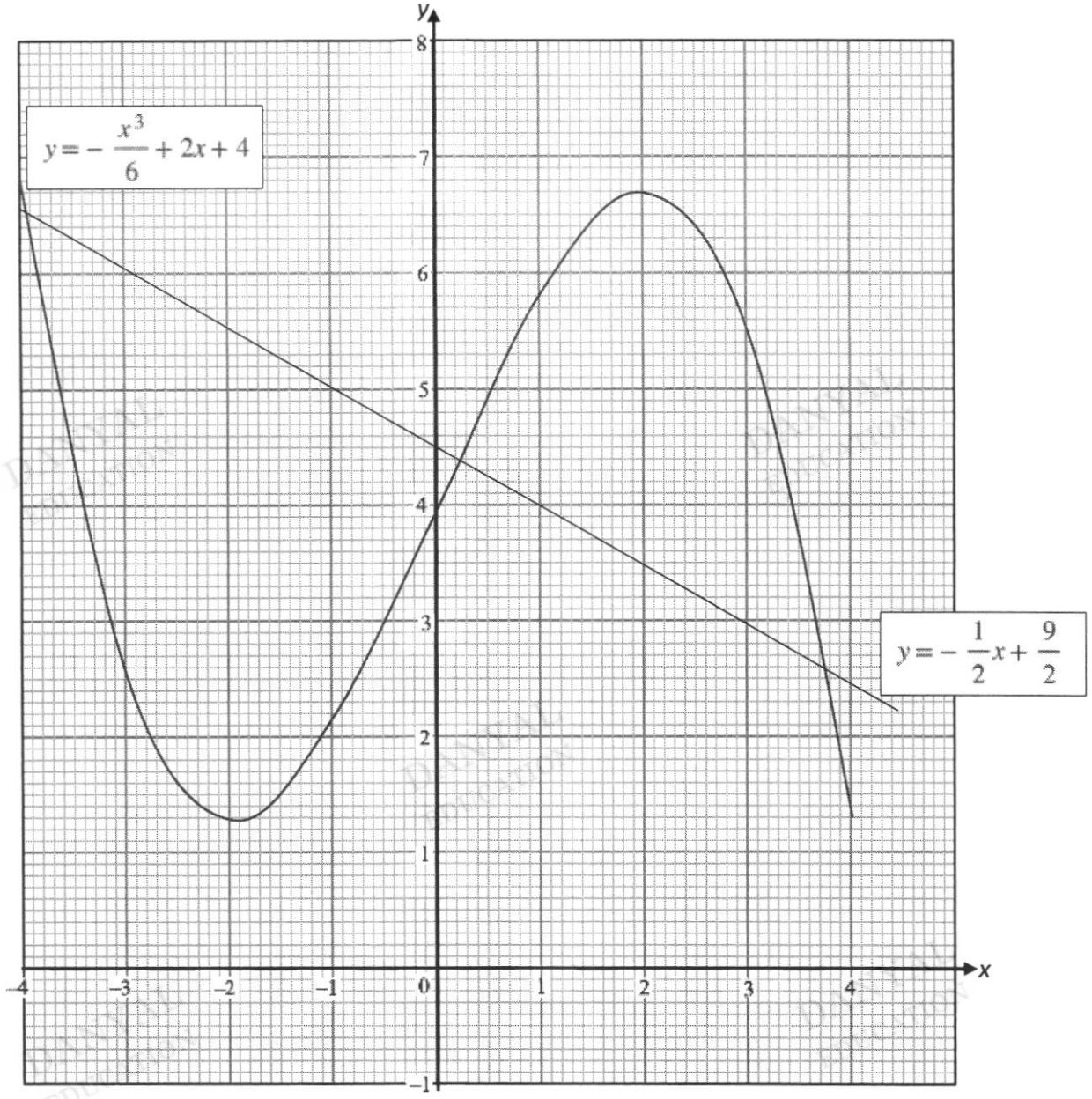
2023 Sec 4E/5N Prelim Math Paper 2 Marking Scheme

QN	Solution	Marks	AO Level
1a(i)	$p=\frac{4}{25}$ or 0.16	B1	N5 AO1
1a(ii)	$p=\frac{2+f}{4f-1}$ $p(4f-1)=2+f$ $4pf-p=2+f$ $4pf-f=2+p$ $f(4p-1)=2+p$ $f=\frac{2+p}{4p-1}$	M1 (x multiply) A1	N5 AO1
1b	$\frac{3}{x-2}-\frac{4}{2x+3}$ $=\frac{3(2x+3)-4(x-2)}{(x-2)(2x+3)}$ $=\frac{6x+9-4x+8}{(x-2)(2x+3)}$ $=\frac{2x+17}{(x-2)(2x+3)}$	M1 (common denominator A1	N5 AO1
1c	$3x-2y=56$----(1) $3y+5x=1.5$----(2) (1)x3, (1)x2 $9x-6y=168$----(3) $6y+10x=3$----(4) (3)+(4) $19x=171$ $x=9,\ y=-14.5$	 M1 (for subst/elim method) A1, A1	N7 AO1

QN	Solution	Marks	AO Level
1d	$\frac{y+2}{2}-\frac{10}{3y+2}=0$ $\frac{y+2}{2}=\frac{10}{3y+2}$ $(y+2)(3y+2)=20$ $3y^2+2y+6y+4-20=0$ $3y^2+8y-16=0$ $(3y-4)(y+4)=0$ $3y-4=0$ or $y+4=0$ $y=\frac{4}{3}$ $y=-4$	M1 (Form Quadratic Eqn) A1, A1	N7 AO1
2a	CPF funds $0.20\times 6000=\$1200$ Ordinary Account $63\%\times 4800=\$756$	B1 B1	N3 AO1
2b	Amount Petrol used $4.4\times 12.5=55l$ Petro Cost $55\times 2.70=\$148.50$	B1/M1 B1/A1	N4 AO1
2c	Return after 1st yr 0.025×10000 $=\$250$ Return after 2nd yr $0.0865\times 10000-250$ $=\$615$ Let x % be rate of interest for 2nd year $\frac{10250x}{100}=615$ $x=6$	M1 A1	N3 AO2

QN	Solution	Marks	AO Level
2d	Option B $1.015\left(\frac{50000}{108}\right)$ $= \$\,469.907$ $= \$\,469.91$ (2dp) Option A because the total charge for Option B is higher than Option A	M1 (converting to SGD) M1 (1.5% fee) A1 (only if Option B is calculated correctly	N10 AO3
3a(i)	150 min	B1	S1/AO1
3a(ii)	LQ = 138 UQ = 160 IQR = 160 – 138 = 22	M1 for LQ/UQ A1	S1 AO1
3b	$200\times 2 = 400$ mins $= 6$ hr 40 mins	B1	S1 AO1
3c	Between 140 mins 160 mins Airlines A has 90 – 34 = 56 movies Airlines B has 106 – 14 = 92movies Airlines B because there are more movies for Ali to choose.	M1 for finding no of movies A1	S1 AO3
3d	Prob of first movie is still playing $= \frac{120-13}{120} = \frac{107}{120}$	B1	S2 AO2
3e	Prob of choosing at least 2 comedy movies $\frac{60\times 59\times 60}{120\times 119\times 118}\times 3 + \frac{60\times 59\times 58}{120\times 119\times 118}$ $= \frac{1}{2}$	M1 A1	S2 AO1
4a	5.8 (1dp) Graph_	B1 P2 all points plotted correct P1 for 7 points plotted correct else P0 C1	N6/AO1

4a



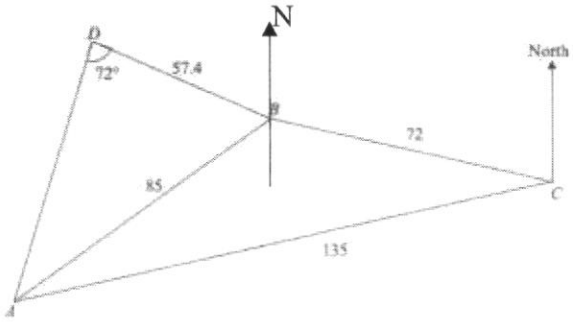
QN	Solution	Marks	AO Level
4b	$1.3<k<6.7 \pm 0.1$	B1	N6 AO2
4c(i)	$x^3-15x+3=0$ $-x^3+15x-3=0$ $-x^3+12x-3=-3x$ $-x^3+12x+24=-3x+27$ $\frac{-x^3+12x+24}{6}=\frac{-3x+27}{6}$ $\frac{-x^3}{6}+2x+4=-\frac{1}{2}x+\frac{9}{2}$ $a=-\frac{1}{2},\ b=\frac{9}{2}$	B1, B1	N6 AO2
4c(ii)	Refer to graph $x=-3.9\pm 0.1$ $x=0.25\pm 0.1$ $x=3.75\pm 0.1$	M1 for drawing $y=-\frac{1}{2}x+\frac{9}{2}$ A2 for all correct A1 for 1 or 2 correct	N6 AO2
5a(i)	$\begin{pmatrix}-2\\8\end{pmatrix}$	B1	G7 AO1
5a(ii)	$\overrightarrow{PQ}=\sqrt{(-2)^2+8^2}$ $=\sqrt{68}$ $=8.246211$ $=8.25\ (3sf)$	B1	G7 AO1

QN	Solution	Marks	AO Level
5a(iii)	$\overrightarrow{PR}=m\overrightarrow{RQ}$ $\overrightarrow{OR}-\overrightarrow{OP}=m(\overrightarrow{OQ}-\overrightarrow{OR})$ $\begin{pmatrix}2\\k\end{pmatrix}-\begin{pmatrix}8\\-4\end{pmatrix}=m\left(\begin{pmatrix}6\\4\end{pmatrix}-\begin{pmatrix}2\\k\end{pmatrix}\right)$ $\begin{pmatrix}-6\\k+4\end{pmatrix}=m\begin{pmatrix}4\\4-k\end{pmatrix}$ $-6=4m$ $m=-\frac{3}{2}$ $k+4=\left(-\frac{3}{2}\right)(4-k)$ $k=20$ $\overrightarrow{OR}=\begin{pmatrix}2\\20\end{pmatrix}$	M1 A1	G7 AO2
5b(i)	$\overrightarrow{BD}=-4a+8b$ $\overrightarrow{BE}=\frac{3}{4}\overrightarrow{BD}$ $\overrightarrow{BE}=\frac{3}{4}(-4a+8b)$ $=-3a+6b$	M1 A1 –1M from whole qn if there is no vector notation	G7 AO1
5b(ii)	$\overrightarrow{BF}=\overrightarrow{BE}+\overrightarrow{EF}$ $=-3a+6b+2a-2b$ $=4b-a$ $\overrightarrow{BC}=2(4b-a)$ $=8b-2a$	M1 A1	G7 AO1

QN	Solution	Marks	AO Level
5b(iii)	$\overrightarrow{DC} = \overrightarrow{DB} + \overrightarrow{BC}$ $= 4a - 8b + 8b - 2a$ $= 2a$ $\overrightarrow{AB} = 2\overrightarrow{DC}$ Since vector AB is a scalar multiple of vector DC, AB is parallel to DC. $ABCD$ is trapezium because AB is parallel to DC.	M1 M1 A1 Must explain scalar multiple therefore AB is // DC	G7 AO3
6(a) (i)(a)	angle EBC = 64° (angles in the same segment)	B1	G3 AO1
6(a) (i)(b)	angle EOC = 2 × 64° = 128° (angles at centre = 2 × angles at circumference) reflex angle EOC = 360°-128° = 232° (angles at a point)	 B1	G3 AO1
6(a) (i)(c)	angle EBC = 64° (angles in the same segment) angle EDC = 180° – 64° = 116° (angles in opposite segments) angle EDG = 180° – 116° – 46° =18° (adj angles on a str line)	 M1 A1 For Qn 6a(i) minus 1 mark if no/wrong reason given	G3 AO1
6(a) (ii)	$CH = DH$ (tangent from ext point) angle CHD = 180°–2(46°) = 88° Since angle CHD does not form a right angle in a semi circle, therefor a semicircle with CD as diameter will not pass through H.	 M1 A1	G3 AO3

QN	Solution	Marks	AO Level
6b(i)	A: angle ORS = angle PRQ (common angle) Angle $OSR = x^\circ$ (base angle of isosceles triangle) Angle $OSP = 180^\circ - x^\circ$ (adj angles on a str line) Angle $PQR = x^\circ$ (angles in opposite segments) A: Angle PQR = angle $OSR = x^\circ$ By AA, triangles ORS and PRQ are similar.	M1 showing both corr angles No mark if no/wrong reason A1	G2 AO3
6b(ii)	Since $x^\circ = 60^\circ$, triangle ORS is equilateral $OR : QR$ 1 : 2 triangle ORS : triangle PRQ 1 : 4 area of triangle ORS and quadrilateral $PQOS$. 1 : 3	 B1 B1 or B2	G2 AO1
7a	$(4x+10)(x+20) = 13550$ $4x^2+80x+10x+200-13550=0$ $4x^2+90x-13350=0$ $2x^2+45x-6675=0$	M1 M1 simplification AG1	N7 AO3
7b	$2x^2+45x-6675=0$ $x=\frac{-45\pm\sqrt{45^2-4(2)(-6675)}}{2(2)}$ $x=\frac{-45\pm\sqrt{55425}}{4}$ $x=47.606$ or $x=-70.106$ $x=47.61\ (2dp)$ or $x=-70.11\ (2dp)$	 M1 A1, A1	N7 AO1

7c	Area of paper $=4(47.606)\times 47.606$ $=9065.3249\ cm^2$ $=0.90653249\ m^2$ Cost of paper $=63\times 0.90653249$ $=\$\ 57.1115$ $=\$\ 57.11\ (2dp)$	M1 for Area M1 for conversion to m^2 A1	G5 AO2

8a	 $135^2 = 85^2 + 72^2 - 2(85)(72)\cos\angle ABC$ $18225 = 7225 + 5184 - 12240\cos\angle ABC$ $-12240\cos\angle ABC = 18225 - 7225 - 5184$ $\cos\angle ABC = \dfrac{5816}{-12240}$ $\angle ABC = \cos^{-1}\left(\dfrac{5816}{-12240}\right)$ $\angle ABC = 118.36998°$ $\angle ABC = 118.4°$ (1*dp*) Angle NBC = 180° – (360° – 290°) =110° Bearing of A from B = 118.4° + 110° =228.4° (1dp) OR $\dfrac{\sin\angle DAB}{57.4} = \dfrac{\sin 72°}{85}$ $\angle DAB = \sin^{-1}\left(\dfrac{\sin 72°}{85} \times 57.4\right)$ $= 39.959°$ $\angle DBA = 180° - 72° - 39.959°$ $= 68.041°$ Bearing of A from B = 360° – (70° + 68.041°) =222.0° (1dp)	 M1 M1 A1 B1 OR M1 A1 M1 A1	G4 AO2

QN	Solution	Marks	AO Level
8b	$\frac{\sin\angle DAB}{57.4}=\frac{\sin 72^\circ}{85}$ $\sin\angle DAB=\frac{\sin 72^\circ}{85}\times 57.4$ $\angle DAB=\sin^{-1}\left(\frac{\sin 72^\circ}{85}\times 57.4\right)$ $\angle DAB=39.95926^\circ \text{ or } 180^\circ-39.95926^\circ \text{ (rej)}$ $\angle ABD=180^\circ-39.95926^\circ-72^\circ=68.04074^\circ$ Area of ABD $=\frac{1}{2}\times 57.4\times 85\times \sin 68.04074^\circ$ $=2262.614527$ $=2260\ m^2\ (3sf)$	M1 A1 M1 A1	G4 AO2

8c	Let DX be the shortest distance from D to AB $\sin\angle ABD = \frac{DX}{57.4}$ $DX = \sin 68.04074° \times 57.4$ $DX = 53.235629\ m$	M1	G4 AO2
	Or	OR	
	$\frac{1}{2}(85)(DX) = 2262.614527$ $DX = \frac{2\times 2262.614527}{85}$ $= 53.2379889$	M1	
	Let largest angle of depression from the top of the mast to point along the path AB be θ° $\tan\theta = \frac{40}{DX}$ $\tan\theta = \frac{40}{53.235629}$ $\theta = \tan^{-1}\left(\frac{40}{53.235629}\right)$ $\theta = 36.9203$ $\theta = = 36.9°\ (1dp)$	M1 A1	

QN	Solution	Marks	AO Level
9(a)	Measure distance = 11.9 to 13 cm 1 : 4 050 000 1 cm: 4 050 000 cm 1 cm : 4 050 0 m 1 cm : 40.5 km Driving distance = 12.4 × 40.5 km = 502 km (nearest km)	M1 for measuring in cm A1 accept 482 to 527 km	N2 AO1
9b	Osaka to rest stop 1 $dist = 90 \times 2 = 180\ km$ Rest stop 1 to 2 $time = \frac{200}{100} = 2hr$ Rest stop 2 to Tokyo $time = \frac{502.2 - 180 - 200}{110} = 1.1109hr$ Total duration $2 + 2 + 1.1109 + 0.5 + 0.5$ $= 6.11\ hr$ $= 6\ hrs\ (nearest\ hour)$	 M1 502.2 or their A1	N10 AO1

QN	Solution	Marks	AO Level
9c	Fuel per way 5.022* × 8.2 = 41.1804*l* Total fuel used 41.1804*l* × 2 = 82.3608*l* Fuel top up cost = 82.3608 × 170 =¥14 001.336 <u>Parking</u> ¥6000 × 5 =¥30 000 <u>Toll Charges</u> ¥13 500 × 2 =¥27 000 <u>Total Cost</u> ¥90 000 + ¥14 001.336+¥30 000+¥27 000 =¥161 001.336 <u>Bullet Train</u> 1.45(¥18 000 × 2 × 3) =¥156 600 Conclusion Cheaper to travel by bullet train	*their distance M1 B1 B1 M1 Car Rental must be correct their Fuel their Parking their Toll Charges B1 C1 only if previous 5M are awarded.	AO3