O

GAN ENG SENG SCHOOL
Preliminary Exam 2025

CANDIDATE NAME

CLASS | | | **INDEX NUMBER** | | |

MATHEMATICS
Paper 1

4052/01

28 Aug 2025
2 hours 15 minutes

Sec 4 Express/ 5 Normal Academic

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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.
Calculators should be used 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 of the marks for this paper is 90.

	For Examiner's Use
Total	90

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

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

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

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

Statistics

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

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

Answer **all** the questions.

1 **(a)** Calculate $\dfrac{33.17\times 55.2^{\frac{1}{3}}}{-(-1)+\sqrt[3]{647.9}}$, giving your answer correct to 1 significant figure.

Answer _____ [1]

(b) Convert 3 m/s to km/h.

Answer _____ km/h [1]

---

2 **(a)** If $10^m = 2$ and $10^n = 11$, find the value of 10^{2m-n}.

Answer _____ [1]

(b) Simplify $\dfrac{7mn^{-1}}{m^2} \div \dfrac{(mn^2)^3}{7}$.

Answer _____ [2]

---

3 The period, T, of a pendulum is proportional to the square root of its length, L.
If the period is increased by 25%, calculate the percentage change in the length.

Answer _____ [2]

---

4 The stem and leaf diagram below shows the times, in minutes, taken by a group of students in a school to assemble a toy car for a charity event.

1	0	2	4	5	5	8	8	9					
2	1	1	3	3	4	5	6	6	6	7	7	8	9
3	0	0	0	1	1	3	7						

Key: 2|0 represents 20 minutes

(a) Find the time taken by the slowest student to assemble a toy car.

Answer _____ minutes [1]

(b) 25% of the students took less than p minutes to assemble a toy car.
Find the value of p.

Answer $p =$ _____ [1]

---

5 Mdm Siti took a bank loan of \$12 000 where the bank charges an annual compound interest of 7% compounded half-yearly.
Find the interest earned at the end of 2 years.

Answer \$_____ [3]

---

6 Given that $z = \frac{\sqrt{x^2 + y}}{2}$, express x in terms of z and y.

Answer $x =$ _____ [2]

---

7 **(a)** **(i)** Express $x^2-6x-16$ in the form $(x+a)^2+b$.

Answer _____ [2]

(ii) Write down the coordinates of the turning point of the graph $y=x^2-6x-16$.

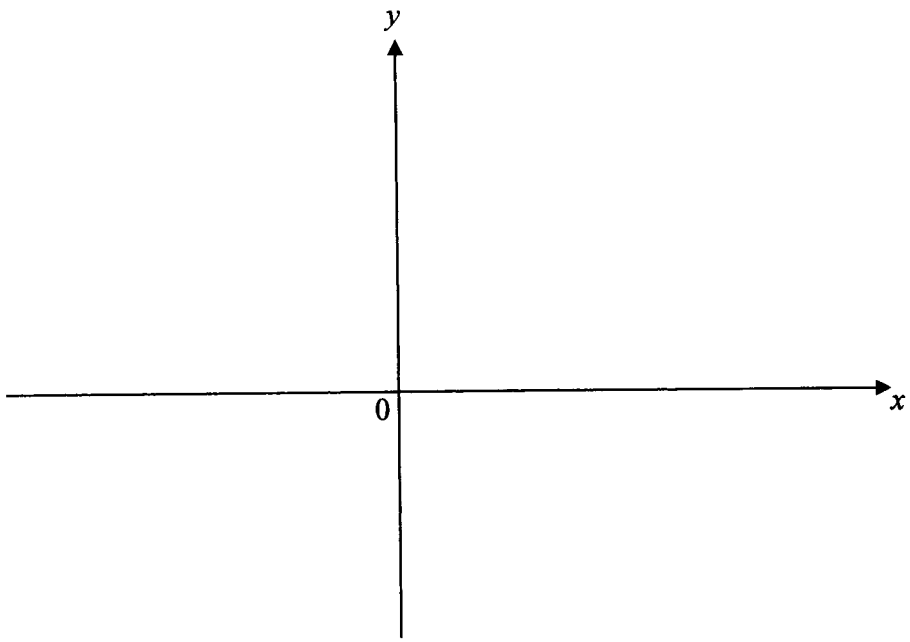
Answer (_____ , _____) [1]

(iii) Write down the equation of line of symmetry.

Answer _____ [1]

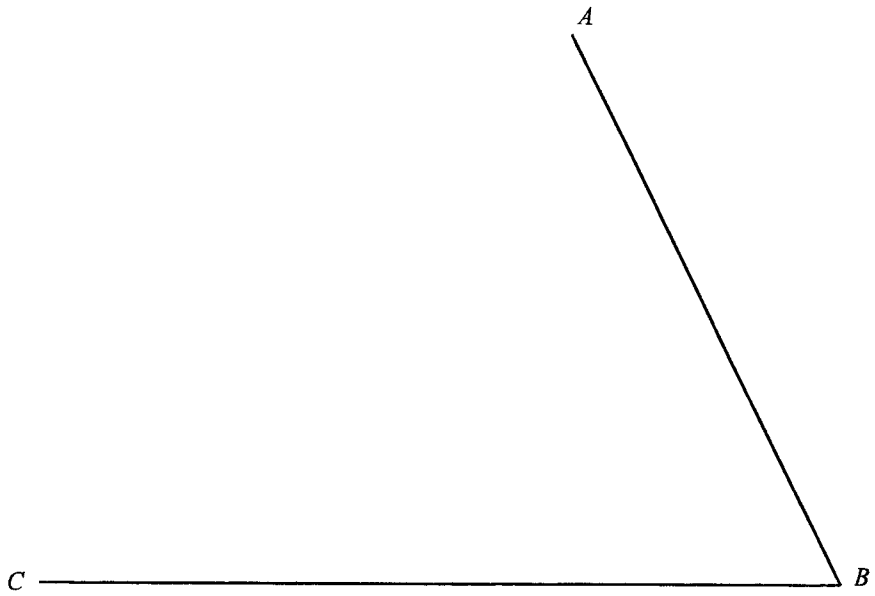
(b) Sketch the graph of $y=-3(x+1)(x-5)$ on the axes below. Indicate clearly the points where the graph crosses the axes and the turning point.

Answer



[2]

8 Three points A, B and C are shown below.



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

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

(c) Mark clearly a possible point which is equidistant from B and C, and is nearer to AB than to BC. Label this point P. [1]

(d) The point N is such that angle $BCN = 85°$ and $AN = 7$ cm.
Find the two possible positions of N and label them N_1 and N_2. [2]

9 The sum of the first n terms of a sequence is $n(3n-2)$.

(a) Find the first 3 terms of the sequence.

Answer _____ , _____ , _____ [2]

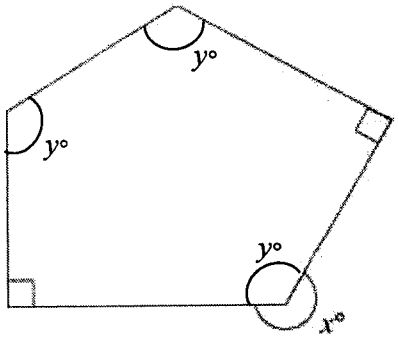
(b) Find, in terms of n, and expression for the nth term of this sequence.

Answer _____ [1]

---

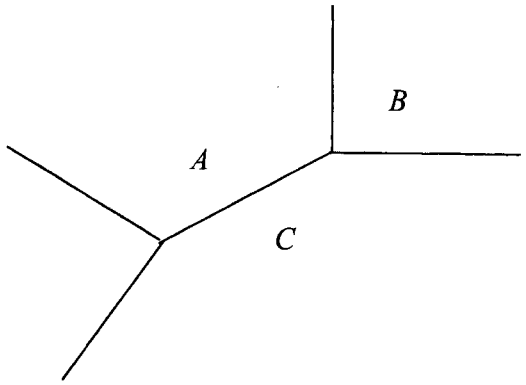
10 (a) The diagram below shows a pentagon with two of its interior angles as right angles, and the remaining interior angles are equal.

Find the value of $\frac{y}{x}$.



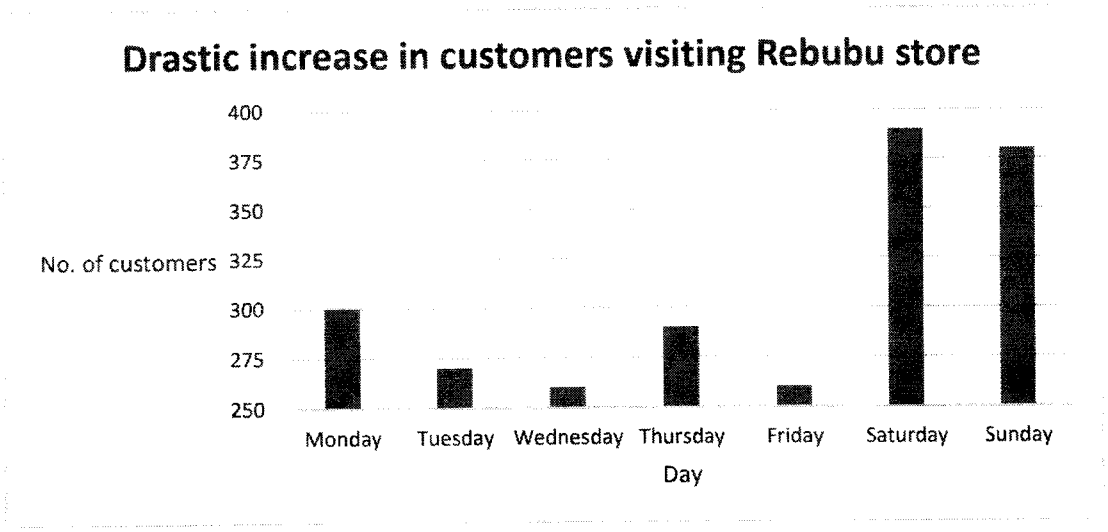
Answer $\frac{y}{x}$ = _____ [2]

(b) The diagram shows three regular polygons, A, B and C, joined together.
Polygon A has 12 sides and polygon B has 4 sides.
Find the number of sides in polygon C.



Answer _____ sides [2]

11 Charles drew the bar graph below for his Element of Business Studies project.



Explain how the bar graph may be misleading.

Answer _____

_____

_____ [1]

12 The position vector of C is $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$. The position vector of D is $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$.

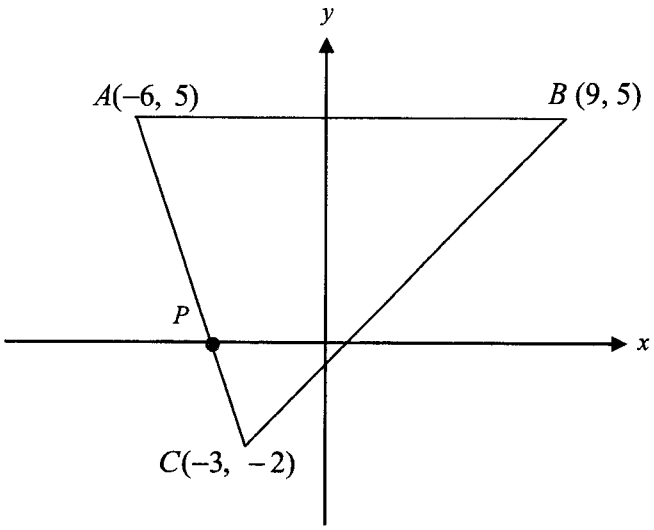
(a) Find the vector that represents the translation from C to D.

Answer _____ [1]

(b) E is a point on CD such that $\left|\overrightarrow{CE}\right| = 2\sqrt{61}$, and the x-coordinate of C is greater than the x-coordinate of E. Find $\overrightarrow{CE}$.

Answer _____ [2]

13 A, B and C are the points $A(-6, 5)$, $B(9, 5)$ and $C(-3, -2)$.



Find

(a) the equation of line AC,

Answer _____ [2]

(b) the equation of the line that is parallel to AC and passes through B,

Answer _____ [2]

(c) area of triangle ABC,

Answer _____ units^2 [2]

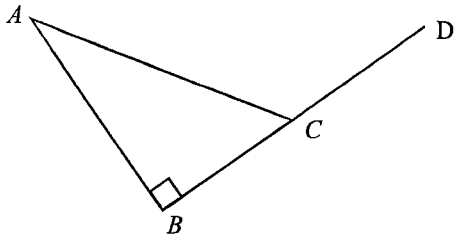
(d) the shortest distance from A to BC,

Answer _____ units [2]

(e) the coordinate of point P as the line AC intersects the x-axis at P.

Answer _____ [2]

14 In the figure, $AB = 12$ cm, $BC = 5$ cm and $\angle ABC = 90°$



(a) Find the value of $\cos \angle ACD$.

Answer _____ [2]

(b) If A, B and C lie on the circumference of a circle, write down the radius of the circle.

Answer _____ cm [1]

---

15 Some bacteria were introduced into a culture.

The number, N, of bacteria t hours after being introduced is given by

$$N = 500 \times 4^t$$

(a) How many bacteria were introduced into the culture?

Answer _____ [1]

(b) Find the percentage increase in the number of bacteria at the end of the second hour.

Answer _____ % [2]

(c) Find the time taken for the number of bacteria to reach 64 000.

Answer $t =$ _____ hours [1]

---

16 **(a)** Simplify $\dfrac{x^2+xy}{x^2+2xy+y^2}$

Answer _____ [2]

(b) Factorise completely $10yz-5y^2-2xz+xy$.

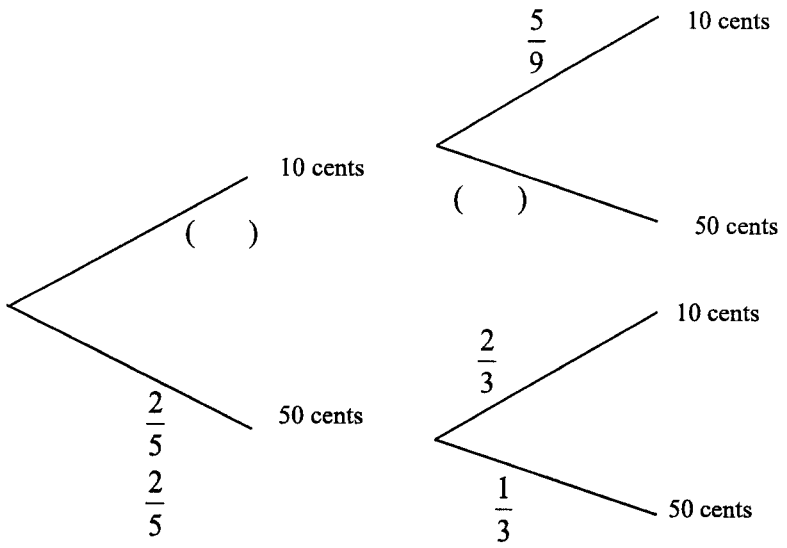
Answer _____ [2]

---

17 Mrs Chan has four 50-cent coins and six 10-cent coins in her purse. She takes out two coins at random from her purse, one after another.

(a) Complete the tree diagram below. [1]

Answer



(b) Find the probability that

(i) the total amount of the two coins taken is exactly 60 cents.

Answer _____ [2]

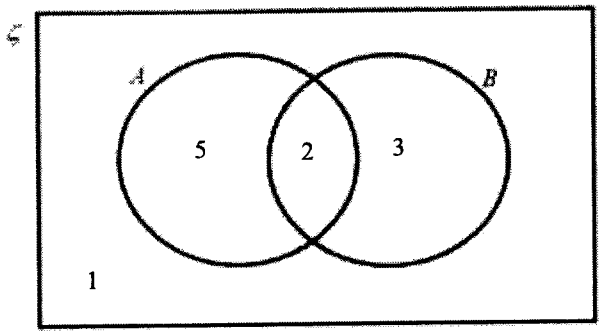
(ii) at least one 50-cent coin is taken.

Answer _____ [2]

18 **(a)** Mr Lim bought a refrigerator on hire purchase. The cash price of the refrigerator is \$1,200. He paid a 20% deposit and agreed to pay the balance in 12 equal monthly instalments. Each instalment included an interest of 1.5% per month on the unpaid balance.
Calculate the total amount paid for the refrigerator under hire purchase.

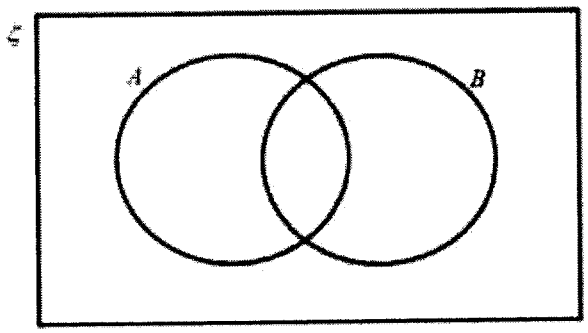
Answer _____ [2]

(b) **(i)** The Venn diagram shows the universal set and the number of elements in each of its subsets.
Find the number of element in the set $(A \cap B) \cup (A \cup B)'$.



Answer _____ [1]

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



Answer On the diagram [1]

19 A nature reserve has a land area of 225 km^2.

(a) Find the area of the nature reserve on a map with a scale of 1: 1 000 000.

Answer _____ cm^2 [2]

(b) The same nature reserve is represented by an area of 36 cm^2 on another map. Express the scale of this map in 1: n.

Answer _____ [2]

---

20 **(a)(i)** Express 4624 as a product of its prime factors.

Answer _____ [1]

(ii) Given that p and q are prime numbers, find the value of p and of q so that $4624 \times pq^{-1}$ is a perfect cube.

Answer $p =$ _____, $q =$ _____ [2]

(b) Javen's test marks are listed below.

26 a 29 25 b c

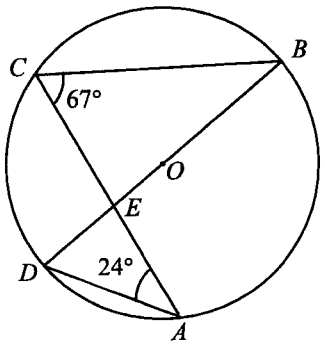
The mean mark is 28.
The median mark is 28.
The modal mark is 29.

Given that $a < b < c$, find the values of a, b, and c.

Answer _____ [2]

---

21 The diagram shows a circle $ABCD$ with centre O and BD passing through O. AC intersects BD at E. Angle $ACB = 67°$ and angle $DAC = 24°$.



(a) Prove, stating your reasons clearly, that ΔAED is similar to ΔBEC.
Answer

[2]

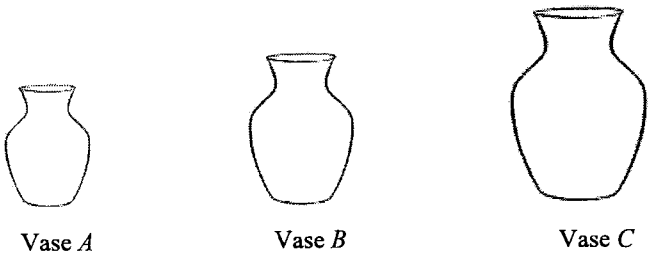
(b) Given that $AE = 3.5$ cm, $CE = 4$ cm, $DE = 2$ cm, calculate the length of EB.

Answer _____ cm [2]

(c) Calculate, as a fraction, the numerical value of the ratio $\frac{\text{minor arc length } AD}{\text{minor arc length } BC}$.

Answer _____ [2]

22 The diagram shows three geometrically similar vases, A, B and C.
The volume of Vase A is 400 cm^3 and its base area is 50 cm^2.



Vase A Vase B Vase C

(a) The base radius of Vase B is three times that of Vase A.
Calculate the base area of Vase B.

Answer _____ cm^2 [2]

(b) The base area of Vase C is 800 cm^2.
Find

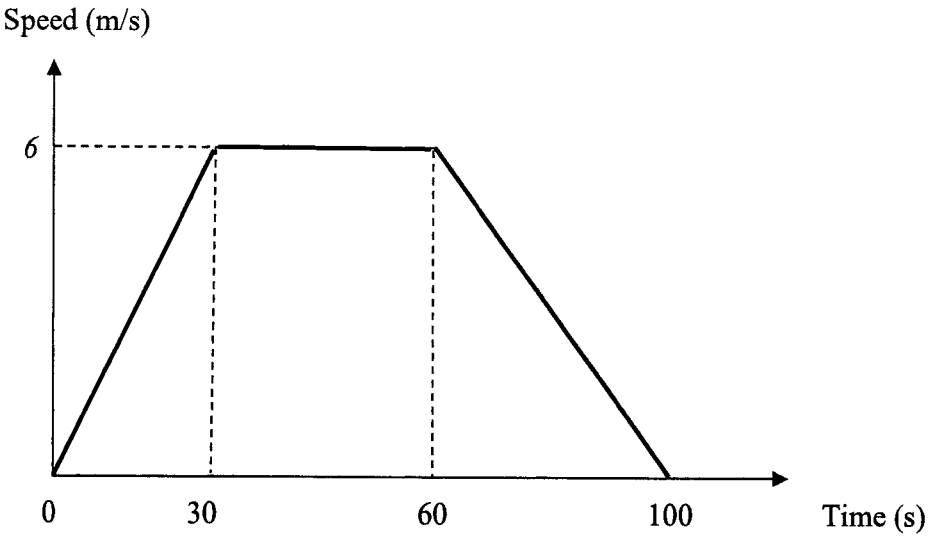
(i) the ratio of the curved surface area of Vase C to the curved surface area of Vase A,

Answer _____ [1]

(ii) the volume of Vase C.

Answer _____ cm^3 [2]

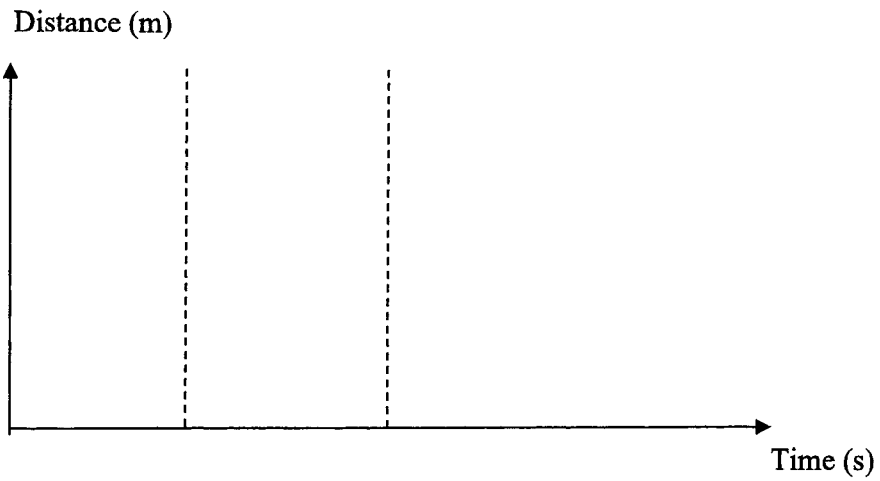
23 The diagram below shows part of the speed-time graph of Javier's cycle journey. Javier travelled from the starting point to point A in 100 seconds.



(a) Calculate Javier's cycling speed at $t = 70s$.

Answer _____ m/s [2]

(b) Sketch the corresponding distance-time graph on the axes below.
Answer [2]



END OF PAPER

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GAN ENG SENG SCHOOL
Preliminary Examination 2025

CANDIDATE NAME

CLASS | | | **INDEX NUMBER** | | |

MATHEMATICS
Paper 2

4052/02

29 August 2025
2 hour 15 minutes

Sec 4 Express / 5 Normal (Academic)

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

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Trigonometry

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

Statistics

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

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

1. **(a)** Solve the inequality $-\frac{2x+1}{3} \leq \frac{3x-1}{-5}$.

Answer _____ [2]

(b) Express as a single fraction in its simplest form $-\frac{x}{1-3x}+\frac{7}{(3x-1)^2}$.

Answer _____ [3]

(c) Solve the simultaneous equations.

$$5x = 49 - 4y$$
$$4x - 5y = -10$$

Answer $x =$ _____

$y =$ _____ [3]

(d) Simplify $\left(\frac{h^{15}}{64f^{12}}\right)^{-\frac{2}{3}}$.

Answer _____ [2]

2. The organiser of the SG60 events held SG60 concerts on two specific weekends in June 2025. The seats in the concert hall were divided into three sections. The table below summarises the number of tickets sold on Saturday and Sunday in week 1.

	Section A	Section B	Section C (obstructed view)
Saturday	164	144	50
Sunday	128	90	40

(a) Write down a 2×3 matrix **A** to represent the information shown in the above table.

Answer _____ [1]

The price per ticket for each section is as shown in the table below.

	Section A	Section B	Section C
Price per ticket	\$30	\$25	\$20

(b) Represent the price of the tickets in a 3×1 column matrix **P**.

Answer _____ [1]

(c) Evaluate the matrix (1 1)**AP** and interpret the element(s) in the matrix.

Answer _____ [2]

_____

_____ [1]

(d) In week 2, the number of tickets sold changes for the various sections on Saturday and Sunday.

The number tickets sold for section A increased by 25%.
The number of tickets sold for section B increased by 50%.
The number to tickets sold for section C decreased to 80%.

(i) Write down a matrix **M** such that the elements of matrix **F**, where **F** = **AM**, represents the number of tickets sold for sections A, B and C respectively on Saturday and Sunday in week 2.

Answer _____ [1]

(ii) State what each element of matrix **FP** represents.

Answer

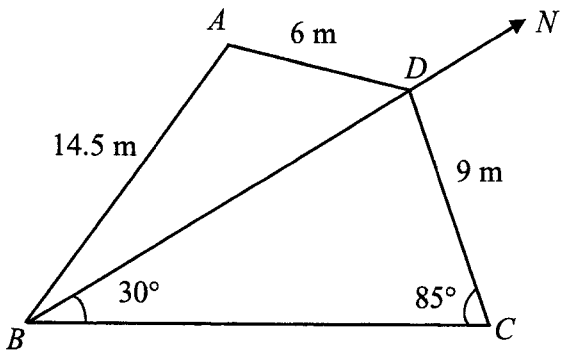
_____

_____

_____

_____ [1]

3. The diagram below shows the points A, B, C and D on the level ground where D is due north of B. $CD = 9$ m, $AB = 14.5$ m, $AD = 6$ m, $\angle DBC = 30°$ and $\angle DCB = 85°$.



(a) Calculate the length of BD.

Answer _____ m [2]

(b) Calculate the bearing of A from D.

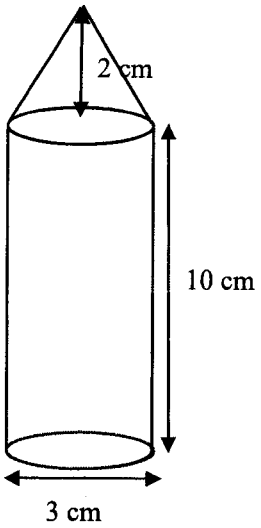
Answer _____ [3]

(c) CT is a vertical pole of height 12 m standing at C.
X is a point along the path BD such that the angle of elevation of the top of the pole, T, from X is the greatest.

Find the angle of elevation of T from X.

Answer _____ [3]

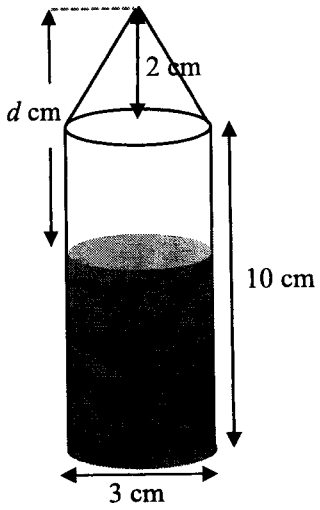
4. A container is in the shape of a cylinder of height 10 cm with a conical top of height 2 cm. The base of the container has a diameter of 3 cm.



(a) Calculate the volume of the container correct to 3 significant figures.

Answer _____ cm^3 [3]

(b) 75% of the container is filled with water as shown in the diagram below. Calculate the depth, d cm, of the empty space in the container.



Answer _____ cm [3]

All the liquid is transferred to fill up a pyramid with square based completely in x minutes.

(c) Find the height of the pyramid if the side of the base is 4 cm.

Answer _____ cm [2]

(d) Find the time taken in terms of x, for the liquid to fill up to $\frac{1}{3}$ the height of the square pyramid in (c).

Answer _____ minutes [1]

5. **(a)** Complete the table of values for $y = \frac{x^2}{7} + \frac{2}{x} - 2$.

Give your answer to 2 decimal places.

x	1	2	3	4	5	6
y	0.14	– 0.42		0.79	1.97	3.48

[1]

(b) Using a scale of 2 cm to 1 unit, draw a horizontal x-axis for $0 < x \leq 6$.
Using a scale of 4 cm to 1 unit, draw a vertical y-axis for $-1 \leq y \leq 5$.
On your grid opposite, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to explain why the equation $\frac{x^2}{7} + \frac{2}{x} - 2 = 0$ has two solutions for $0 < x \leq 6$.

Answer

_____

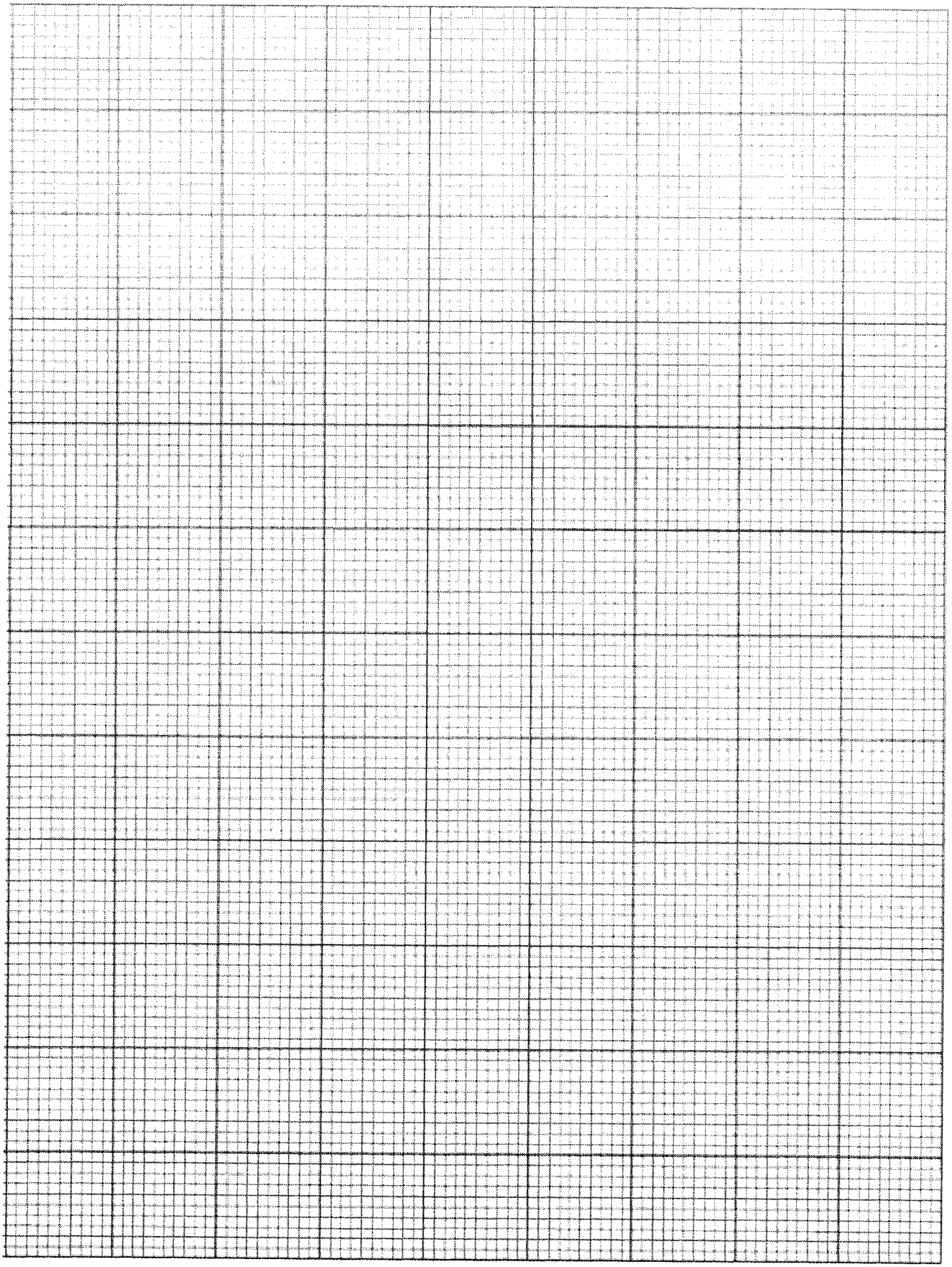
_____ [1]

(d) By drawing a tangent, find the gradient of the curve at (4, 0.79).

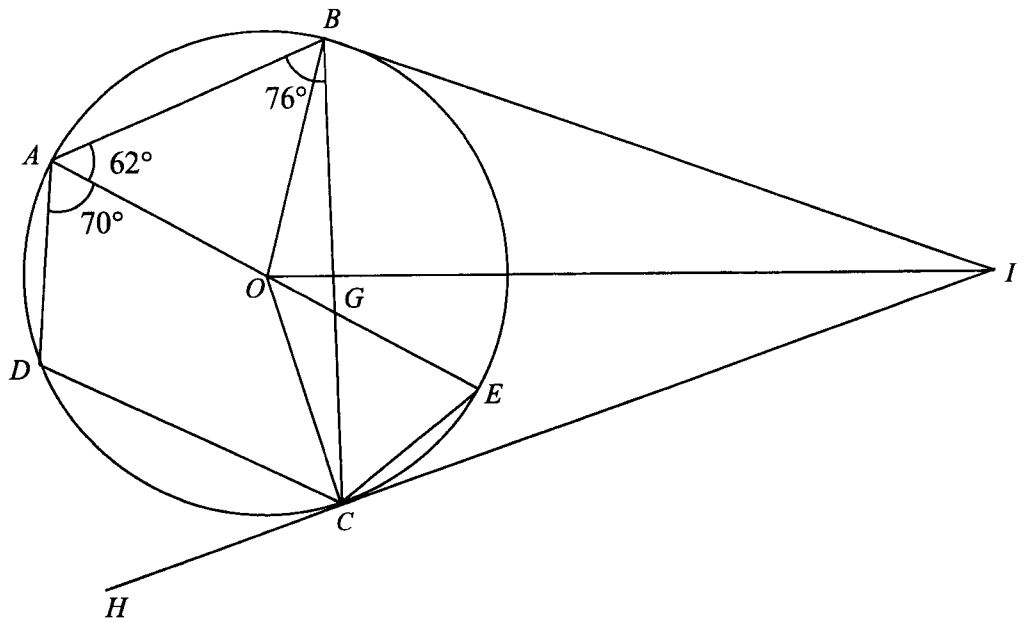
Answer _____ [2]

(e) By drawing a suitable straight line on the grid, solve the equation $x^3 + 7x^2 - 28x + 14 = 0$.

Answer $x =$ _____ [3]



6. **(a)** The points A, B, C, D and E lie on a circle with centre O.
The line HI and BI are tangents to the circle at C and B respectively.
BC intersects AE at G.
Given that $\angle ABC = 76°$, $\angle OAB = 62°$ and $\angle DAE = 70°$.



(i) Show that the triangle OBI is congruent to triangle OCI. Give a reason for each statement you make.

Answer

_____

_____

_____

_____

_____ [2]

(ii) Give reasons for each step of your working, find

(a) angle DCB,

Answer _____ [1]

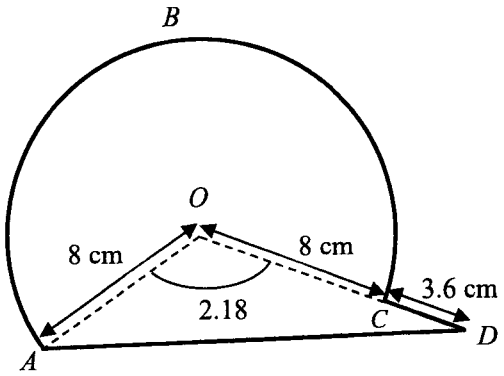
(b) angle *GCO*,

Answer _____ [2]

(c) angle *BCH*.

Answer _____ [1]

(b) In the figure below, O is the centre of the circle. $ABCO$ is a sector.



Given that $\angle AOC = 2.18$ radians, $OA = OC = 8$ cm and $CD = 3.6$ cm,

(i) calculate the perimeter of $ABCDA$,

Answer _____ cm [4]

(ii) find the value of $\frac{\text{area of sector } ABCO}{\text{area of triangle } AOD}$.

Give your answer correct to 2 decimal places.

Answer _____ [3]

7. The waiting times, in minutes, for 50 patients at the Accident and Emergency clinics in two hospitals are given below.

Hospital A

Time (mins)	No. of patients
$20 < t \leq 24$	8
$24 < t \leq 28$	10
$28 < t \leq 32$	21
$32 < t \leq 36$	7
$36 < t \leq 40$	4

Hospital B

Mean = 29.12
Standard Deviation = 3.2

(a) Calculate the mean and standard deviation of the waiting times in hospital A.

Answer Mean = _____ [1]

SD = _____ [2]

(b) Compare briefly, the waiting time for the A&E clinics in both hospitals.

Answer

_____

_____

_____

_____

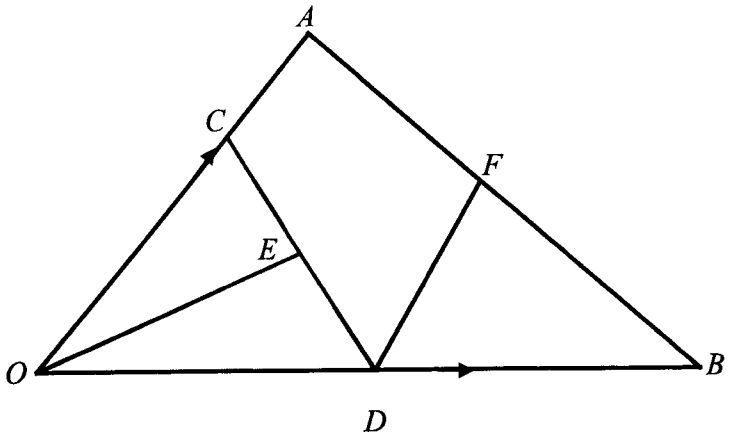
_____

_____ [2]

(c) Two patients are selected at random from the 50 patients in hospital A.
Find the probability of selecting one patient having to wait 24 minutes or less and the other having to wait more than 32 minutes.

Answer _____ [2]

8. In triangle OAB, the point C on OA is such that $3OC = 2OA$. E and D are the midpoints of CD and OB respectively and $AF = mAB$. $\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{OB} = \boldsymbol{b}$.



(a) Express, as simply as possible, in terms of **a** and **b**,

(i) $\overrightarrow{AB}$,

Answer _____ [1]

(ii) $\overrightarrow{CE}$.

Answer _____ [2]

(b) **(i)** Write down $\overrightarrow{OF}$ in terms of **a**, **b** and m.

Answer $\overrightarrow{OF}$ = _____ [2]

(ii) $\overrightarrow{OE} = \frac{3}{5}(1-m)\,\mathbf{a} + \frac{3}{5}m\,\mathbf{b}$.

Show that O, E and F lie on a straight line.

Answer

[2]

(c) Find, as a fraction in its simplest form,

(i) $\dfrac{\text{area of triangle } AEC}{\text{area of triangle } OEC}$,

Answer _____ [1]

(ii) $\dfrac{\text{area of triangle } OCD}{\text{area of triangle } OAB}$.

Answer _____ [1]

9. Ali and Robert participated in the 42 km running event organised by SC Company. Ali completed the race with an average speed of x km/h. Robert completed the race at an average speed of 2 km/h slower than Ali.

(a) Given that Robert completed the race 30 minutes later than Ali, form an equation in x and show that it reduces to $x^2 - 2x - 168 = 0$.

Answer

[4]

(b) Solve the equation $x^2 - 2x - 168 = 0$.

Answer $x =$_____or_____ [2]

(c) Explain why one of the solutions in (b) must be rejected.

Answer

_____

_____ [1]

(d) Calculate the time taken for Robert to complete the race.

Answer _____ hours [1]

10. Mdm Siti is planning a trip from Singapore to London. She will spend 6 days in London. Here are the information on her trip.

- The total flight duration is 13 hours 50 minutes, which excludes a 2-hour layover at Doha.

Singapore to Doha	7 h 40 min
Doha to London	6 h 10 min

- Her flight departs at 11:15 PM (Singapore time).
- London time is 7 hours behind Singapore time.
- The exchange rate is 1 Pound Sterling (£) = 1.65 Singapore Dollars (SGD).

(a) What is her arrival time in London, in local London time?

Answer _____ [1]

Mdm Siti plans to bring a total amount of SGD$700 for meals, transport, sightseeing and emergencies.
She plans to spend the following amount on average for the entire trip in London:
£25 per day on food
£10 per day on transport
£15 per day on sightseeing
10% of the total amount for emergencies

(b) By showing your working clearly, determine whether SGD$700 is sufficient for her meals, transport and sightseeing.

Answer Sufficient / Insufficient [3]

(c) Mdm Siti plans to spend four days sightseeing in London and only visit 2 attractions per day. She is considering three sightseeing options:

Option	Type	Description
A	Fixed daily pass	4-day London Sightseeing Pass, covering unlimited entries for £90, with 5% discount if she stays more than 5 days in London.
B	Pay-as-you-go	Each attraction costs £12.50.
C	Partial Pass + Pay-as-you-go	She buys a 2-day pass for £35, covering unlimited entries for 2 days, and pays £6 per attraction for the other 2 days.

Assuming the total amount set aside for sightseeing remains the same for the four days, show your calculations and explain which option would be more cost-effective for Mdm Siti, considering her sightseeing plans and budget.

I would recommend Option _____.

Reason : _____

_____ [5]

End of Paper