SWISS COTTAGE SECONDARY SCHOOL
SECONDARY FOUR AND FIVE
PRELIMINARY EXAMINATION

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Name: _____ ( ) Class: _____

MATHEMATICS

4052/02

Paper 2

Tuesday 27 August 2024

2 hours 15 minutes

Candidates answer on the Question Paper.

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.
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.
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	
Section A	/31
Section B	/59
Total	/90

This document consists of **21** printed pages and **1** blank page.

Setter: Mdm Tan Poh Kim
Vetter: Mdm Zoe Pow

[Turn over

Mathematical Formulae

Compound interest

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

Mensuration

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

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 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

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

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

TURN OVER FOR QUESTION 1

Questions	1	2	3
Marks	/11	/10	/10

Section A (31 marks)

1 **(a)** Solve the inequality $\frac{3x+1}{3} < \frac{2-5x}{4}$.

Answer ……. [2]

(b) It is given that $a = \frac{2b-3c}{b+2c}$.

(i) Find a when $b = 0.2$ and $c = -1.5$.

Answer a = …….. [1]

(ii) Express b in terms of a and c.

Answer b = ……... [3]

(c) Solve the equation $\frac{5x}{x-3} - \frac{2}{2x-3} = 1$.

Give your solutions correct to 3 decimal places.

Answer $x =$ ……..……. or …….……. [5]

2 **(a)** Complete the table of values for $y = x^2 + 2x - 1$

x	–4	–3	–2	–1	0	1	2
y		2	–1	–2	–1	2	7

[1]

(b) On the grid opposite, draw the graph of $y = x^2 + 2x - 1$ for $-4 \le x \le 2$. [3]

(c) Use your graph

(i) to write down an inequality in x to describe the range of values where $y < 3$,

Answer …..…….. [1]

(ii) to solve the equation $x^2 + 2x + \frac{1}{2} = 0$.

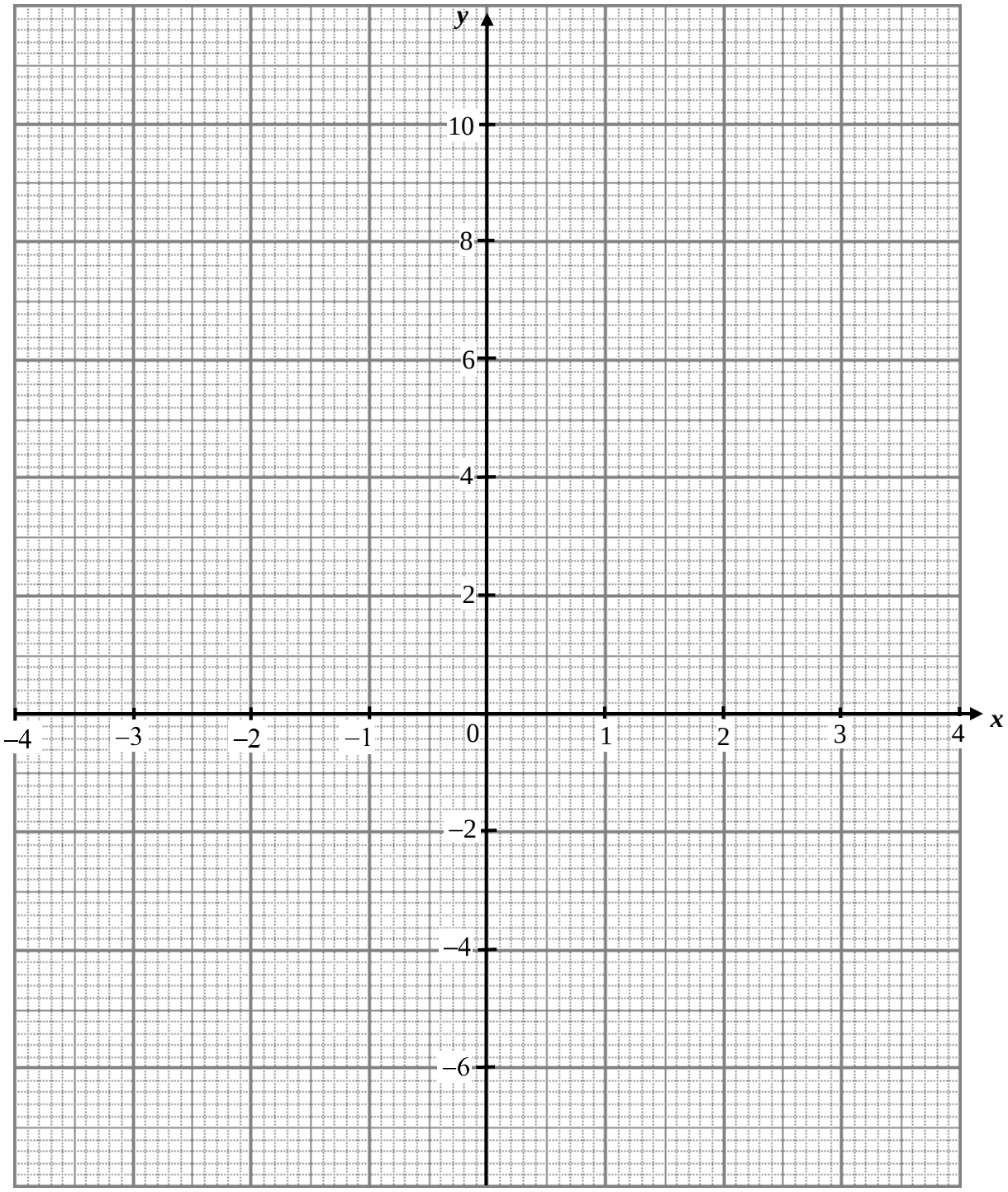
Answer x = ……..… or ……..... [3]

(d) Based on the graph, Eileen stated that 'the coordinates of the minimum point of the graph is $(-1, -2)$'.

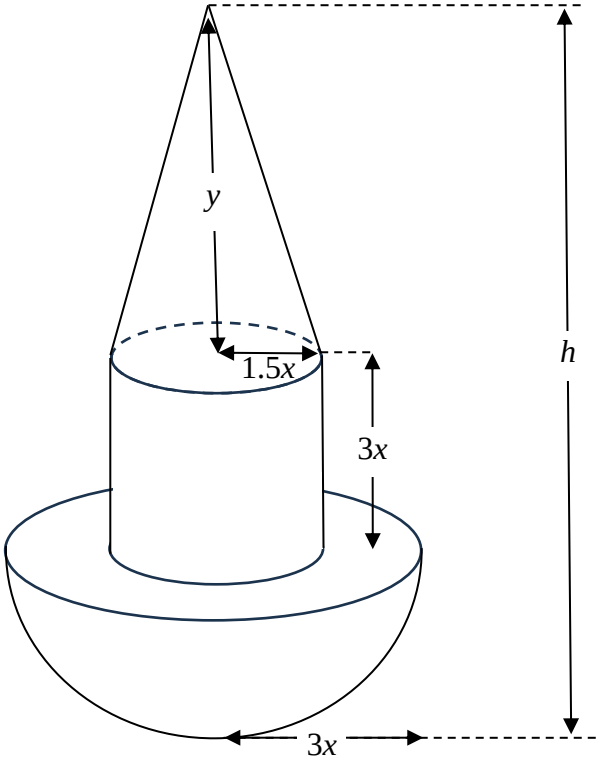
Show, with working, how you can verify this by expressing $x^2 + 2x - 1$ in the form $(x + p)^2 + q$.

Answer

[2]


y
x
10
8
6
4
2
−2
−4
−6
−4
−3
−2
−1
0
1
2
3
4

3



The diagram shows a solid formed from a cone, a cylinder and a hemisphere.
The cone has base radius 1.5x cm and height y cm.
The cylinder has radius 1.5x cm and height 3x cm.
The hemisphere has radius 3x cm.

(a) The volume of the hemisphere is thrice the volume of the cone.

Show that $y = 8x$.

Answer

[3]

(b) The total surface area of the solid is 450 cm^2.

Calculate the total height, h cm, of the solid.

Answer h = ……..…..... cm [7]

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Name: _____( )

Class: _____

Questions	4	5	6	7	8	9
Marks	/8	/10	/9	/12	/10	/10

Section B (59 marks)

4 Here are the first four terms of a sequence.

$$\frac{13}{5} \quad \frac{10}{10} \quad \frac{7}{15} \quad \frac{4}{20}$$

(a) Find the fifth term of the sequence.

Answer ……... [1]

(b) T_n is the nth term of the sequence.

Find an expression, in terms of n, for T_n

Answer T_n = ……... [3]

(c) The difference between the two consecutive terms of the sequence is $T_{n+1} - T_n$.

Show that $T_{n+1} - T_n = \dfrac{-16}{5n(n+1)}$.

Answer

[3]

(d) Explain why the difference between the two consecutive terms of the sequence is always negative.

Answer……...…….……...…….…….……..……

……...…….……...…….…….……..…

……...…….……...…….……..… [1]

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5 Line *l* passes through the points $(-4, 4)$ and $(8, -2)$.

(a) Find the equation of line *l*.

Answer ……... [2]

(b) The equation of line *m* is $6y = 18 - 3x$.

Show how you can tell that the line *m* does **not** intersect the line *l*.

Answer

[2]

(c) The equation of line n is $2y = 3x - 4$.

Line n and line l intersect at point A. Find the coordinates of A.

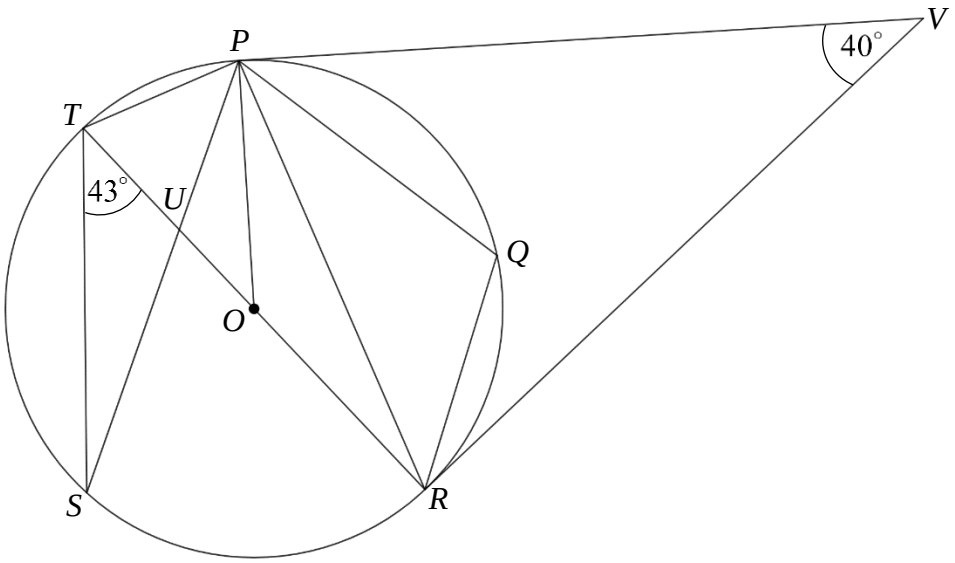
Answer A (…… , …….....) [3]

(d) Line l intersects the y-axis at point B and line n intersects the y-axis at point C.

Calculate the area of triangle ABC.

Answer ……..…… units^2 [3]

6



The diagram shows a circle *PQRST*, with centre *O*.

PV and *RV* are tangents to the circle and *U* is the intersection of *PS* and *TR*.

Angle $PVR = 40^\circ$ and angle $STU = 43^\circ$.

(a) Find angle *PQR*.

Give a reason for each step of your working.

Answer Angle *PQR* = ……..... [3]

(b) Find angle *TUP*.

Give a reason for each step of your working.

Answer Angle *TUP* = ……..... [3]

(c) Alice claims that the area of the minor sector *OSR* is more than one third of the area of the major sector *OSR*.

Do you support her claim?

Justify your decision with calculations.

Answer

…… because ……..…….

……..…….……. [3]

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

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

(i) Find the vector that represents the translation from X to Y.

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

(ii) Find the magnitude of $\overrightarrow{XY}$.

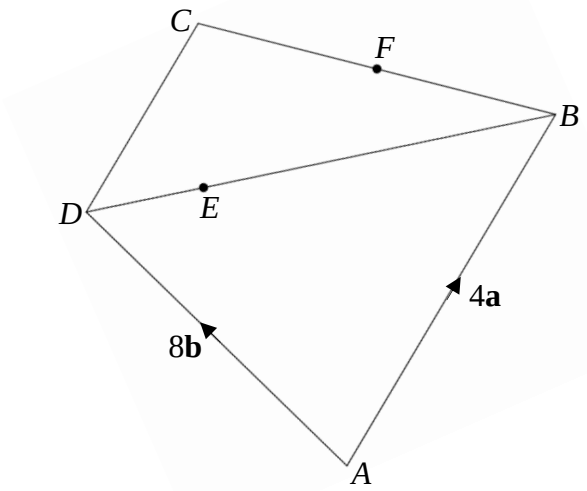
Answer ……..…… units [2]

(iii) Z has coordinates $(-1,\ k)$ and lies on the line XY produced.

Find the position vector of point Z.

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

(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.

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

Answer ……... [2]

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

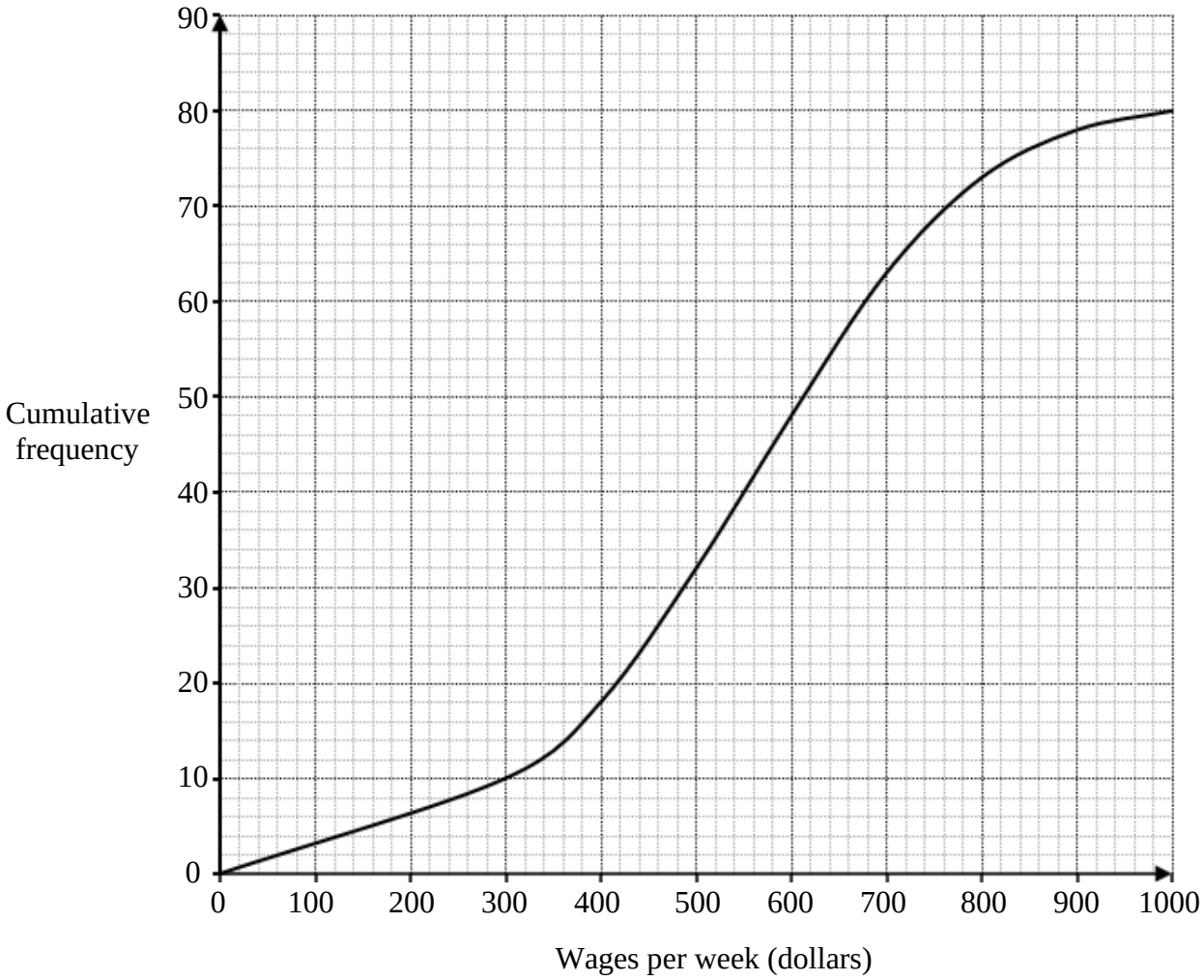
Answer ……... [2]

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

$ABCD$ is a …… because ……....

…….. [3]

8 The cumulative frequency curve shows the distribution of the wages per week of 80 workers in a factory.



(a) Use the curve to estimate

(i) the median wages per week,

Answer $ ……..…….... [1]

(ii) the interquartile range of the wages per week.

Answer $ ……..…….... [2]

(b) In June 2024, the average wages per week of factory workers in Singapore was $540.
Calculate the percentage of the workers in the factory who earned more than this average.

Answer ……..…..... % [2]

(c) Find the number of workers who earned between $460 and $800.

Answer ……..…..... [2]

(d) The factory employed more workers and paid them not more than $650 per week.
Find the additional number of workers employed if the probability of choosing a worker who earned not more than $650 is $\frac{11}{15}$.

Answer ……..…..... [3]

9 An event organiser is organising a 3-day Pet Festival for 300 exhibitors.
The event organiser charges each exhibitor a registration fee of \$90 and a daily booth rental of \$150.

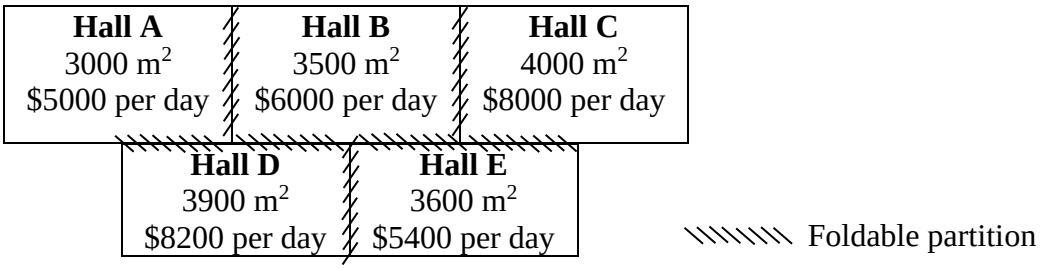
(a) Calculate the total amount of money the organiser collected from each exhibitor.

Answer \$ ……..…..... [1]

The event organiser needs to rent an exhibition space for the Pet Festival.
The spaces required for the exhibition are as follows:

Each booth size	15 m^2
Aisle space for visitors and open spaces required	65% of the total area occupied by the booths

The layout, size and rental fees for the exhibition halls are as follows:



- *Adjacent halls have foldable partitions that can be opened up for rental of two halls.*
- *Rental is for one entire hall space.*

(b) Calculate the minimum amount payable by the event organiser for the daily rental of the exhibition hall(s) needed.

Answer \$ ……..…..... [2]

In order to set up the exhibition, the event organiser needs to rent the hall(s) and the items needed one day before the start of the 3-day Pet Festival.

Items needed for the exhibition and their rental fees are as follows:

Location	**Items**
Each booth	• 1 long table • 2 square tables • 4 chairs
Open space	• 75 round tables • 300 chairs

Items	**Rental fees**
Long table	$2 each table per day
Square table	Every 100 tables at $30 per day
Round table	Every 5 tables at $20 per day
Chairs	Every 50 chairs at $10 per day

For the 3 days of exhibition, the event organiser will employ 2 security guards and 4 part-timers for 12 hours for each day of the exhibition.
The costs are as follows:

- $10 per hour for each security guard
- $8 per hour for each part-timer

(c) It is estimated that there will be a total of 35 000 visitors for the 3-day exhibition.

The event organiser says:

> We will meet our minimum target profit of $300 000 if we charge an entrance fee of $6 per visitor.

Is the event organiser correct?
Using your answers in part **(a)** and **(b)**, justify your decision with calculations.

Answer

Continuation of working space for question **9(c)**.

…….

……... [7]

End-of-paper