

NAME	FORM CLASS	ACAD CLASS



ST. PATRICK'S SCHOOL PRELIMINARY EXAMINATION 2026

SUBJECT : Mathematics
(4052/02)

DATE : 18 August 2026

LEVEL : Secondary 4EXP/5NA

DURATION : 2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, Form Class and Acad Class in the spaces at the top of the page.

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.

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			
Type of Penalties		Question Number	90
Presentation	−1		
	−2		

This paper consists of 21 printed pages including this cover page and 1 blank page.

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

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

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

- 1 (a) Express $\frac{5}{x-2} - \frac{3}{2x+1}$ as a single fraction in its simplest form.

Answer [2]

- (b) Make r the subject of the formula $V = \frac{h(R^2 + r^2)}{r^2}$.

Answer $r =$ [2]

- (c) Simplify $\frac{2x^2 - xy - 6x + 3y}{9 - x^2}$.

Answer [3]

- (d) Simplify $(2x^3y^{-2})^4 \div (8x^5y^{-3})$, giving your answer with positive indices.

Answer [2]

- 2 (a) A television has a cash price of \$2400. It can also be bought on hire purchase with a deposit of 20% of the cash price, followed by 24 monthly instalments of \$92.
- (i) Calculate the total hire purchase price.

Answer \$ [2]

- (ii) Calculate how much more the hire purchase price is than the cash price, giving your answer as a percentage of the cash price.

Answer % [2]

- (b) After a discount of 15%, a laptop is sold for \$1734.
Calculate the original price of the laptop.

Answer \$ [2]

(c) Mark has a vintage watch valued at \$6666.

Its value appreciates at a rate of 8% per year.

- (i) Show that the value of the watch at the end of 2 years is \$7775.22, correct to the nearest cent.

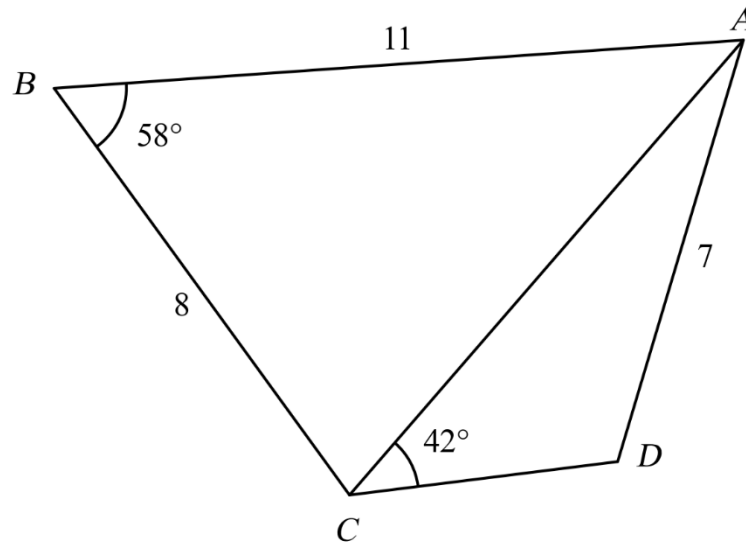
Answer

[2]

- (ii) Find the number of complete years it takes for the value of the watch to exceed \$8888 and the profit Mark will make if he sells it then.

Answeryears for a profit of \$..... [3]

- 3 The quadrilateral $ABCD$, is made up of an acute triangle ABC and an obtuse triangle ADC .
 $AB = 11$ cm, $BC = 8$ cm, $AD = 7$ cm, angle $ABC = 58^\circ$, and angle $ACD = 42^\circ$.



Find

- (a) the length of AC ,

Answer cm [3]

- (b) angle CAD ,

Answer degrees [3]

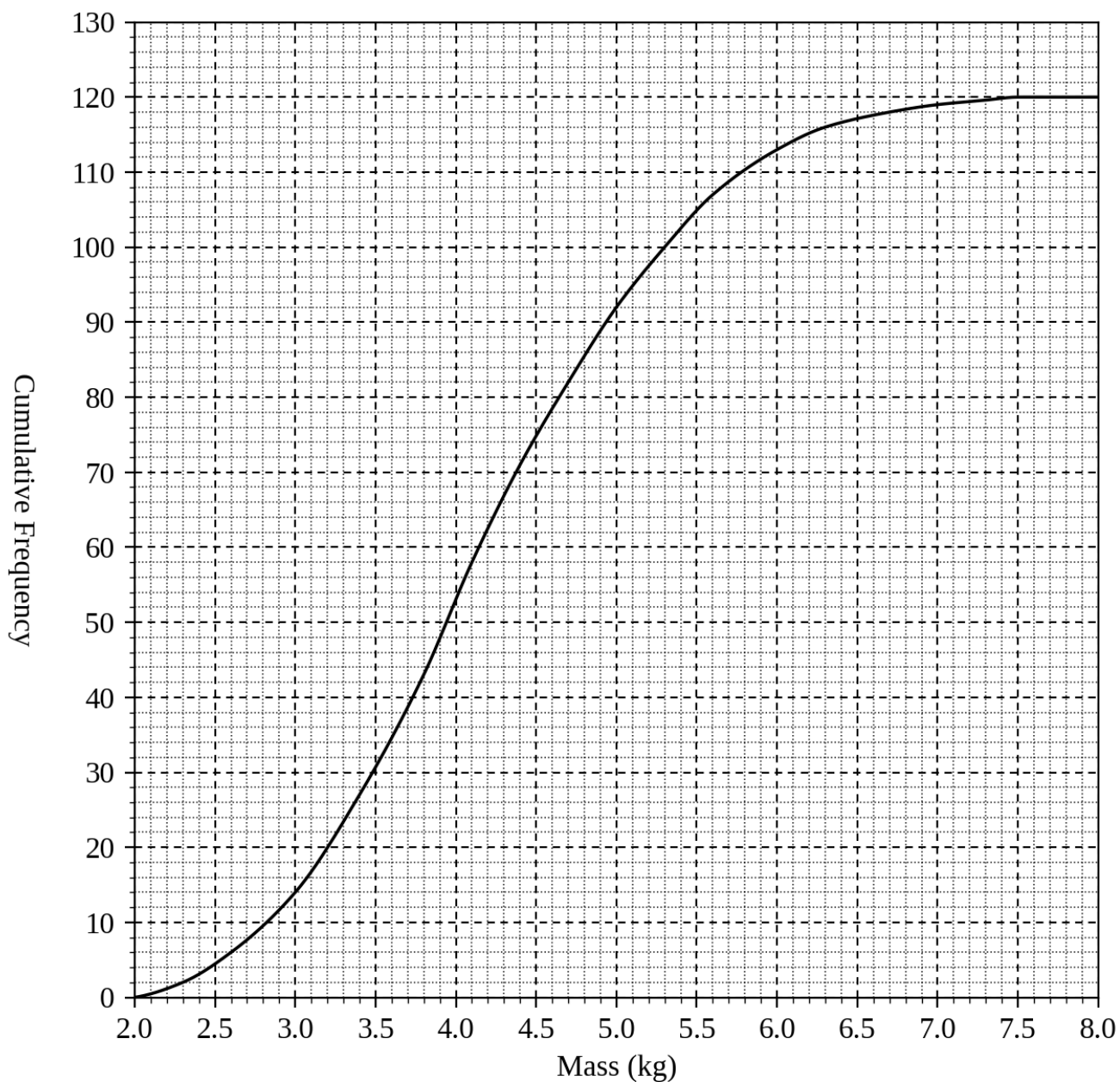
(c) the length of CD ,

Answer cm [2]

(d) the area of quadrilateral $ABCD$.

Answer cm^2 [2]

- 4 The cumulative frequency curve shows the masses, in kilograms, of the 120 watermelons in a shipment delivered to a supermarket.



(a) Use the graph to find

(i) the median,

Answer kg [1]

(ii) the interquartile range.

Answer kg [2]

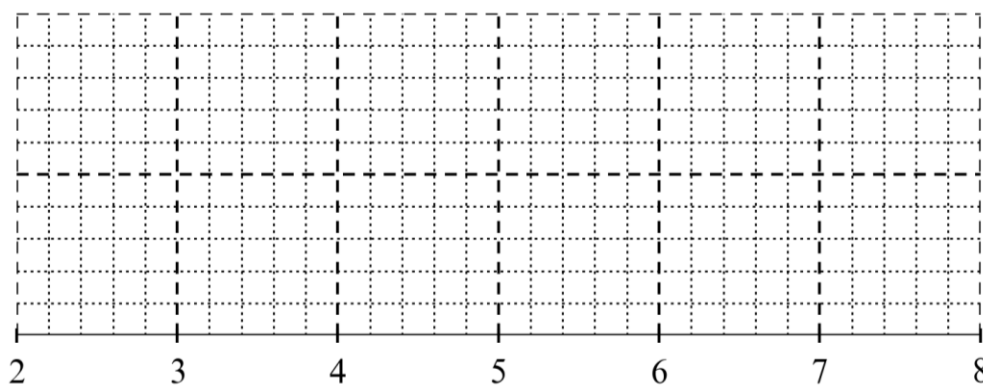
- (b) The supermarket can only sell watermelons with a mass between 3 kg and 6.5 kg. Watermelons with a mass outside this range are unpopular sizes and have to be sold at a discount.

Find the percentage of the shipment that has to be sold at a discount.

Answer % [3]

- (c) A second supplier delivers another shipment of watermelons. For this shipment, the smallest mass is 3 kg and the range is 4.5 kg. The lower quartile, median and upper quartile are 4 kg, 5 kg and 6.5 kg respectively.

Draw a box-and-whisker diagram for this shipment on the scale below.



Mass (kg)

[3]

- (d) Which shipment is more desirable for the supermarket? Justify your answer with reference to the acceptable range.

Answer

.....
 [2]

- 5 The depth of water, d metres, at a harbour entrance is modelled by

$$d = 0.1t^3 - 1.2t^2 + 3.3t + 4$$

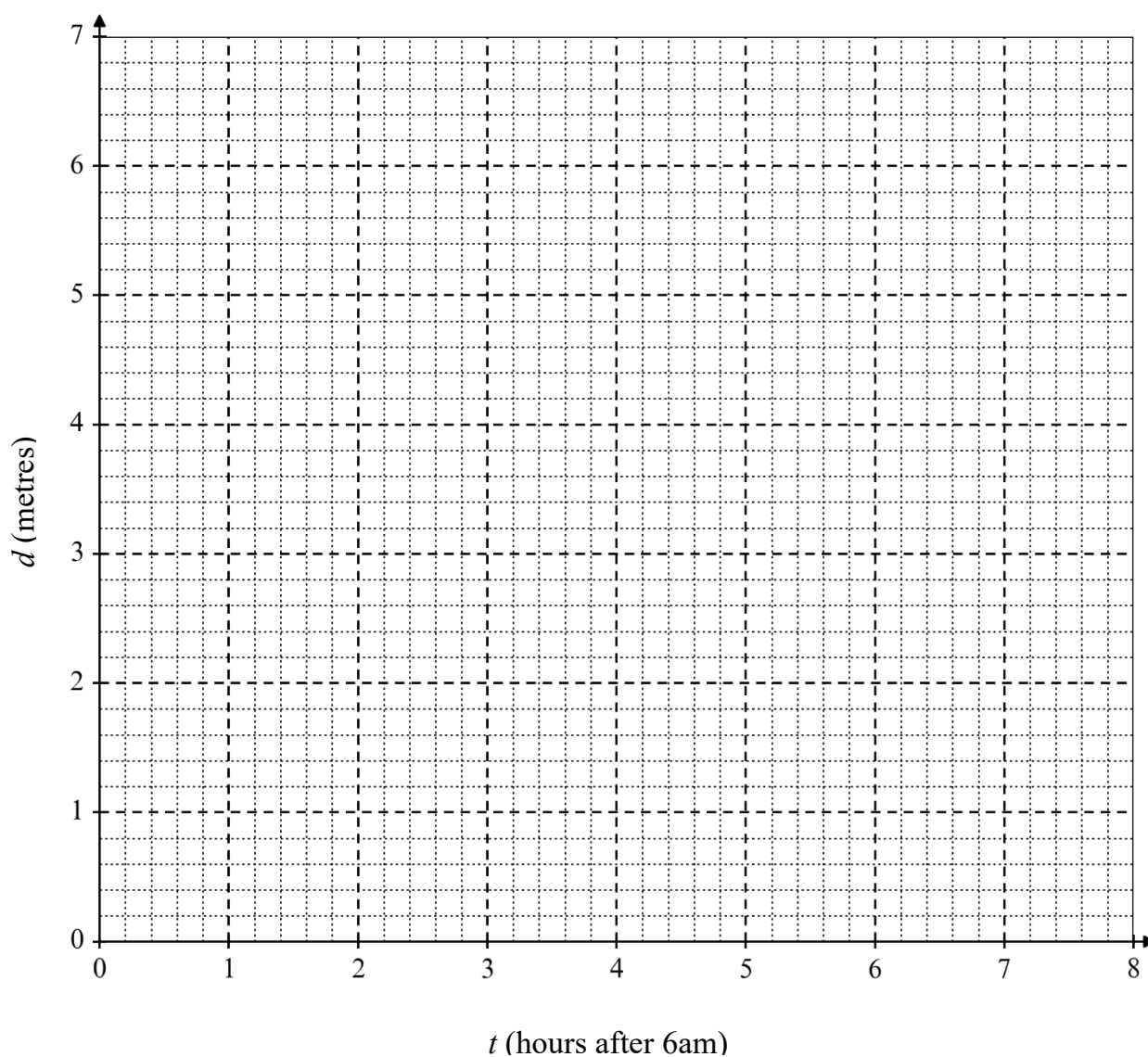
where t is the number of hours after 6 am, for $0 \leq t \leq 8$.

The table shows some values of d .

t	0	1	2	3	4	5	6	7	8
d	4	6.2	6.6		4.4	3.0	2.2	2.6	4.8

- (a) Complete the table of values. [1]

- (b) On the grid, draw the graph of d against t . [3]



- (c) (i) By drawing a tangent, find the gradient at $t = 5$.

Answer [2]

- (ii) Use your graph to find the minimum depth of water at the harbour entrance.

Answer m [1]

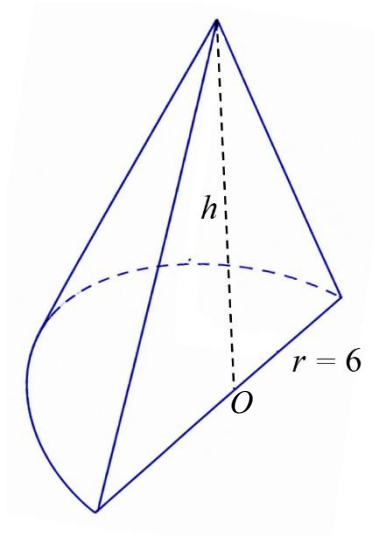
- (d) Use your graph to find the values of t for which the depth of water is decreasing.

Answer [1]

- (e) A cargo ship is being loaded at the quay. As loading continues, the depth of water the ship needs is modelled by $d = 0.2t + 2$. By drawing the line $d = 0.2t + 2$ on your grid, find the time by which the ship must leave in order to avoid becoming stranded. Give your answer as a time of day.

Answer [2]

- 6 (a) The diagram shown is a solid in the shape of half of a right cone. The solid has height h cm, base radius 6 cm and volume $48\pi \text{ cm}^3$.



- (i) Find h .

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

- (ii) Calculate the total surface area of the solid.

Answer..... cm^2 [4]

- (b) A company sells detergent in geometrically similar containers in two sizes. The ratio of the height of the Large container to the height of the Small container is 3 : 2.

The table shows the cost of producing one filled Small container.

Component	Cost
Detergent	\$3.20
Material for the container	\$0.80
Printing the label	\$0.15

The cost of the detergent is proportional to the volume of the container.

The cost of the materials for the container is proportional to the surface area of the container.

Printing the label costs \$0.15 per container, regardless of size.

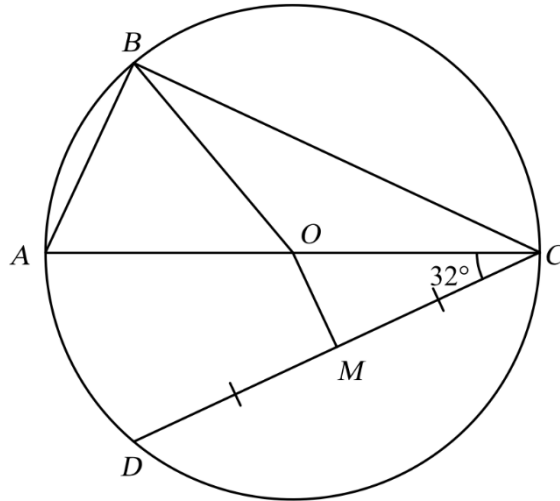
Calculate the total cost of producing one filled Large container.

Answer \$ [3]

- 7 In the diagram, AC is a diameter of the circle, with centre O , and the points A , B , C and D lie on the circle with radius of 9.2 cm.

AC bisects angle BCD . Angle $DCA = 32^\circ$

M is the point on DC such that $DM = MC$.



- (a) Find angle BOA . Give reasons for each step of your working.

Answer Angle $BOA = \dots\dots\dots$ [2]

- (b) Show that triangle COM is similar to triangle CAB .

.....

 [2]

- (c) Show that $BC = DC$.

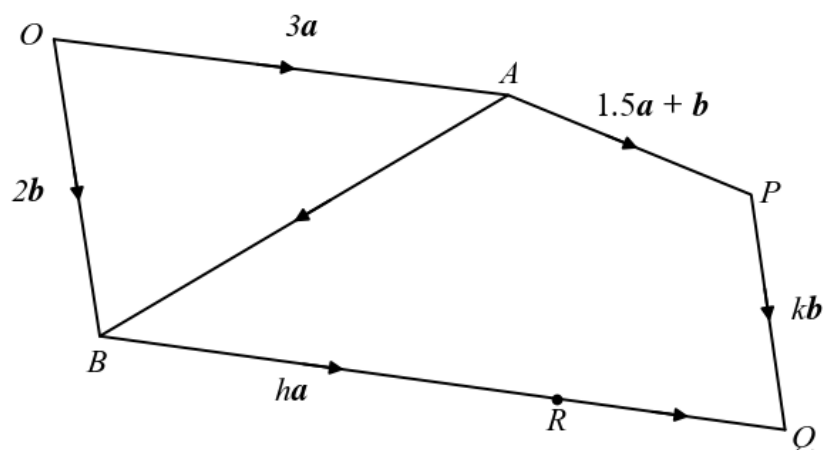
Answer

[2]

- (d) Find the shortest distance of BC from O .

Answer cm [2]

8



In the diagram,

$\vec{OA} = 3\mathbf{a}$, $\vec{OB} = 2\mathbf{b}$, $\vec{AP} = 1.5\mathbf{a} + \mathbf{b}$, $\vec{PQ} = k\mathbf{b}$ and $\vec{BR} = h\mathbf{a}$, where k and h are constants.

(a) Find, in terms of $\mathbf{a}$ and/or $\mathbf{b}$,

(i) $\vec{AB}$

Answer $\vec{AB} = \dots\dots\dots$ [1]

(ii) $\vec{BP}$

Answer $\vec{BP} = \dots\dots\dots$ [1]

(b) The points B , R and Q are collinear Find the value of k .

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

- (c) Given that $\overrightarrow{PR}$ is parallel to $\overrightarrow{AB}$, show that $h = 3$.

Answer

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..... [3]

- (d) Find $BR : RQ$, and hence describe the position of R on BQ .

Answer

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..... [2]

- (e) Given that the area of triangle AOB is 60 units², find the area of triangle ABR .

Answer Area = units² [2]

- 9 Based on past events, a charity fundraising carnival predicts that it will sell 2400 tickets if the ticket price is \$8. The break-even ticket price is \$8, so tickets must not be priced below this. Ticket prices are set in whole dollars.

The organising committee estimates that for every \$1 increase in the ticket price, 100 fewer tickets will be sold.

- (a) Complete the table below.

[1]

Increase in ticket price, x (\$)	New ticket price (\$)	Expected number of tickets sold	Revenue, R (\$)
0	8	2400	19 200
1	$8 + 1 = 9$	$2400 - 100(1) = 2300$	20 700
2	$8 + 2 = 10$	$2400 - 100(2) = 2200$	22 000
x	$8 + x$	$2400 - 100(x)$	

- (b) If the committee wishes to collect exactly \$23 100 from ticket sales, while maintaining an attendance of at least 2000 people, show that the ticket should be priced at \$11.

[4]

- (c) If however, the organisers wish to maximise revenue, find the ticket price they should set, and state this maximum revenue.

Answer Ticket price = \$

Maximum revenue = \$ [2]

- (d) Two corporate sponsors have each offered to support the charity, but the committee may accept only **one** of them:

Sponsor A will donate \$15 000 if at least 1900 tickets are sold.

Sponsor B will donate fifty cents for every dollar collected from ticket sales.

Determine which sponsor the committee should accept, and the ticket price it should set, in order to raise the greatest total amount for the charity.

Justify your recommendation with calculations.

[4]

END OF PAPER

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