

Paper 2
Solutions

Candidate Name _____

Class

Index
Number

--	--



ST ANDREW'S SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
SECONDARY 4 EXPRESS/ 5 NORMAL ACADEMIC

ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL
ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL
ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL
ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL
ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL
ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL
ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL ST ANDREW'S SCHOOL

MATHEMATICS

4048/02

Paper 2

WEDNESDAY

17 AUGUST 2022

2 hours 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page.

Write in dark blue or black pen.

You may use a 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 of the marks for this paper is 100.

This question paper consists of 21 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

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

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

1 (a) $S = \frac{RV}{3V-1}$

- (i) Calculate the value of S when $R=100$ and $V=-13$.

$$S = \frac{100(-13)}{3(-13)-1}$$

$$= \frac{-1300}{-40} = 32.5 \quad \text{Answer } S = \dots\dots\dots 32.5 \quad [1]$$

- (ii) Rearrange the formula to make V the subject.

$$S = \frac{RV}{3V-1}$$

$$S(3V-1) = RV$$

$$3SV - S = RV$$

$$3SV - RV = S$$

$$V(3S - R) = S$$

$$\therefore V = \frac{S}{3S - R}$$

$$-S = RV - 3SV$$

$$-S = V(R - 3S)$$

$$\frac{-S}{R-3S} = V$$

$$\text{Answer } V = \dots\dots\dots \frac{S}{3S-R} \quad [3]$$

- (b) Given that n is an integer and $n > 1$, decide whether each statement in the table is **true** or **false**.

For each statement write **true** or **false** in the table.

If you write **false**, give an example to justify your decision.

Statement	True or False	Example (if false)
$n^3 > 1$	True	
$\frac{1}{n} > \frac{1}{n^2}$	True	
$(n-1)(n+3)$ is always odd	False	Sub $n=3$, $(3-1)(3+3)=12$ is even, not odd.

[2]

(c) Solve these simultaneous equations.

$$\frac{1}{4}x + \frac{3}{5}y = -6 \quad \text{--- (1)}$$

$$3y = -4x + 3 \quad \text{--- (2)}$$

You must show your working.

From (1), $5x + 12y = -120$ --- (3)

From (2), $4x + 3y = 3$

$$3y = 3 - 4x$$

$$\therefore 12y = 12 - 16x \quad \text{--- (4)}$$

sub (4) into (3),

$$5x + 12 - 16x = -120$$

$$-11x = -132$$

$$x = 12$$

$$3y = 3 - 4(12)$$

$$3y = -45$$

$$\therefore y = -15$$

Answer $x = 12$

$y = -15$ [3]

- 2 A gift shop sells two types of fruit hampers, A and B.
The contents of each type of hamper are given in the table below.

	Apples	Oranges	Pears	Pineapples
Hamper A	3	4	2	0
Hamper B	4	6	5	1

The information given is represented by the matrix $\mathbf{P} = \begin{pmatrix} 3 & 4 & 2 & 0 \\ 4 & 6 & 5 & 1 \end{pmatrix}$.

The cost price of an apple, an orange, a pear and a pineapple are \$0.50, \$0.45, \$0.60 and \$1.80 respectively.

- (a) Write down a 4×1 matrix $\mathbf{Q}$ to represent the cost price of the fruits.

Answer $\mathbf{Q} = \begin{pmatrix} 0.50 \\ 0.45 \\ 0.60 \\ 1.80 \end{pmatrix}$ [1]

- (b) Calculate $\mathbf{PQ}$.

$$\mathbf{PQ} = \begin{pmatrix} 3 & 4 & 2 & 0 \\ 4 & 6 & 5 & 1 \end{pmatrix} \begin{pmatrix} 0.50 \\ 0.45 \\ 0.60 \\ 1.80 \end{pmatrix} = \begin{pmatrix} 4.50 \\ 9.50 \end{pmatrix}$$

Answer $\mathbf{PQ} = \begin{pmatrix} 4.50 \\ 9.50 \end{pmatrix}$ [2]

- (c) Describe what is represented by the elements of $\mathbf{PQ}$.

The total cost price of fruits in Hamper A and B respectively [1]

- (d) Given that $\mathbf{R} = \begin{pmatrix} 30 & 20 \end{pmatrix}$, calculate $\mathbf{RPQ}$.

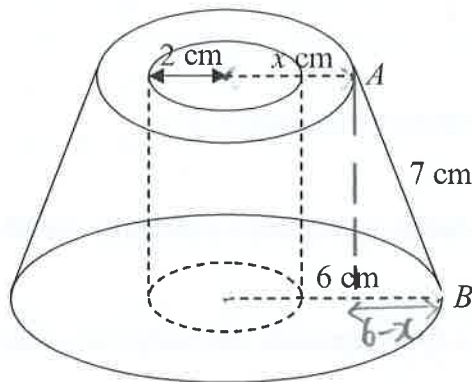
$$\begin{pmatrix} 30 & 20 \end{pmatrix} \begin{pmatrix} 4.50 \\ 9.50 \end{pmatrix} = \begin{pmatrix} 325 \end{pmatrix}$$

Answer $\mathbf{RPQ} = \begin{pmatrix} 325 \end{pmatrix}$ [1]

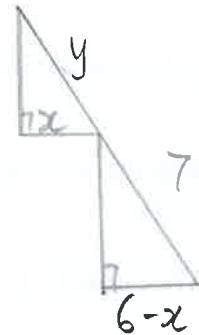
- (e) Suggest a meaning for the information represented by the matrix $\mathbf{RPQ}$.

The total cost ^{price} of fruits in 30 Hamper A and 20 Hamper B. [1]

- 3 The upper part of a solid wooden right circular cone was cut off leaving the frustum illustrated in the diagram.
The top and the base of the frustum are horizontal circles with radii x cm and 6 cm respectively.
The slant height AB of the frustum is 7 cm.
A cylindrical hole of radius 2 cm is drilled centrally through the frustum.



(a)



$$\frac{y}{x} = \frac{7}{6-x}$$

$$y = \frac{7x}{6-x}$$

- (a) Show that the slant height of the cone which was cut off is $\frac{7x}{6-x}$ cm.

Answer Let the slant height of the cone be y .

By similar figures,

$$\frac{y}{y+7} = \frac{x}{6}$$

$$6y = xy + 7x$$

$$6y - xy = 7x$$

$$y(6-x) = 7x$$

$$\therefore y = \frac{7x}{6-x}$$



[2]

- (b) The curve surface area of the cone which was cut off is 180 cm^2 .

Taking $\pi = \frac{22}{7}$, show that $11x^2 + 90x - 540 = 0$.

Answer $\pi r l = 180$

$$\frac{22}{7} (x) \left(\frac{7x}{6-x} \right) = 180$$

$$\frac{22x^2}{6-x} = 180$$

$$22x^2 = 180(6-x)$$

$$22x^2 = 1080 - 180x$$

$$22x^2 + 180x - 1080 = 0$$

$$\therefore 11x^2 + 90x - 540 = 0 \text{ (shown)}$$

$$\text{or } 154x^2 = 7560 - 1260x$$

$$77x^2 = 3780 - 630x$$

[2]

- (c) Solve the equation $11x^2 + 90x - 540 = 0$, giving your answers correct to three decimal places.

$$a=11, b=90, c=-540$$

$$x = \frac{-90 \pm \sqrt{90^2 - 4(11)(-540)}}{2(11)}$$

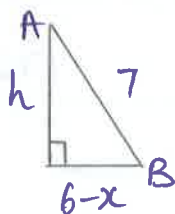
$$= \frac{-90 \pm \sqrt{31860}}{22}$$

$$= 4.02244 \text{ or } -12.20425897$$

$$= 4.022 \text{ or } -12.204 \text{ (3 d.p.)}$$

Answer $x = 4.022$ or -12.204 [4]

- (d) Hence, calculate the volume of the cylindrical hole.



By Pythagoras' Theorem,

$$h = \sqrt{7^2 - (6 - 4.022)^2}$$

$$= 6.7147$$

$\therefore$ vol. of cylindrical hole

$$= \pi r^2 h$$

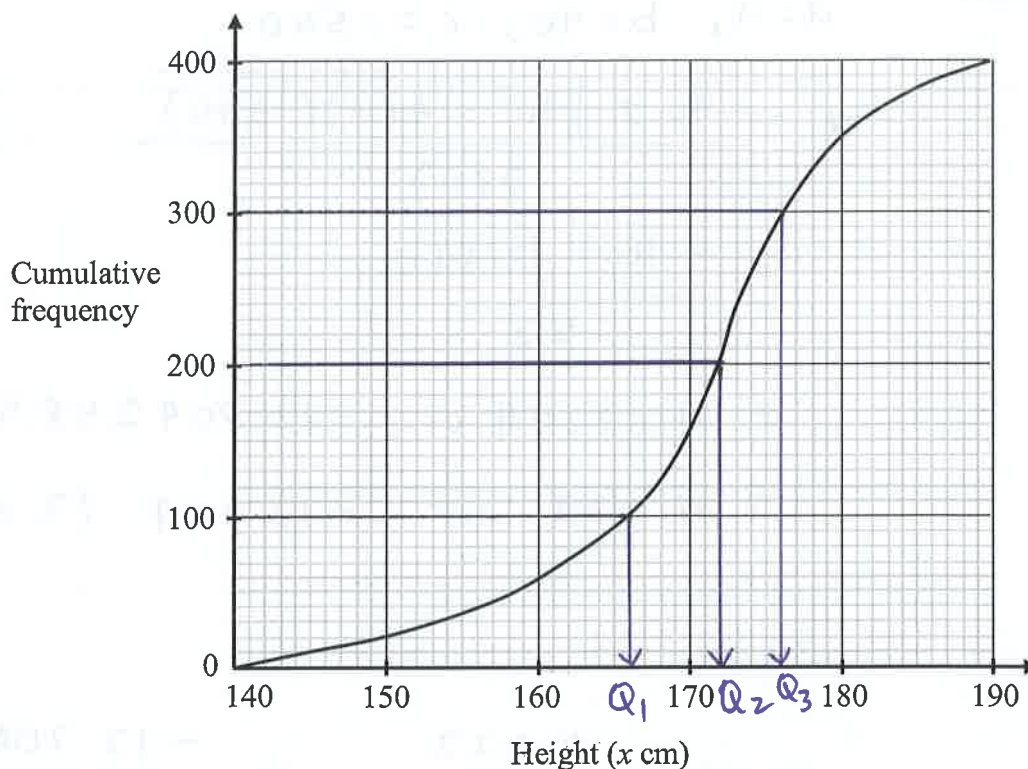
$$= \pi (2)^2 (6.7147)$$

$$= 84.3794$$

$$= 84.4 \text{ cm}^3 \text{ (3 s.f.)}$$

Answer 84.4 cm³ [3]

- 4 (a) The cumulative frequency curve shows the height of 400 students in school A.



Find

- (i) the median height,

$$Q_2 = 172 \text{ cm}$$

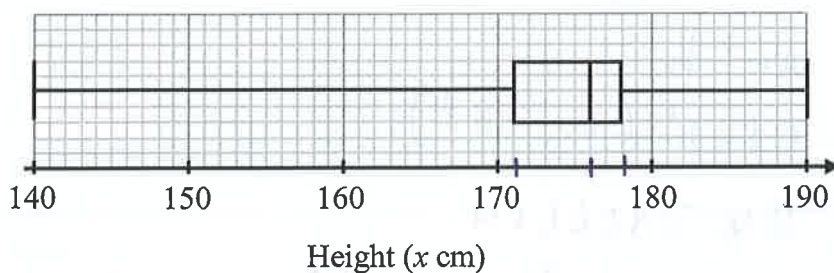
Answer 172 cm [1]

- (ii) the interquartile range.

$$\begin{aligned} Q_3 - Q_1 &= 176 - 166 \\ &= 10 \text{ cm} \end{aligned}$$

Answer 10 cm [2]

- (b) The box-and-whisker plot shows the height of 400 students in school B.



- (i) Write down the median height of the students in school B.

Answer 176 cm [1]

- (ii) Find the interquartile range.

$$\begin{aligned} Q_3 - Q_1 &= 178 - 171 \\ &= 7 \text{ cm} \end{aligned}$$

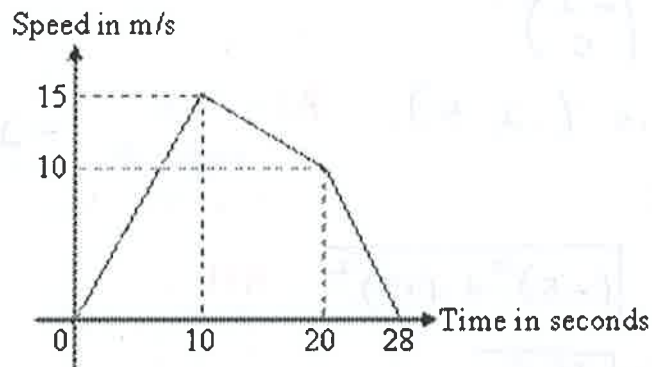
Answer 7 cm [1]

- (c) Olivia commented that the students in school A are shorter than the students in school B.

Do you agree? Give a reason for your answer.

Yes, I agree, because the median height of students in school A is lower than that of B ($172 \text{ cm} < 176 \text{ cm}$) [1]

5



The diagram shows the speed-time graph of a despatch's journey. Calculate

- (a) the retardation of the car when $t = 13$,

$$a = \frac{v - u}{t}$$

$$= \frac{10 - 15}{10}$$

$$\therefore \text{retardation} = 0.5 \text{ m/s}^2$$

$$= -0.5 \text{ m/s}^2$$

Answer 0.5 m/s^2 [2]

- (b) the speed of the car when $t = 13$,

let the speed be $x \text{ m/s}$.

$$\frac{x - 15}{13 - 10} = -0.5$$

$$x - 15 = -1.5$$

$$\therefore x = 13.5$$

Answer 13.5 m/s [2]

- (c) the total distance travelled in the first 20 s.

$$\text{Total distance} = \frac{1}{2}(10)(15) + \frac{1}{2}(10 + 15)(10)$$

$$= 75 + 125$$

$$= 200 \text{ m}$$

Answer 200 m [2]

- 6 (a) The point A has position vector $\begin{pmatrix} 3 \\ -7 \end{pmatrix}$ and $\overrightarrow{AB} = \begin{pmatrix} -5 \\ 12 \end{pmatrix}$.

(i) Find the coordinates of point B .

$$\begin{aligned}\vec{OB} &= \vec{OA} + \vec{AB} \\ &= \begin{pmatrix} 3 \\ -7 \end{pmatrix} + \begin{pmatrix} -5 \\ 12 \end{pmatrix} \\ &= \begin{pmatrix} -2 \\ 5 \end{pmatrix}\end{aligned}$$

$\therefore B$ is $(-2, 5)$.

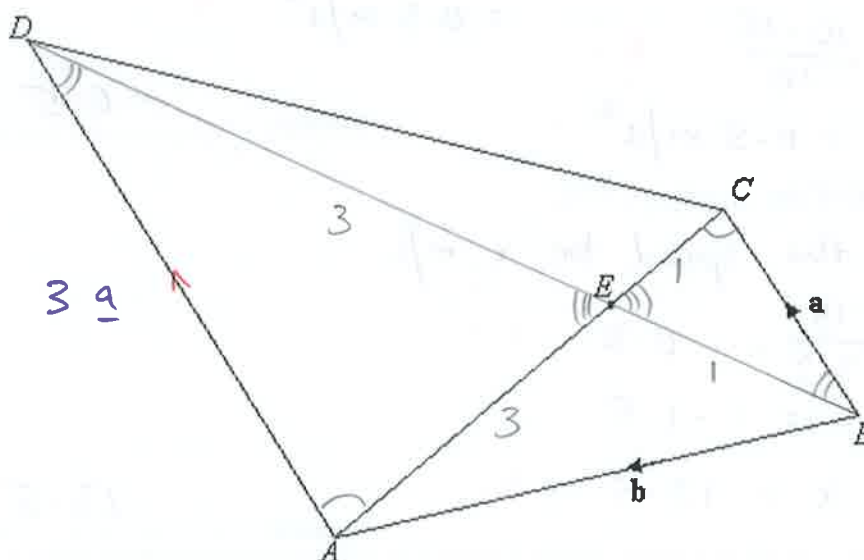
Answer $B(-2, 5)$ [2]

(ii) Find $|\overrightarrow{AB}|$.

$$\begin{aligned}|\vec{AB}| &= \sqrt{(-5)^2 + (12)^2} \\ &= \sqrt{169} \\ &= 13 \text{ units}\end{aligned}$$

Answer $|\overrightarrow{AB}| = 13$ units [2]

(b)



$ABCD$ is a quadrilateral in which $\overrightarrow{BC} = \mathbf{a}$, $\overrightarrow{BA} = \mathbf{b}$ and $\overrightarrow{BC} = \frac{1}{3}\overrightarrow{AD}$.

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

(a) $\overrightarrow{AC}$,
$$\begin{aligned}\vec{AC} &= \vec{AB} + \vec{BC} \\ &= -\mathbf{b} + \mathbf{a}\end{aligned}$$

Answer $\mathbf{a} - \mathbf{b}$ [1]

(b) $\overrightarrow{BD} = \overrightarrow{BA} + \overrightarrow{AD}$
 $= \underline{b} + 3\underline{a}$

Answer $\underline{b} + 3\underline{a}$ [1]

- (ii) The point E is on AC such that $4AE = 3AC$. $AE = \frac{3}{4} AC$

Prove that B , E and D lie in the same straight line.

Answer $\overrightarrow{BE} = \overrightarrow{BA} + \overrightarrow{AE}$
 $= \underline{b} + \frac{3}{4} \overrightarrow{AC}$
 $= \underline{b} + \frac{3}{4} (\underline{a} - \underline{b})$
 $= \underline{b} + \frac{3}{4} \underline{a} - \frac{3}{4} \underline{b}$
 $= \frac{1}{4} \underline{b} + \frac{3}{4} \underline{a}$
 $= \frac{1}{4} (\underline{b} + 3\underline{a})$
 $= \frac{1}{4} \overrightarrow{BD}$

$\overrightarrow{BE} = \frac{1}{4} \overrightarrow{BD}$
 $\overrightarrow{BD} = 4 \overrightarrow{BE}$
 $\overrightarrow{DE} = 3 \overrightarrow{EB}$
 $\overrightarrow{DE} = -\frac{3}{4} \overrightarrow{BD}$
 $\overrightarrow{ED} = \frac{3}{4} \overrightarrow{BD}$

$\therefore \overrightarrow{BE} \parallel \overrightarrow{BD}$,
 and since B is a common point,
 B , E and D lie in the same straight line. [3]

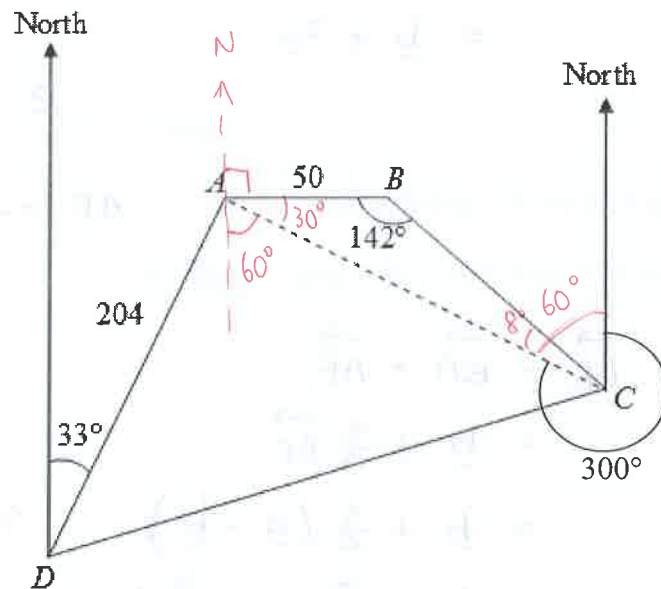
- (iii) Find the numerical value of

(a) $\frac{\text{area of } \triangle CEB}{\text{area of } \triangle AED} = \left(\frac{1}{3}\right)^2$
 $= \frac{1}{9}$

Answer $\frac{1}{9}$ [1]

(b) $\frac{\text{area of } \triangle CEB}{\text{area of } \triangle CED} = \frac{\frac{1}{2} \times EB \times h}{\frac{1}{2} \times ED \times h}$
 $= \frac{1}{3}$

Answer $\frac{1}{3}$ [1]



The diagram shows a plot of land with points $ABCD$ on level ground. The bearing of A from D is 033° and the length of AD is 204 m. B is 50 m due east of A . Angle $ABC = 142^\circ$ and the bearing of A from C is 300° .

- (a) Find the bearing of C from A .

$$180^\circ - 60^\circ = 120^\circ$$

Answer 120° [1]

- (b) Find angle BAC .

$$120^\circ - 90^\circ = 30^\circ$$

Answer 30° [1]

- (c) Show that the distance AC is 221.19 m, correct to two decimal places.

Answer $\angle BCA = 180^\circ - 142^\circ - 30^\circ$ ($\angle$ sum of $\triangle$)
 $= 8^\circ$

$$\frac{AC}{\sin 142^\circ} = \frac{50}{\sin 8^\circ}$$

$$AC = \frac{50 \sin 142^\circ}{\sin 8^\circ}$$

$$= 221.1855$$

$$= 221.19 \text{ (2 d.p.)}$$

- (d) Find the area of triangle ABC .

$$\begin{aligned}\text{Area of } \triangle ABC &= \frac{1}{2} (50)(221.19) \sin 30^\circ \\ &= 2764.875 \\ &= 2760 \text{ cm}^2 \text{ (3 s.f.)}\end{aligned}$$

Answer 2760 m² [2]

- (e) Find angle DAC .

$$\begin{aligned}\angle DAC &= 33^\circ + 60^\circ \text{ (alt. } \angle\text{s)} \\ &= 93^\circ\end{aligned}$$

Answer 93° [1]

- (f) Hence, calculate the distance DC .

$$\begin{aligned}DC^2 &= 204^2 + 221.19^2 - 2(204)(221.19) \cos 93^\circ \\ &= 95264.10 \dots\end{aligned}$$

$$\begin{aligned}DC &= \sqrt{95264.10} \\ &= 308.6488 \\ &= 309 \text{ m}\end{aligned}$$

Answer 309 m [3]

- (g) A tree, 15 m tall, stands vertically at A .

Find the angle of elevation of the top of the tree from D .

let the angle of elevation be θ .

$$\tan \theta = \frac{15}{204}$$

$$\begin{aligned}\therefore \theta &= 4.205357 \\ &= 4.2^\circ \text{ (1 d.p.)}\end{aligned}$$

Answer 4.2° [2]

- 8 (a) Complete the table of values for $y = \frac{x^2}{6} + \frac{12}{x} - 6$.

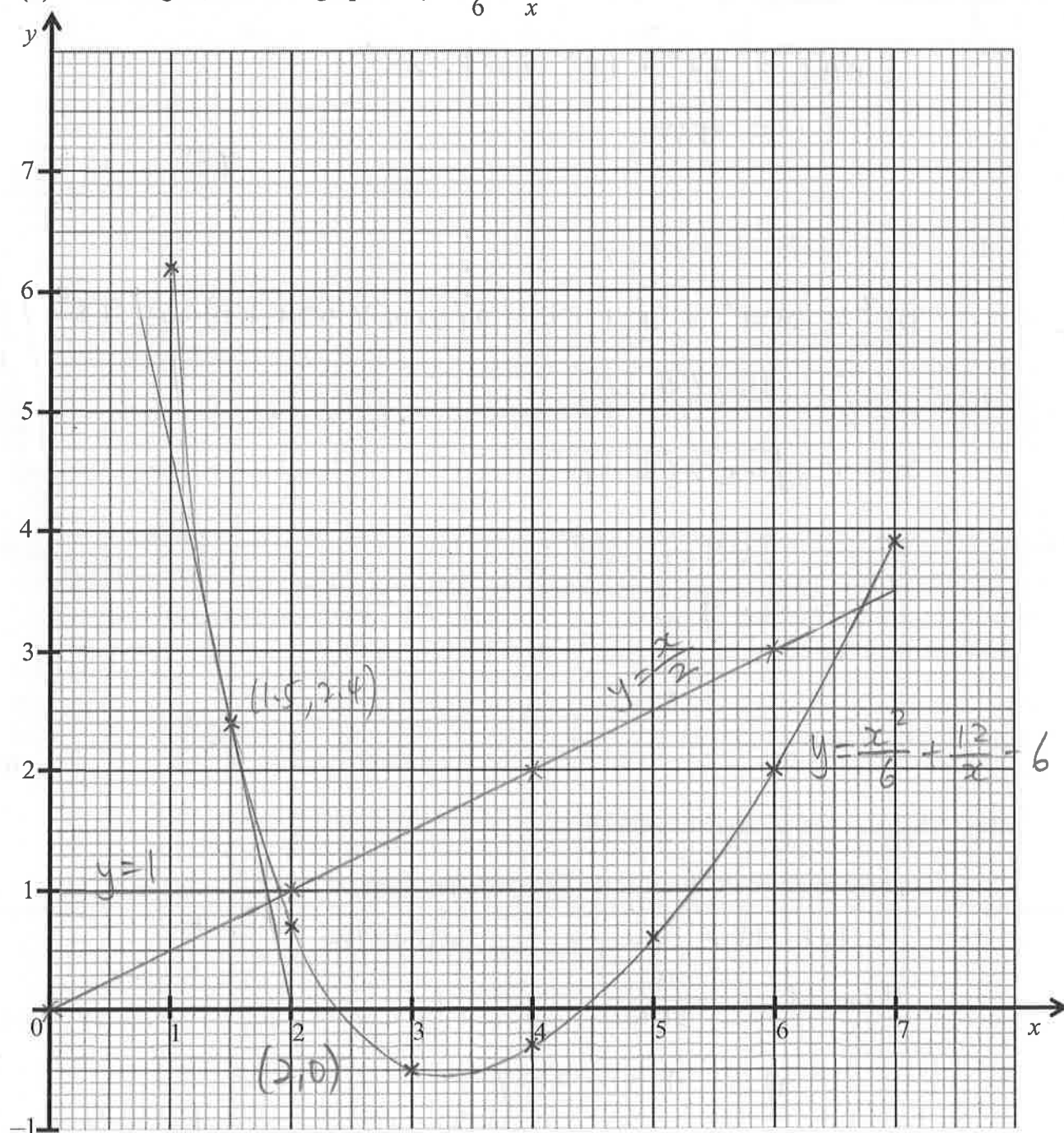
Give your answer correct to 1 decimal place.

x	1	1.5	2	3	4	5	6	7
y	6.2	2.4	0.7	-0.5	-0.3	0.6	2	3.9

[1]

- (b) On the grid, draw the graph of $y = \frac{x^2}{6} + \frac{12}{x} - 6$ for $1 \leq x \leq 7$.

[3]



15

$$y = \frac{1}{6}x^2 + 12x^{-1} - 6$$

$$\left. \frac{dy}{dx} \right|_{1.5} = \frac{1}{3}x - \frac{12}{x^2} = -4\frac{5}{6} = -4.8\bar{3}$$

- (c) By drawing a tangent, find the gradient of the graph of $y = \frac{x^2}{6} + \frac{12}{x} - 6$ when $x = 1.5$.

$$(1.5, 2.4), (2, 0)$$

$$\begin{aligned} \text{gradient} &= \frac{2.4 - 0}{1.5 - 2} \\ &= -4.8 \end{aligned}$$

Answer -4.8 [2]

- (d) Use your graph to find the solutions of the equation $\frac{x^2}{6} + \frac{12}{x} = 7$ in the range $1 \leq x \leq 7$.

$$\frac{x^2}{6} + \frac{12}{x} = 7$$

$$\frac{x^2}{6} + \frac{12}{x} - 6 = 7 - 6$$

$$y = 1$$

Answer $x =$ 1.9 or 5.3 [2]

- (e) (i) On the grid in part (b), draw the line $y = \frac{x}{2}$ for $0 \leq x \leq 7$. [2]

Ruled straight line through (0, 0) to (7, 3.5)

- (ii) The x -coordinates of the points where the line intersects the curve are the solutions of the equation $x^3 + Ax^2 + Bx + 72 = 0$.

Find the value of A and the value of B .

$$\frac{x^2}{6} + \frac{12}{x} - 6 = \frac{x}{2}$$

$$x^3 + 72 - 36x = 3x^2$$

$$x^3 - 3x^2 - 36x + 72 = 0$$

$$\therefore A = -3$$

$$B = -36$$

Answer $A =$ -3

$B =$ -36 [3]

- 9 The diagram shows a circle $ABCDE$.
The tangent at D meets the chord AB produced at T .
Angle $TBC = 69^\circ$, angle $ADB = 24^\circ$ and angle $CED = 21^\circ$.

- (a) Find angle CBD , giving a reason for your answer.

Angle $CBD = 21^\circ$ because

angles in the same segment
(are equal) [1]

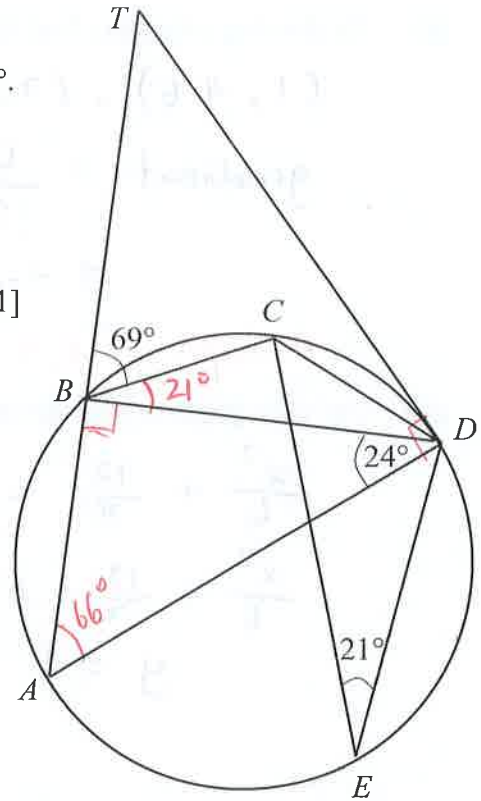
- (b) Explain why AD is a diameter of the circle.

Answer

$$\begin{aligned}\angle ABD &= 180^\circ - 69^\circ - 21^\circ \\ &= 90^\circ\end{aligned}$$

$\Rightarrow \angle$ in a semicircle

$\Rightarrow AD$ is a diameter
of the circle



[2]

- (c) Find, giving reasons for each answer,

- (i) angle BCD ,

$$\begin{aligned}\angle BAD &= 180^\circ - 90^\circ - 24^\circ \text{ (}\angle \text{sum of } \triangle\text{)} \\ &= 66^\circ\end{aligned}$$

$$\begin{aligned}\therefore \angle BCD &= 180^\circ - 66^\circ \text{ (}\angle\text{s in opposite segments)} \\ &= 114^\circ\end{aligned}$$

Answer 114° [2]

- (ii) angle $BT D$.

$$\angle ADT = 90^\circ \text{ (tangent } \perp \text{ radius)}$$

$$\begin{aligned}\therefore \angle BTD &= 180^\circ - 66^\circ - 90^\circ \text{ (}\angle \text{sum of } \triangle\text{)} \\ &= 24^\circ\end{aligned}$$

Answer 24° [2]

- 10 In the diagram, O is the centre of a circular poster $ACBQ$ of radius 20 m. APB is an arc of a circle centre C and radii AC and BC . COQ is a diameter of the circular poster $ACBQ$. COQ bisects AB at M .

If angle $ACB = 1.4$ radians,

- (a) show that AC is approximately 30.594 m,

Answer

$$\angle AOB = 2(1.4) \quad (\angle \text{ at centre} = 2\angle \text{ at circumference})$$

$$= 2.8 \text{ radians}$$

$$\angle AOC = \pi - \left(\frac{2.8}{2}\right)$$

$$= (\pi - 1.4) \text{ radians (adj. } \angle \text{ s on a straight line)}$$

$$AC^2 = 20^2 + 20^2 - 2(20)(20)\cos(\pi - 1.4) \quad \text{or Sine Rule}$$

$$= 935.9737$$

$$\therefore AC = \sqrt{935.9737}$$

$$= 30.5936$$

$$= 30.594 \text{ m (shown)}$$

$$\frac{20}{\sin 0.7} = \frac{AC}{\sin(\pi - 1.4)}$$

$$AC = \frac{20 \sin(\pi - 1.4)}{\sin 0.7}$$

$$= 30.593687$$

$$= 30.594^{[3]}$$

- (b) calculate the perimeter of the shaded region,

$$\text{Perimeter} = \text{arc length } APB + \text{arc length } AQB$$

$$= (30.594 \times 1.4) + (20 \times 2.8)$$

$$= 42.8316 + 56$$

$$= 98.8316$$

$$= 98.8 \text{ (3 s.f.)}$$

Answer 98.8 m [3]

- (c) calculate the total cost of painting the sector $OAQB$ if the painting cost is \$0.50 per square metre.

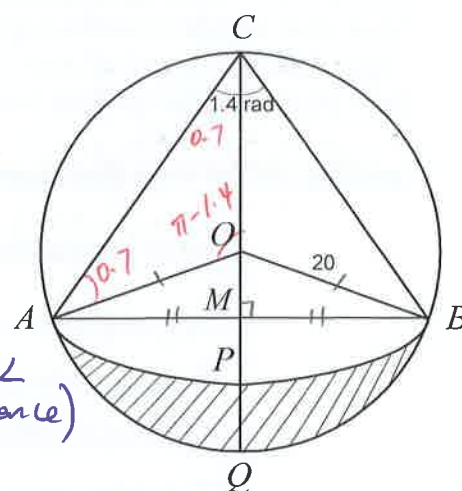
$$\text{Area of sector } OAQB = \frac{1}{2}(20)^2(2.8)$$

$$= 560 \text{ m}^2$$

$$\therefore \text{Total cost} = \$0.50 \times 560$$

$$= \$280$$

Answer \$ 280 [3]



- 11 In an effort to raise funds for the needy, your school is organising a charity cafe. Your class decides to make sugar cookies to sell at the charity cafe. Sugar cookies are packed into clear plastic bags used for food packaging. Each plastic bag (or packet) contains 6 cookies.

Information that your class needs is as follows.

List of ingredients for Sugar Cookies (makes 48 cookies)

350 g all-purpose flour
1 teaspoon baking soda (7 g)
130 g butter, softened
300 g caster sugar
1 egg



Cost of relevant items sold at two different local supermarkets (exclusive of 7% GST)		
Item	Supermarket A	Supermarket B
H/Family all-purpose flour (454 g)	\$0.95	\$0.90
H/Family all-purpose flour (1 kg)	\$1.85	\$1.90
	2 for \$3.50	Not on offer
Kings baking soda (150 g)	\$0.80	\$1.15
TST butter (250 g)	\$4.80	\$4.80
	2 for \$7.00	Buy 2 = \$6.95 Buy 2 and get \$2.65 off
Caster sugar (500 g)	\$1.65	\$1.65
Eggs (10 per pack)	\$1.65	\$1.50
Eggs (30 per pack)	Not available	\$3.85
Clear plastic bag for packaging (100 per pack)	\$8.43	\$7.15

Your class estimates that they will be able to sell 480 **packets** of sugar cookies.

- (a) How much flour does your class need?
Give your answer in kilograms.

$$\begin{aligned}\text{Total number of cookies} &= 480 \times 6 \\ &= 2880\end{aligned}$$

$$\therefore \text{Total no. of batches of cookies} = \frac{2880}{48} = 60$$

$$\begin{aligned}\text{Amount of flour needed} &= 60 \times 350 \text{ g} \\ &= 21000 \text{ g} \\ &= 21 \text{ kg}\end{aligned}$$

Answer 21 kg [1]

Your class decides to buy the ingredients for making sugar cookies, and the plastic bags, from either Supermarket A or B, whichever is cheaper.

- (b) Which supermarket should your class buy the flour from?
Show your calculations and reason clearly.

Answer	
<u>Supermarket A</u>	<u>Supermarket B</u>
$(454 \text{ g pack}) : \frac{1000 \text{ g}}{454 \text{ g}} \times \$0.95 = \$2.09/\text{kg}$ $47 \text{ pks} \times \$0.95 = \44.65	$47 \times \$0.90 = \42.30 $\frac{1000 \text{ g}}{454 \text{ g}} \times \$0.90 = \$1.98/\text{kg}$
1 kg pack : \$1.85 / kg	\$1.90 / kg
2 for \$3.50 : each \$1.75 / kg offer	No offer

My class should buy flour from Supermarket A
at 2 for \$3.50, as the unit price is the cheapest.

or

buy flour from Supermarket A as \$36.85 is the
lowest total amount (\$3.50(10) + \$1.85 = \$36.85) [2]
w GST = \$39.4295

Your class needs to decide on the selling price for one packet of sugar cookies. They must make sure that they charge enough money to cover the costs of the ingredients and the plastic bags for 480 packets, and to make at least \$1000 to donate to charity.

- (c) Suggest a sensible amount for your class to charge for a packet of sugar cookies. Show working to justify your decision.

[7]

Answer

Total no. of batches of baking = 60

Ingredients required : 21 kg flour ,

$7 \times 60 = 420 \text{ g}$ baking soda ,

$130 \text{ g} \times 60 = 7800 \text{ g}$ butter ,

$300 \text{ g} \times 60 = 18000 \text{ g}$ caster sugar ,

$1 \times 60 = 60$ eggs ,

and 480 plastic bags.

Cost of flour from A = $(\$3.50 \times 10 \text{ kg}) + (\$1.85 \times 1 \text{ kg})$
 = \$36.85 \$39.4295 w GST

Cost of baking soda from A = $3 \times \$0.80$

$\left(\frac{420 \text{ g}}{150 \text{ g}} = 2\frac{4}{5} \approx 3 \text{ units} \right) = \underline{\$2.40}$ \$2.568 w GST

Cost of butter from B

$\left(\frac{7800 \text{ g}}{250 \text{ g}} = 31\frac{1}{5} \approx 32 \text{ units} \right) = \underline{\$111.20}$ \$118.984 w GST

Cost of caster sugar from A or B = $36 \times \$1.65$

$\left(\frac{18000 \text{ g}}{500 \text{ g}} = 36 \text{ units} \right) = \underline{\$59.40}$ \$63.558 w GST

Cost of eggs from B

$\left(\frac{60 \text{ eggs}}{30 \text{ per pack}} = 2 \text{ packs} \right) = \underline{\$7.70}$ \$8.239 w GST

Cost of plastic bags from B = $5 \times \$7.15$

$\left(\frac{480}{100} = 4.8 \approx 5 \text{ packs} \right) = \underline{\$35.75}$ \$38.2525

(Candidates may continue to answer **part (c)** on this page.)

$$\text{Total amount before GST} = \$253.30$$

$$\begin{aligned}\text{Total amount after GST} &= 253.30 \times 1.07 \\ &= \$271.031\end{aligned}$$

Minimum amount to make
to donate to charity = \$1000

$$\begin{aligned}\therefore \text{price per packet} &= (\overset{\$1271.031}{\$1000 + \$271.031}) \div 480 \\ &= \$2.64798125 \\ &= \$2.65 \text{ (nearest cent)}\end{aligned}$$

A sensible amount to charge
for one packet would be \$3.
