

Mrs Cooper
Mrs Greenberg
Mrs Kerr
Mrs Millar
Mrs Ward

Mr Feng
Ms Hua
Ms Lau
Mrs Squires

Name:

Teacher:



Pymble Ladies' College

YEAR 11

YEAR 10 MA01

MATHEMATICS ADVANCED

ASSESSMENT TASK 2

**Term 2
2024**

General Instructions

- Working time 55 minutes
- Write using black or blue pen.
- Erasable pens are not to be used.
- Approved calculators may be used.
- Diagrams are not drawn to scale.
- All necessary working should be shown in every question.
- Marks may be deducted for careless or untidy work.
- Reference sheets are provided.

Mark	/36
Rank	/
Highest Mark	/36

Mathematics Advanced

Name:

Teacher's Name:

Section I – Multiple Choice Answer Sheet

Select the alternative (A), (B), (C) or (D) that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
 A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐
 correct

Assessment Task 2

1 A ☐ B ☐ C ☐ D ☐

2 A ☐ B ☐ C ☐ D ☐

3 A ☐ B ☐ C ☐ D ☐

4 A ☐ B ☐ C ☐ D ☐

5 A ☐ B ☐ C ☐ D ☐

6 A ☐ B ☐ C ☐ D ☐

7 A ☐ B ☐ C ☐ D ☐

8 A ☐ B ☐ C ☐ D ☐

9 A ☐ B ☐ C ☐ D ☐

10 A ☐ B ☐ C ☐ D ☐

SECTION I

(10 Marks)

Answer using the Multiple-Choice Answer Sheet provided.

1 Which is the correct conversion of 40° to radians?

(A) $\frac{\pi}{4}$

(B) $\frac{2\pi}{7}$

(C) $\frac{2\pi}{9}$

(D) $\frac{2\pi}{6}$

2 Which of the following is the exact value of $\operatorname{cosec}300^\circ$?

(A) $\frac{-2\sqrt{3}}{3}$

(B) $\frac{2\sqrt{3}}{3}$

(C) 2

(D) -2

3 What are the equations of the asymptotes for the curve $y = \frac{1}{x-1} + 2$?

(A) $x = 2, y = 1$

(B) $y = 2, x = 0$

(C) $x = -1, y = 0$

(D) $x = 1, y = 2$

4 The bearing of B from A is 50° . What is the bearing of A from B ?

(A) 50°

(B) 130°

(C) 220°

(D) 230°

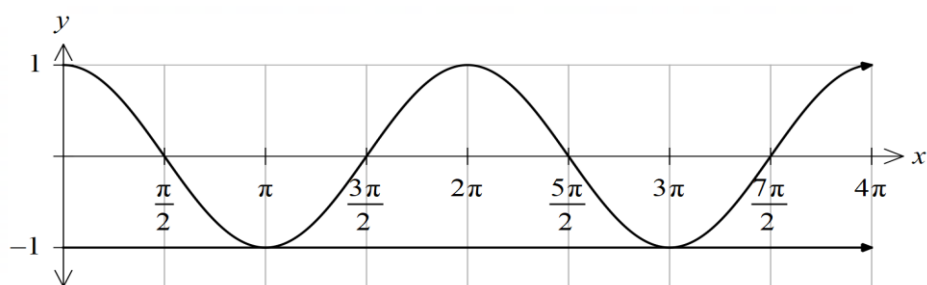
- 5 The number of hours, h , needed to complete a project is inversely proportional to the number of workers, w employed by the project manager.
Given that 12 workers can complete the task in 3 hours, which of the following equations gives the relationship between h and w ?

- (A) $h = \frac{36}{w}$
 (B) $h = \frac{4}{w}$
 (C) $h = 36w$
 (D) $h = 4w$

- 6 If $\tan \theta = \frac{3}{5}$ and $\sin \theta < 0$ which of the following is the correct value for $\cos \theta$?

- (A) $\frac{5}{\sqrt{34}}$
 (B) $\frac{\sqrt{34}}{5}$
 (C) $-\frac{5}{\sqrt{34}}$
 (D) $-\frac{3}{\sqrt{34}}$

- 7 Which of the following conclusions can be drawn from the graph drawn below?

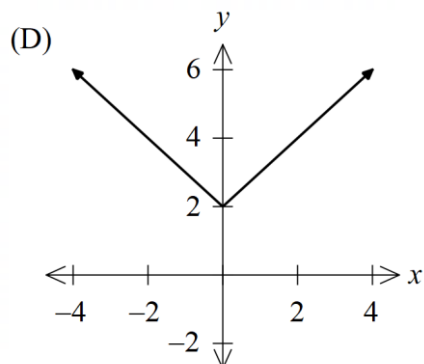
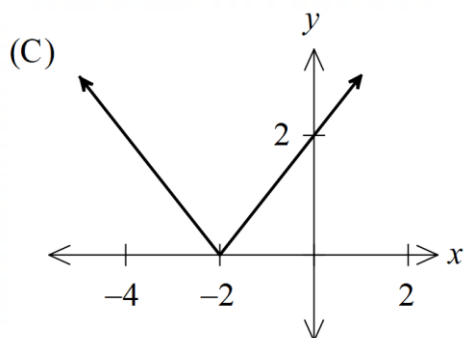
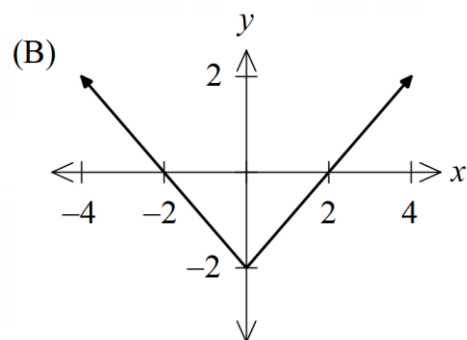
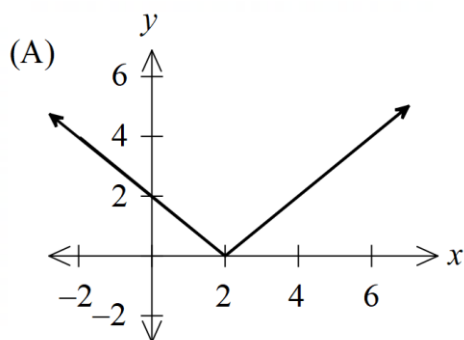


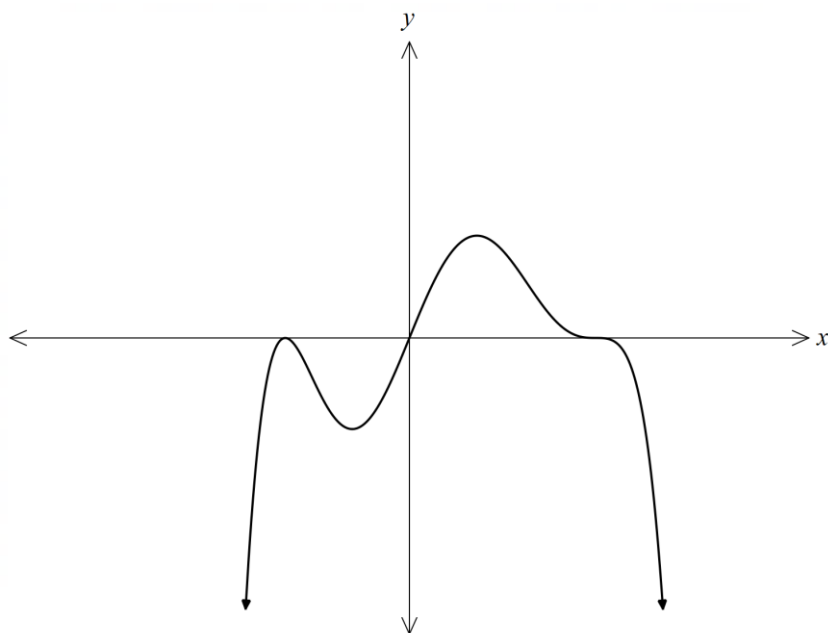
- (A) $\cos x = -1$ has two solutions on the domain $(0, 4\pi)$
 (B) $\cos x = -1$ has four solutions on the domain $(0, 4\pi)$
 (C) $\sin x = -1$ has two solutions on the domain $(0, 4\pi)$
 (D) $\sin x = -1$ has two solutions on the domain $(0, 4\pi)$

8 Which of the following is equivalent to $\tan^2 \theta \operatorname{cosec}^2 \theta$?

- (A) $\tan^2 \theta$
- (B) $\sin \theta$
- (C) $\sec^2 \theta$
- (D) $\cos^3 \theta$

9 Which graph best represents $y = |x| - 2$?





Which of the following could be the equation of this graph?

- (A) $x(x+4)^2(x-3)^3$
- (B) $-x(x-4)^2(x+3)$
- (C) $-x(x+4)^2(x+3)$
- (D) $-x(x+4)^2(x-3)^3$

End of Section I

SECTION II

(26 Marks)

Attempt all questions

Answer these questions in the spaces provided.

Extra writing space is provided at the end of this section.

Your responses should include relevant mathematical reasoning and/or calculations.

Question 11

Marks

Solve $|3x + 4| - 7 = -2$.

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Question 12

Show that $\frac{2\sec^2 \theta - 2}{\sin \theta} = 2 \tan \theta \sec \theta$.

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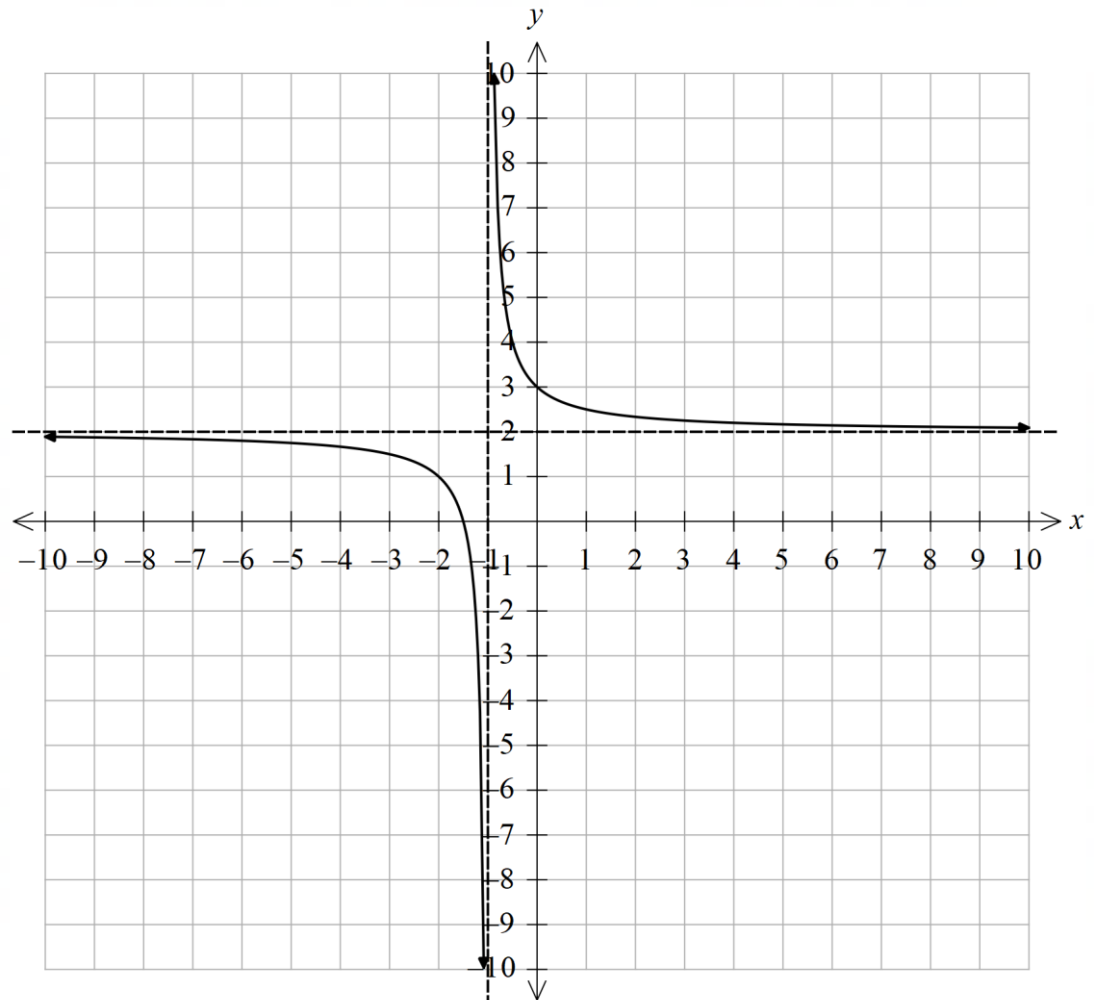
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Question 13**Marks**

The graph of $f(x) = \frac{1}{x+1} + 2$ is shown below.

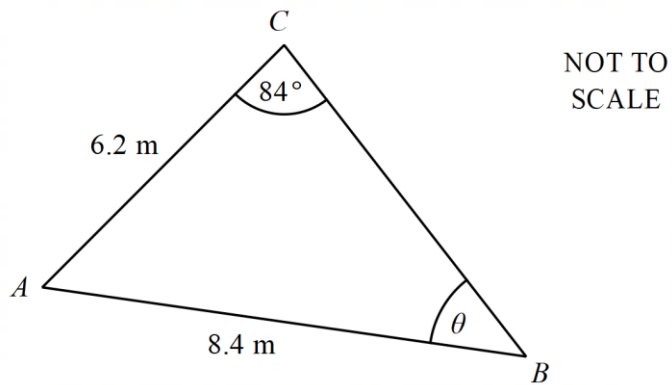
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On the same axis, draw the graph of $y = -f(x)$, showing all key features.



Question 14**Marks**

$\triangle ABC$ is given below. Calculate the area of the triangle.
Give your answer to 2 decimal places.

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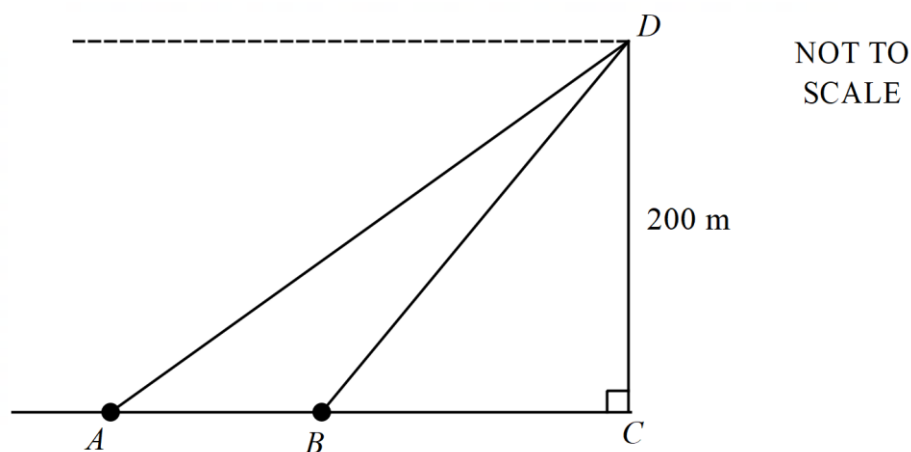
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Question 15**Marks**

From the top of a vertical cliff 200 metres high, the angle of depression of two objects A and B due west of the cliff are 30° and 50° , respectively.

3

Find the distance between A and B . Give your answer to the nearest metre.



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Question 16

Solve the equation $\sin \theta (2 \sin \theta - \sqrt{3}) = 0$ for $0 \leq \theta \leq \pi$.

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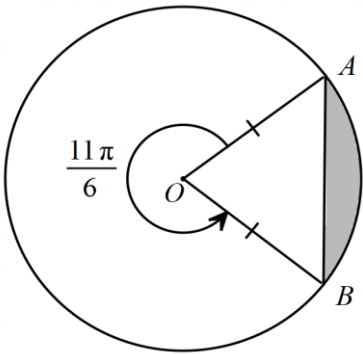
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Question 17

Marks

The diagram shows a sector OAB of a circle, centre O and with chord $AB = 10$ cm.

The reflex angle of $\angle AOB$ is $\frac{11\pi}{6}$ radians.



NOT TO
SCALE

- (a) Show that $\angle OAB = \frac{5\pi}{12}$ radians.

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- (b) Find the length of OB , correct to 2 decimal places.

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- (c) Calculate the area of the shaded segment formed by the chord AB .
Give your answer to 3 decimal places.

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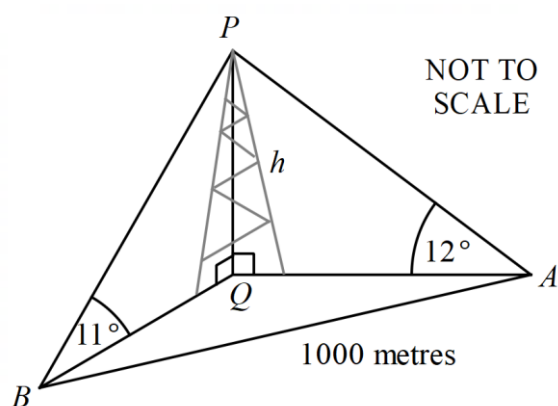
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Question 18

Marks



The angle of elevation of a tower, PQ , of height h metres, at a point A , due east of the tower, is 12° . From another point B , the bearing of the tower is 051°T , and the angle of elevation is 11° . The points A and B are 1000 metres apart and on the same level as the base Q of the tower.

- (a) Show that $\angle AQB = 141^\circ$. 1

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- (b) Consider the triangle APQ and show that $AQ = h \tan 78^\circ$. 1

.....

- (c) Find a similar expression for BQ . 1

.....

Question 18 continues on page 11

Question 18 continued.

Marks

- (d) Use the cosine rule in the triangle AQB to calculate h to the nearest metre.

2

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

End of Assessment Task

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Section II extra writing space

If you use this space, clearly indicate which question you are answering.

[illegible]

Section II extra writing space

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Michelle M Q's 11-14

Catrina 15, 16,
17

Cara 18

Name: Solutions + Marking
Teacher: Guidelines



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YEAR 11

YEAR 10 MA01

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Rank	/
Highest Mark	/36

Mathematics

Advanced

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A ☐ B ☒ C ☐ D ☐

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A ☒ B ☒ C ☐ D ☐
correct

Assessment Task 2

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7 A ☒ B ☐ C ☐ D ☐

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SECTION I

(10 Marks)

Answer using the Multiple-Choice Answer Sheet provided.

- 1 Which is the correct conversion of 40° to radians?

(A) $\frac{\pi}{4}$

(B) $\frac{2\pi}{7}$

☒ (C) $\frac{2\pi}{9}$

(D) $\frac{2\pi}{6}$

$$4 \times \frac{\pi}{180} = \frac{2\pi}{9}$$

- 2 Which of the following is the exact value of $\operatorname{cosec} 300^\circ$?

☒ (A) $\frac{-2\sqrt{3}}{3}$

(B) $\frac{2\sqrt{3}}{3}$

(C) 2

(D) -2

$$= -\operatorname{cosec} 60^\circ$$

$$= -\frac{2}{\sqrt{3}}$$

$$= -\frac{2\sqrt{3}}{3}$$

- 3 What are the equations of the asymptotes for the curve $y = \frac{1}{x-1} + 2$?

(A) $x = 2, y = 1$

(B) $y = 2, x = 0$

(C) $x = -1, y = 0$

☒ (D) $x = 1, y = 2$

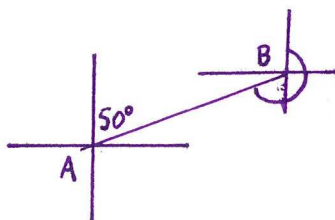
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(A) 50°

(B) 130°

(C) 220°

☒ (D) 230°



- 5 The number of hours, h , needed to complete a project is inversely proportional to the number of workers, w employed by the project manager.
Given that 12 workers can complete the task in 3 hours, which of the following equations gives the relationship between h and w ?

(A) $h = \frac{36}{w}$

(B) $h = \frac{4}{w}$

(C) $h = 36w$

(D) $h = 4w$

$h = \frac{k}{w}$
 $w = 12, h = 3 \therefore 3 = \frac{k}{12}$
 $k = 36$
 $h = \frac{36}{w}$

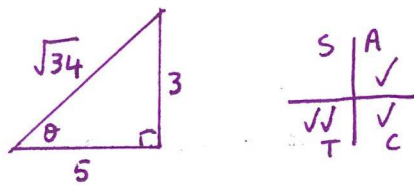
- 6 If $\tan \theta = \frac{3}{5}$ and $\sin \theta < 0$ which of the following is the correct value for $\cos \theta$?

(A) $\frac{5}{\sqrt{34}}$

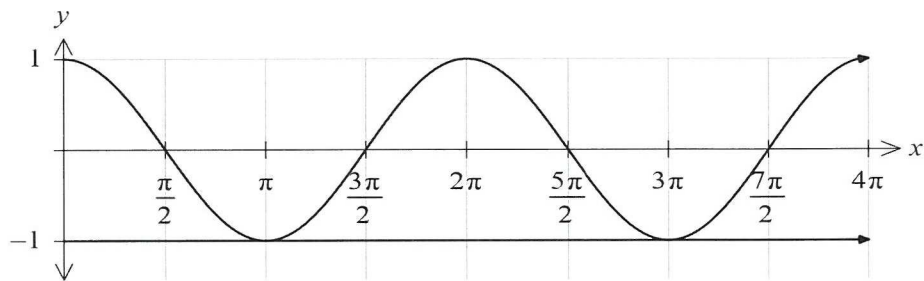
(B) $\frac{\sqrt{34}}{5}$

(C) $-\frac{5}{\sqrt{34}}$

(D) $-\frac{3}{\sqrt{34}}$



- 7 Which of the following conclusions can be drawn from the graph drawn below?



(A) $\cos x = -1$ has two solutions on the domain $(0, 4\pi)$

(B) $\cos x = -1$ has four solutions on the domain $(0, 4\pi)$

(C) $\sin x = -1$ has two solutions on the domain $(0, 4\pi)$

(D) $\sin x = -1$ has two solutions on the domain $(0, 4\pi)$

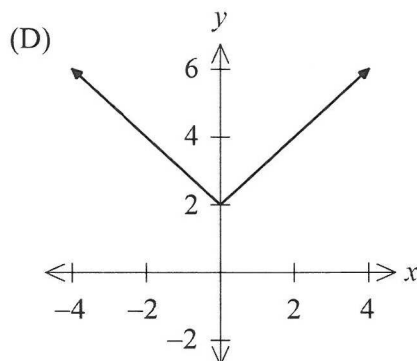
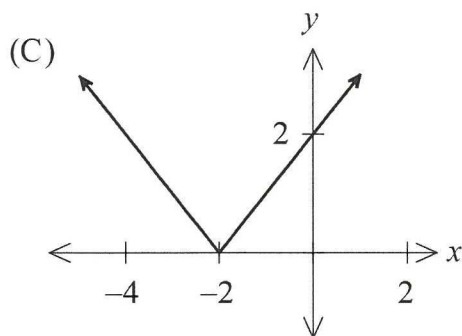
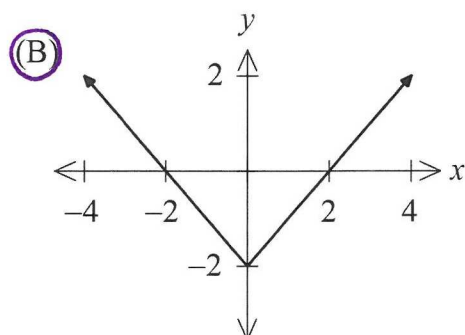
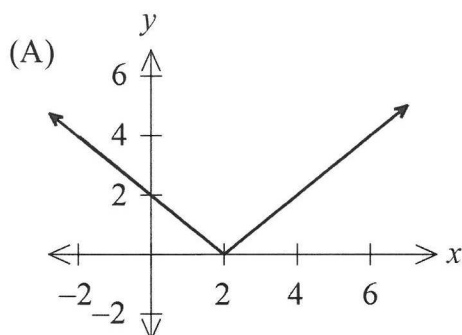
8 Which of the following is equivalent to $\tan^2 \theta \operatorname{cosec}^2 \theta$?

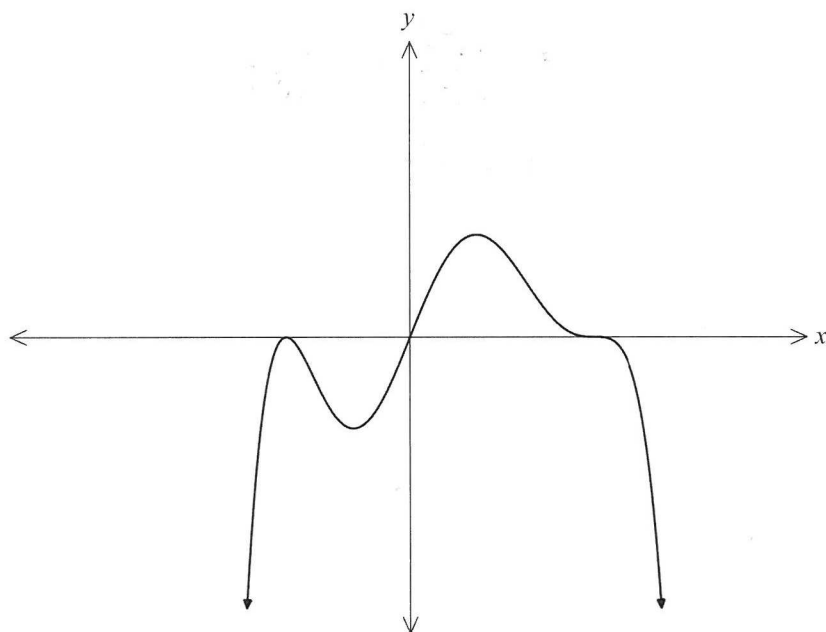
- (A) $\tan^2 \theta$
 (B) $\sin \theta$
 (C) $\sec^2 \theta$
 (D) $\cos^3 \theta$

$$= \frac{\sin^2 \theta}{\cos^2 \theta} \times \frac{1}{\sin^2 \theta}$$

$$= \sec^2 \theta$$

9 Which graph best represents $y = |x| - 2$?





Which of the following could be the equation of this graph?

- (A) $x(x+4)^2(x-3)^3$
- (B) $-x(x-4)^2(x+3)$
- (C) $-x(x+4)^2(x+3)$
- (D) $-x(x+4)^2(x-3)^3$

End of Section I

SECTION II

(26 Marks)

Attempt all questions

Answer these questions in the spaces provided.

Extra writing space is provided at the end of this section.

Your responses should include relevant mathematical reasoning and/or calculations.

Question 11

Marks

Solve $|3x+4|-7=-2$.

2

$$\begin{aligned} |3x+4| &= 5 \quad \checkmark \quad \boxed{1} \\ 3x+4 &= 5 \quad \text{or} \quad -(3x+4) = 5 \\ 3x &= 1 \quad \quad \quad -3x = 9 \\ x &= \frac{1}{3} \quad \quad \quad x = -3 \end{aligned}$$

1 | Simplifies to $\boxed{1}$
2 | Both solutions correct.

Question 12

Show that $\frac{2\sec^2\theta-2}{\sin\theta} = 2\tan\theta\sec\theta$.

2

$$\begin{aligned} \text{L.H.S.} &= \frac{2(\sec^2\theta-1)}{\sin\theta} \\ &= \frac{2\tan^2\theta}{\sin\theta} \quad \checkmark \quad \boxed{1} \\ &= \frac{2\cancel{\sin^2\theta}^{\sin\theta}}{\cancel{\sin\theta}^{\sin\theta}\cos^2\theta} \\ &= \frac{2\sin\theta}{\cos\theta\cos\theta} \\ &= 2\tan\theta\sec\theta \quad \checkmark \\ &= \text{R.H.S.} \end{aligned}$$

1 | Works towards $\boxed{1}$
2 | Correct proof

Question 13

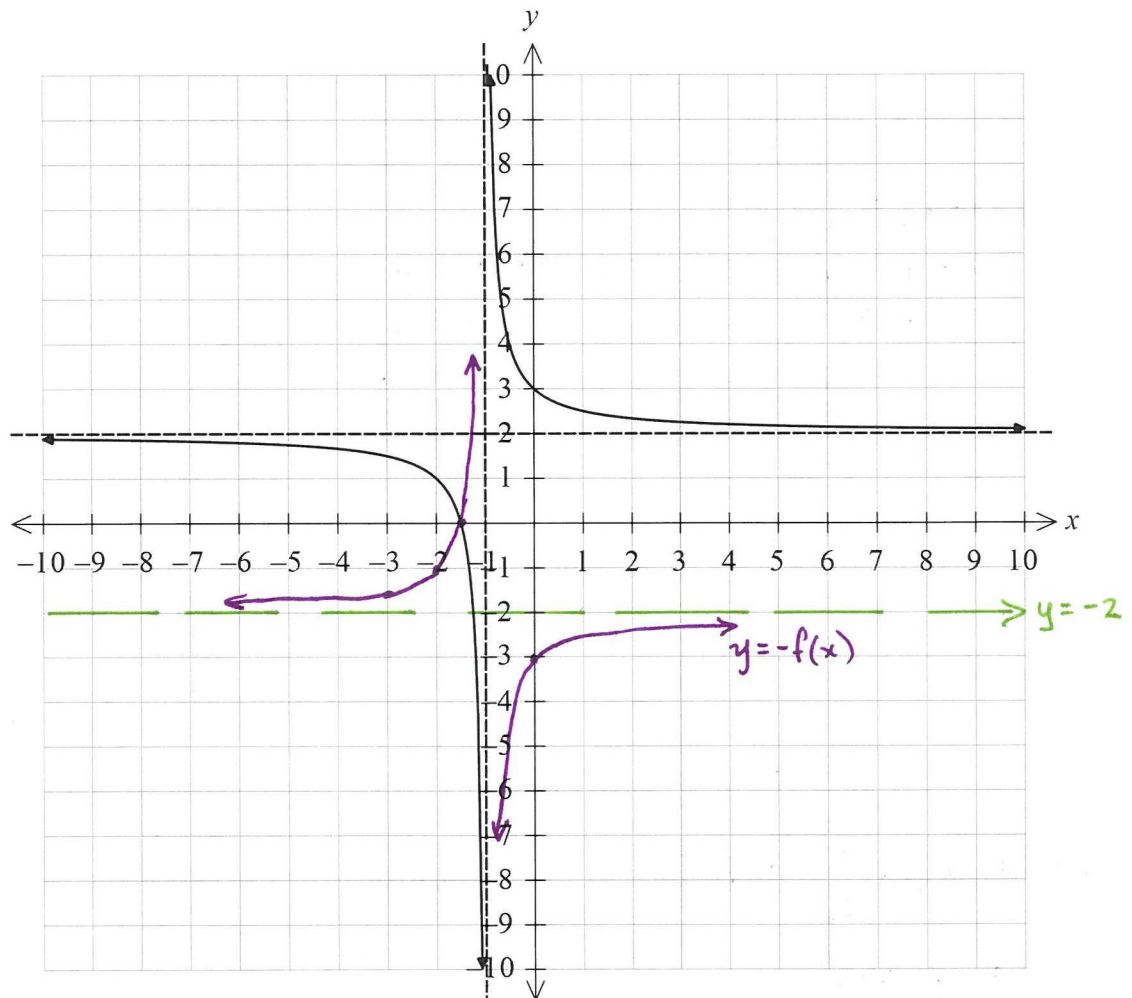
Marks

The graph of $f(x) = \frac{1}{x+1} + 2$ is shown below.

2

On the same axis, draw the graph of $y = -f(x)$, showing all key features.

Flip over x-axis



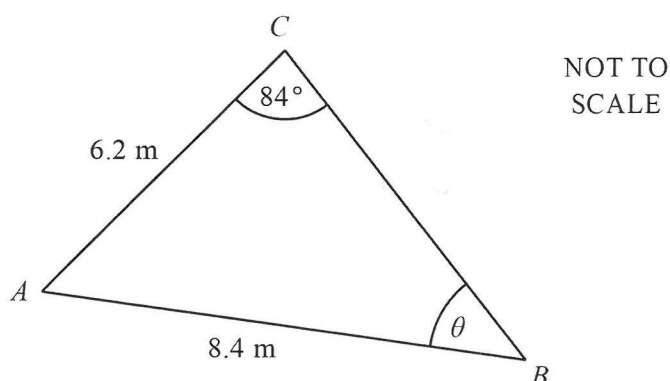
- 1 | Correct new asym. $y = -2$
- 2 | Correct reflected hyperbola (ecf)

Question 14

Marks

$\triangle ABC$ is given below. Calculate the area of the triangle.
Give your answer to 2 decimal places.

3



1	Correct θ
2	Correct $\angle A$
3	Correct application of formula.

$$(1) \quad \frac{\sin \theta}{6.2} = \frac{\sin 84^\circ}{8.4}$$

$$\theta = \sin^{-1}\left(\frac{6.2 \sin 84^\circ}{8.4}\right)$$

$$\theta = 47.22716...^\circ$$

$$(2) \quad \angle A = 180^\circ - (84^\circ + 47.22716...^\circ)$$

$$\angle A = 48.7728...^\circ$$

$$(3) \quad \text{Area} = \frac{1}{2} \times 6.2 \times 8.4 \times \sin 48.7728...^\circ$$

$$= 19.58475...$$

$$\approx 19.58 \text{ m}^2$$

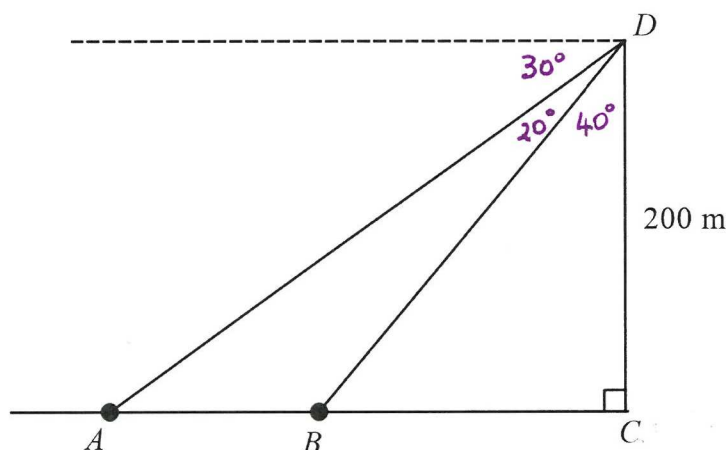
Question 15

Marks

From the top of a vertical cliff 200 metres high, the angle of depression of two objects A and B due west of the cliff are 30° and 50° , respectively.

3

Find the distance between A and B . Give your answer to the nearest metre.



NOT TO
SCALE

$$\triangle ADC: \tan 60^\circ = \frac{AC}{200}$$

$$AC = 200\sqrt{3} \quad \checkmark$$

$$\triangle BDC: \tan 40^\circ = \frac{BC}{200}$$

$$BC = 200 \tan 40^\circ \quad \checkmark$$

$$AB = AC - BC$$

$$= 200\sqrt{3} - 200 \tan 40^\circ$$

$$= 178.59023... \quad \checkmark$$

$$\approx 179 \text{ m}$$

3	Correct
2	Correct process but angles incorrect
1	one process correct

Question 16

Solve the equation $\sin \theta (2 \sin \theta - \sqrt{3}) = 0$ for $0 \leq \theta \leq \pi$.

3

$$\sin \theta = 0$$

$$\theta = 0, \pi$$

$$\text{or } 2 \sin \theta - \sqrt{3} = 0$$

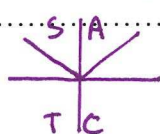
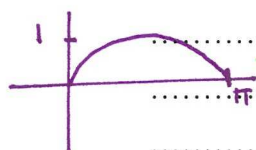
$$\sin \theta = \frac{\sqrt{3}}{2}$$

$$\text{acute } \theta = \frac{\pi}{3}$$

$$\therefore \theta = \frac{\pi}{3}, \pi - \frac{\pi}{3}$$

$$\theta = \frac{\pi}{3}, \frac{2\pi}{3}$$

$$\text{Sol'n: } \theta = 0, \pi, \frac{\pi}{3}, \frac{2\pi}{3}$$



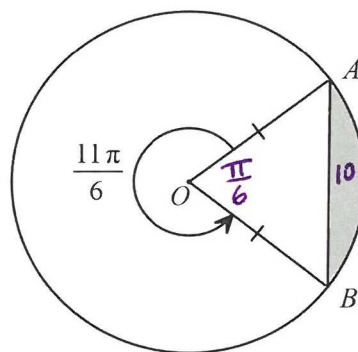
3	Correct
2	one angle missing
1	Two eqns or one eqn with correct soln in radians

Question 17

Marks

The diagram shows a sector OAB of a circle, centre O and with chord $AB = 10$ cm.

The reflex angle of $\angle AOB$ is $\frac{11\pi}{6}$ radians.



NOT TO SCALE

- (a) Show that $\angle OAB = \frac{5\pi}{12}$ radians.

2

$$\begin{aligned} \angle AOB (\text{acute}) &= 2\pi - \frac{11\pi}{6} \\ &= \frac{12\pi - 11\pi}{6} \\ &= \frac{\pi}{6} \quad \checkmark \end{aligned}$$

$$\begin{aligned} \angle OAB &= \frac{\pi - \frac{\pi}{6}}{2} \quad (\text{isosceles triangle}) \\ &= \frac{\frac{5\pi}{6}}{2} \\ &= \frac{5\pi}{12} \quad \checkmark \end{aligned}$$

1 | Correct $\angle AOB = \frac{\pi}{6}$
2 | Correct $\frac{5\pi}{12}$ working

- (b) Find the length of OB , correct to 2 decimal places.

2

$$\begin{aligned} \frac{OB}{\sin \frac{5\pi}{12}} &= \frac{10}{\sin \frac{\pi}{6}} \quad \checkmark \square \\ OB &= \frac{10 \sin \frac{5\pi}{12}}{\frac{1}{2}} \\ OB &= 19.31851... \quad \checkmark \\ OB &\doteq 19.32 \text{ cm} \end{aligned}$$

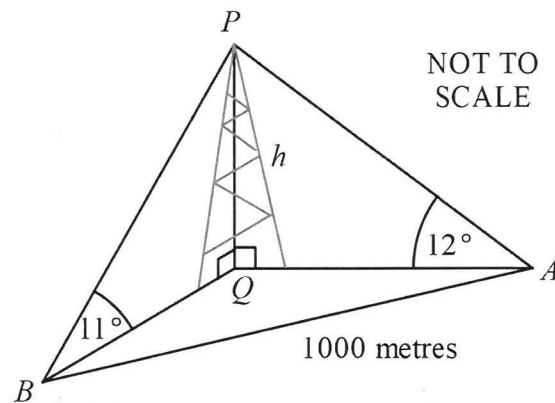
1 | Correct $\square$
2 | Correct OB (ignore rounding)

- (c) Calculate the area of the shaded segment formed by the chord AB .
Give your answer to 3 decimal places.

2

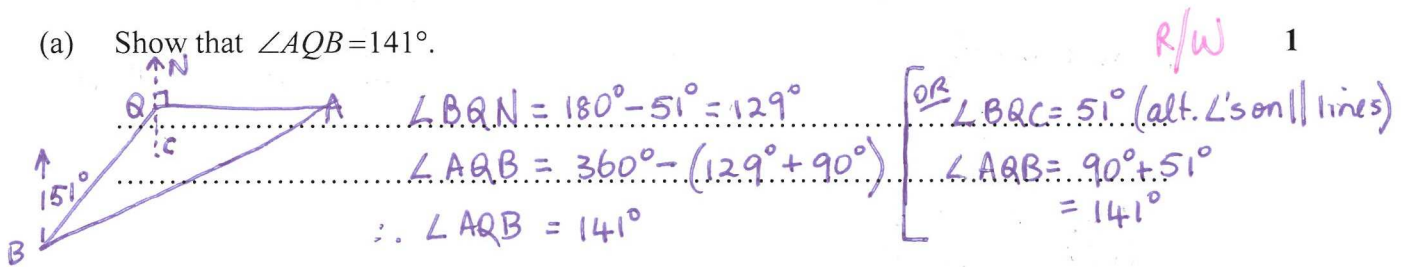
$$\begin{aligned} \text{Shaded Area} &= \frac{1}{2} (19.32)^2 \times \frac{\pi}{6} - \frac{1}{2} (19.32)^2 \sin \frac{\pi}{6} \quad \checkmark \square \\ &= 4.404267... \quad \checkmark \\ &\doteq 4.404 \text{ cm}^2 \end{aligned}$$

1 | Correct $\square$
2 | Correct shaded area (ignore rounding)

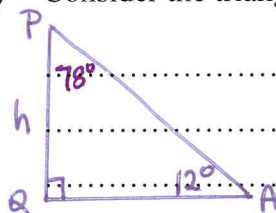


The angle of elevation of a tower, PQ , of height h metres, at a point A , due east of the tower, is 12° . From another point B , the bearing of the tower is 051°T , and the angle of elevation is 11° . The points A and B are 1000 metres apart and on the same level as the base Q of the tower.

- (a) Show that $\angle AQB = 141^\circ$.



- (b) Consider the triangle APQ and show that $AQ = h \tan 78^\circ$.

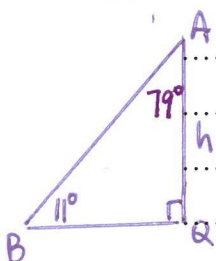


$$\angle APQ = 90^\circ - 12^\circ = 78^\circ$$

$$\tan 78^\circ = \frac{AQ}{h}$$

$$\therefore AQ = h \tan 78^\circ$$

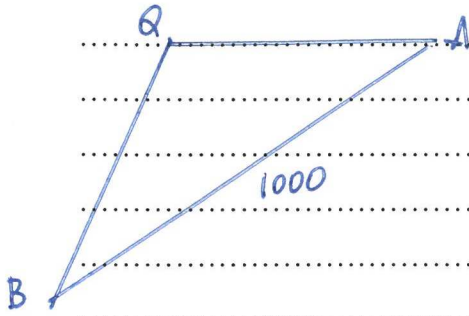
- (c) Find a similar expression for BQ .



$$BQ = h \tan 79^\circ$$

- (d) Use the cosine rule in the triangle AQB to calculate h to the nearest metre.

2



$$1000^2 = h^2 \tan^2 79^\circ + h^2 \tan^2 78^\circ - 2h^2 \tan 79^\circ \tan 78^\circ \cos 141^\circ \checkmark$$

$$1000^2 = h^2 (\tan^2 79^\circ + \tan^2 78^\circ - 2 \tan 79^\circ \tan 78^\circ \cos 141^\circ)$$

$$h^2 = \frac{1000^2}{\tan^2 79^\circ + \tan^2 78^\circ - 2 \tan 79^\circ \tan 78^\circ \cos 141^\circ}$$

$$h = 107.6958 \dots \checkmark$$

$$h \doteq 108 \text{ m}$$

- | | |
|---|--|
| 1 | Correct substitution into Cosine Rule. |
| 2 | Correct height (ignore rounding) |