

Mrs Cooper
Mrs Greenberg
Mrs Kerr
Mrs Millar
Mrs Squires

Mr Feng
Ms Hoang
Ms Lau
Ms Peng
Mrs Ward

Name:

Teacher:



Pymble Ladies' College

YEAR 11

MATHEMATICS ADVANCED

ASSESSMENT TASK 2

**Term 2
2023**

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	/35
Rank	/
Highest Mark	/35

Mathematics Advanced

Year 11

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 

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 ○

SECTION I

Multiple Choice.

Use the multiple-choice answer sheet for Questions 1-8
(Each question in this section is worth 1 mark)

- 1 If $\tan \theta = -\frac{4}{5}$ and $\cos \theta > 0$, what is the value of $\sin \theta$?

(A) $\frac{4}{\sqrt{41}}$

(B) $\frac{5}{\sqrt{41}}$

(C) $\frac{-4}{\sqrt{41}}$

(D) $\frac{-5}{\sqrt{41}}$

- 2 What is the natural domain of the function $f(x) = \frac{1}{x+5}$?

(A) $x \in (-\infty, 5) \cup (5, \infty)$

(B) $x \in (-\infty, -5) \cup (-5, \infty)$

(C) $x \in (-\infty, 5)$

(D) $x \in (5, \infty)$

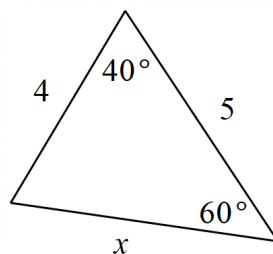
- 3 Which of the following statements is true for the given diagram?

(A) $\cos 60^\circ = \frac{5^2 + 4^2 - x^2}{2 \times 5 \times 4}$

(B) $\frac{4}{\sin 60^\circ} = \frac{x}{\sin 100^\circ}$

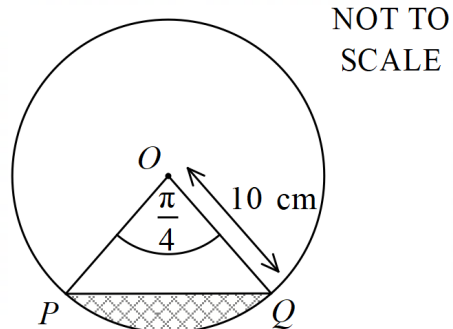
(C) $x^2 = 25 + 16 - 2 \times 5 \times 4 \cos 60^\circ$

(D) $\frac{5}{\sin 80^\circ} = \frac{x}{\sin 40^\circ}$

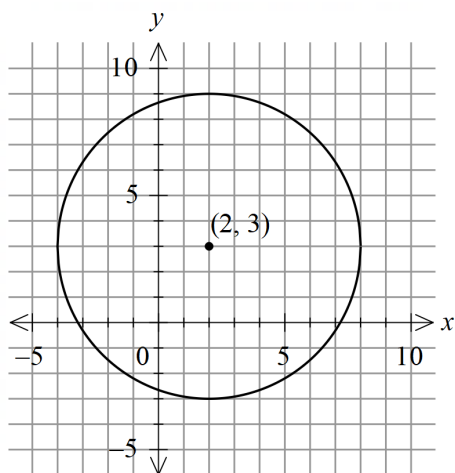


- 4 Given that O is the centre of the circle and $OQ = 10$ cm, what is the exact area of the shaded segment?

- (A) $100\left(\frac{\pi}{4} - \frac{1}{\sqrt{2}}\right) \text{ cm}^2$
- (B) $50\left(\frac{\pi}{4} - \frac{1}{\sqrt{2}}\right) \text{ cm}^2$
- (C) $25\left(\frac{\pi}{4} + \frac{1}{\sqrt{2}}\right) \text{ cm}^2$
- (D) $50\left(\frac{1}{\sqrt{2}} - \frac{\pi}{4}\right) \text{ cm}^2$



5



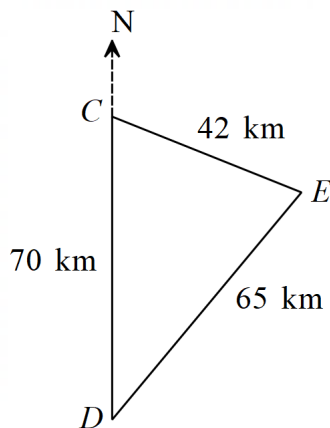
What is the equation of the circle drawn above?

- (A) $(x+2)^2 + (y+3)^2 = 6$
- (B) $(x-2)^2 + (y-3)^2 = 6$
- (C) $(x-2)^2 + (y-3)^2 = 36$
- (D) $(x-2)^2 + (y+3)^2 = 36$

6 Which of the following is an expression for $\sec^2 x - \cos^2 x - \sin^2 x$?

- (A) $-\sin^2 x$
- (B) $\cos^2 x$
- (C) $-\tan^2 x$
- (D) $\tan^2 x$

7 Town D is 70 km due south of Town C and 65 km from Town E .
Town C is 42 km from Town E .



What is the bearing of Town D from Town E , correct to the nearest degree?

- (A) 033°
 - (B) 036°
 - (C) 144°
 - (D) 216°
- 8 How many solutions to the equation $(\sin x + 1)(\tan x + 2) = 0$ lie between 0° and 360° ?
- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4

End of Section I

BLANK PAGE

SECTION II

(27 Marks)

Attempt all questions

Answer these questions in the spaces provided.

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

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

Marks

Question 9 (1 mark)

Express 395° in radians. Simplify your answer and leave in terms of π .

1

.....
.....

Question 10 (2 marks)

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

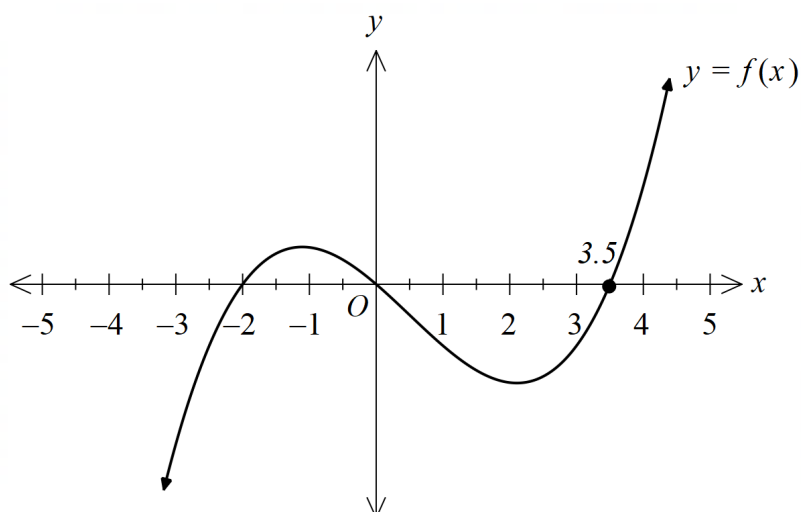
2

.....
.....
.....
.....
.....

Question 11 (1 mark)

Given the graph of $y = f(x)$ below, sketch $y = f(-x)$ on the same number plane.

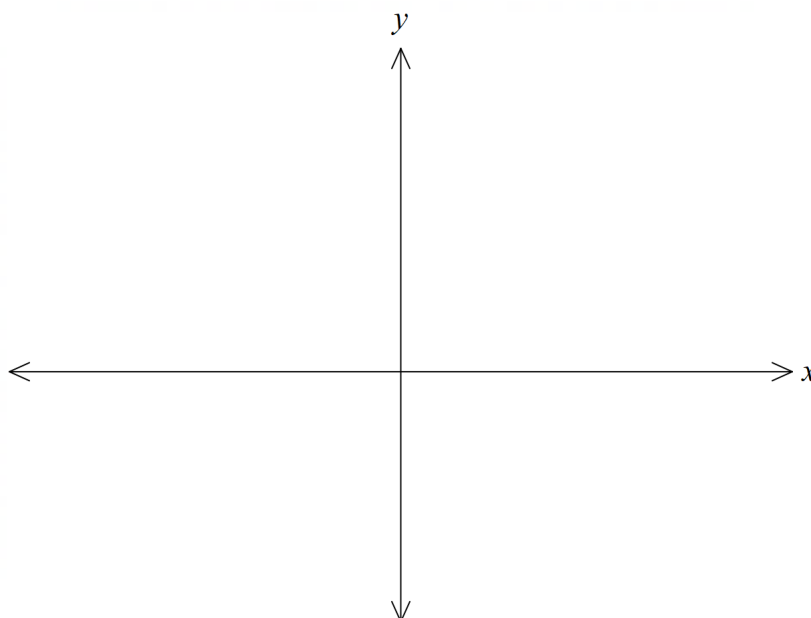
1



Question 12 (4 marks)

- (a) Sketch the graphs of $y = |x - 2|$ and $y = 2$ on the same number plane. Clearly show the point/s of intersection.

2



- (b) Hence, or otherwise, solve $|x - 2| = 2$.

1

.....

.....

.....

- (c) Given the more general equation $|x - 2| = k$, for what values of k would there be no solutions?

1

.....

.....

Question 13 (2 marks)

Find the exact value of $2\sin 315^\circ - 1$.

2

[illegible]

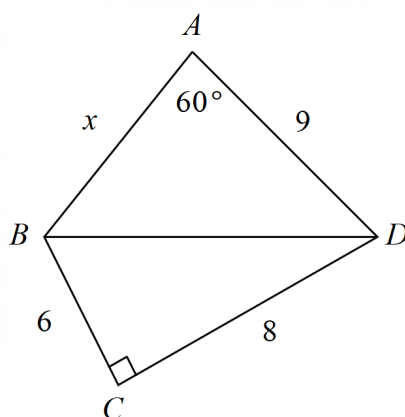
Question 14 (3 marks)

Show that $\frac{1+\cos \theta}{\sin \theta} + \frac{\sin \theta}{1+\cos \theta} = 2\operatorname{cosec} \theta$.

3

[illegible]

Question 15 (5 marks)



NOT TO SCALE

In the above diagram, $AB = x$ cm, $BC = 6$ cm, $AD = 9$ cm and $DC = 8$ cm.
 BC is perpendicular to DC and $\angle BAD = 60^\circ$.

- (a) Use the given information to show that $x^2 - 9x - 19 = 0$.

3

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Hence, show the area of figure $ABCD$ is approximately 66 cm^2 .

2

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

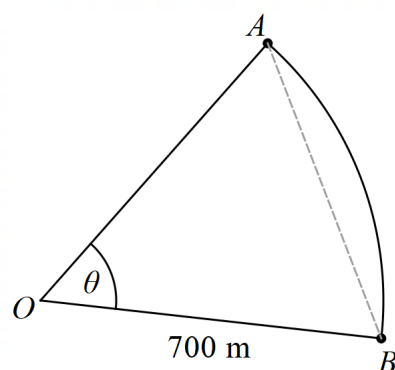
.....

.....

.....

Question 16 (4 marks)

The diagram below illustrates sector AOB .



NOT TO SCALE

- (a) Let A = area of the sector and l = length of arc AB .

2

Given that $A : l^2 = 9 : 4\pi$, show that $\theta = \frac{2\pi}{9}$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Find the length of the chord AB , correct to three significant figures.

2

.....

.....

.....

.....

.....

.....

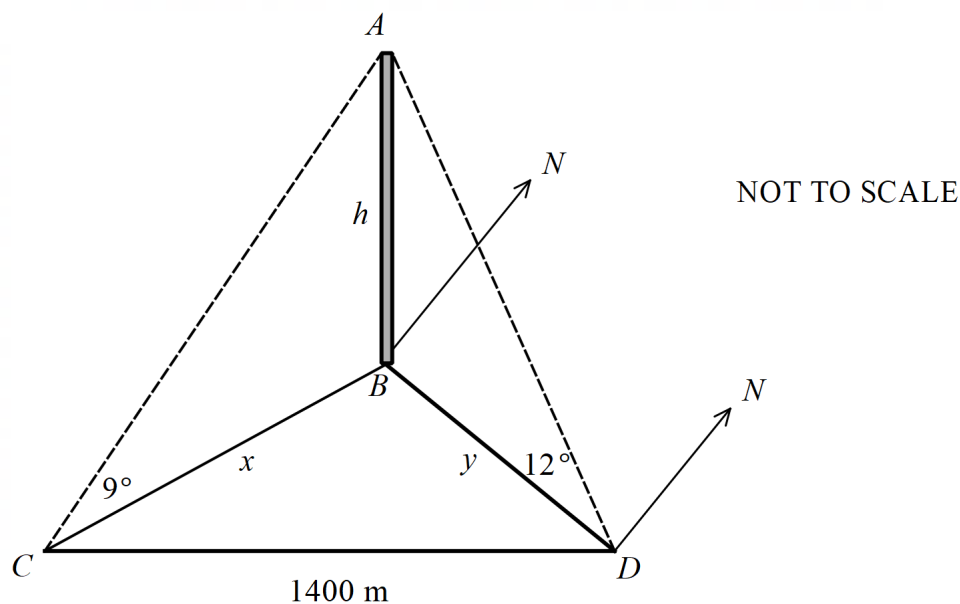
.....

.....

.....

.....

Question 17 (5 marks)



In the diagram above, AB is a tower and CD is a road. A person observes the tower AB , from point C , at a bearing of 023° , with an angle of elevation of 9° .

After travelling 1400 metres along the road to D , a person observes the tower from D at a bearing of 295° and an angle of elevation 12° .

Let $CB = x$, $BD = y$ and $AB = h$.

- (a) Show that $\angle CBD = 88^\circ$.

1

.....

- (b) Express x in terms of h .

1

.....

Question 17 continues on next page

Marks

3

$$h = \sqrt{\frac{1400^2}{\frac{1}{\tan^2 9^\circ} + \frac{1}{\tan^2 12^\circ} + \frac{2 \cos 88^\circ}{\tan 9^\circ \tan 12^\circ}}}.$$

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

BLANK PAGE

Section II extra writing space

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

[illegible]

Section II extra writing space

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

[illegible]

- Solutions
- Marking guidelines

Mrs Cooper
Mrs Greenberg
Mrs Kerr
Mrs Millar
Mrs Squires

Mr Feng
Ms Hoang
Ms Lau
Ms Peng
Mrs Ward

Name:

Teacher:



Pymble Ladies' College

YEAR 11

MATHEMATICS ADVANCED

ASSESSMENT TASK 2

Term 2

2023

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	/35
Rank	/
Highest Mark	/35

Mathematics Advanced

Year 11

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 ☐

SECTION I

Multiple Choice.

Use the multiple-choice answer sheet for Questions 1-8
(Each question in this section is worth 1 mark)

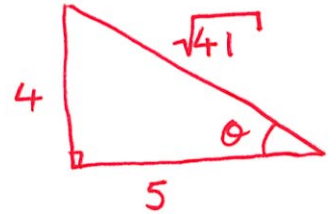
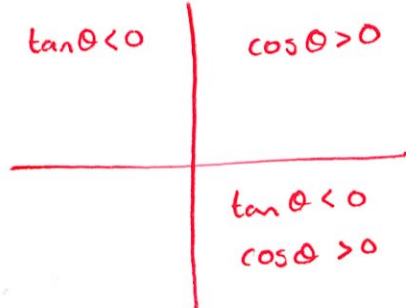
- 1 ✓ If $\tan \theta = -\frac{4}{5}$ and $\cos \theta > 0$, what is the value of $\sin \theta$?

(A) $\frac{4}{\sqrt{41}}$

(B) $\frac{5}{\sqrt{41}}$

(C) $-\frac{4}{\sqrt{41}}$

(D) $-\frac{5}{\sqrt{41}}$



Q4 $\sin \theta < 0$

- 2 ✓ What is the natural domain of the function $f(x) = \frac{1}{x+5}$?

(A) $x \in (-\infty, 5) \cup (5, \infty)$

(B) $x \in (-\infty, -5) \cup (-5, \infty)$

(C) $x \in (-\infty, 5)$

(D) $x \in (5, \infty)$

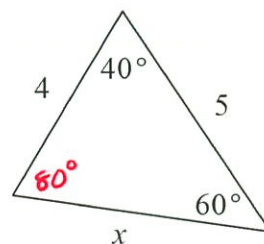
- 3 ✓ Which of the following statements is true for the given diagram?

(A) $\cos 60^\circ = \frac{5^2 + 4^2 - x^2}{2 \times 5 \times 4}$

(B) $\frac{4}{\sin 60^\circ} = \frac{x}{\sin 100^\circ}$

(C) $x^2 = 25 + 16 - 2 \times 5 \times 4 \cos 60^\circ$

(D) $\frac{5}{\sin 80^\circ} = \frac{x}{\sin 40^\circ}$



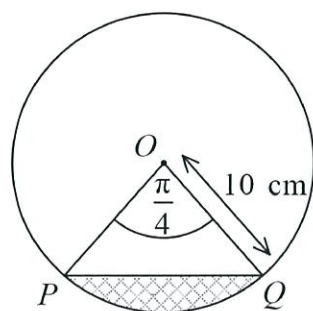
- 4 ✓ Given that O is the centre of the circle and $OQ = 10$ cm, what is the exact area of the shaded segment?

(A) $100\left(\frac{\pi}{4} - \frac{1}{\sqrt{2}}\right) \text{ cm}^2$

(B) $50\left(\frac{\pi}{4} - \frac{1}{\sqrt{2}}\right) \text{ cm}^2$

(C) $25\left(\frac{\pi}{4} + \frac{1}{\sqrt{2}}\right) \text{ cm}^2$

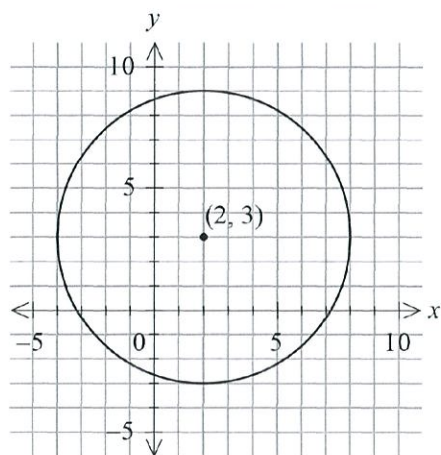
(D) $50\left(\frac{1}{\sqrt{2}} - \frac{\pi}{4}\right) \text{ cm}^2$



NOT TO
SCALE

$$\begin{aligned} \text{Area} &= \frac{1}{2} r^2 \theta - \frac{1}{2} \times 10^2 \times \sin\left(\frac{\pi}{4}\right) \\ &= 50\theta - 50\left(\frac{1}{\sqrt{2}}\right) \\ &= 50\left(\frac{\pi}{4} - \frac{1}{\sqrt{2}}\right) \end{aligned}$$

5 ✓



What is the equation of the circle drawn above?

(A) $(x+2)^2 + (y+3)^2 = 6$

(B) $(x-2)^2 + (y-3)^2 = 6$

(C) $(x-2)^2 + (y-3)^2 = 36$

(D) $(x-2)^2 + (y+3)^2 = 36$

- 6 ✓ Which of the following is an expression for $\sec^2 x - \cos^2 x - \sin^2 x$?

(A) $-\sin^2 x$

(B) $\cos^2 x$

(C) $-\tan^2 x$

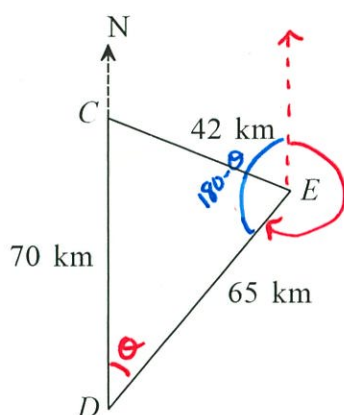
(D) $\tan^2 x$

$$\sec^2 x - (\cos^2 x + \sin^2 x)$$

$$= \sec^2 x - 1$$

$$= 1 + \tan^2 x - 1 = \tan^2 x$$

- 7 ✓ Town D is 70 km due south of Town C and 65 km from Town E. Town C is 42 km from Town E.



$$\cos \theta = \frac{70^2 + 65^2 - 42^2}{2(70)(65)}$$

$$= 0.8089 \dots$$

$$\theta \doteq 36.01$$

$$180 - \theta = 143.988 \dots$$

What is the bearing of Town D from Town E, correct to the nearest degree?

(A) ~~033°~~

(B) ~~036°~~

(C) 144°

(D) 216°

$$\text{bearing} = 360 - 143$$

$$= 216^\circ$$

- 8 ✓ How many solutions to the equation $(\sin x + 1)(\tan x + 2) = 0$ lie between 0° and 360° ?

(A) 1

(B) 2

(C) 3

(D) 4

$$\text{either } \sin x + 1 = 0$$

$$\sin x = -1$$

$$x = 270 \quad \text{one solution}$$

or

$$\tan x + 2 = 0$$

$$\tan x = -2 \quad \text{two solutions}$$

End of Section I

BLANK PAGE

SECTION II

(27 Marks)

Attempt all questions

Answer these questions in the spaces provided.

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

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

Marks

Question 9 (1 mark)

Express 395° in radians. Simplify your answer and leave in terms of π .

1

$$395 \times \frac{\pi}{180} = \frac{395\pi}{180} = \frac{79\pi}{36}$$

R/W

Question 10 (2 marks)

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

2

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

$\sin\theta < 0 \rightarrow Q3 \text{ and } Q4$

S	A
✓	✓
T	C

1 | acute $\theta = \frac{\pi}{3}$

2 | correct sol's

Acute $\theta = \frac{\pi}{3}$ (in Q1) ✓

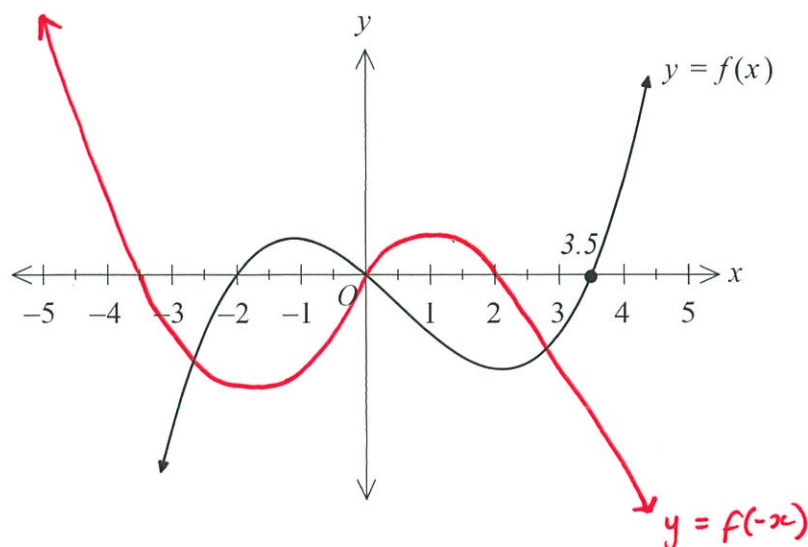
Sol'n: $\theta = \pi + \frac{\pi}{3}, 2\pi - \frac{\pi}{3}$

$= \frac{4\pi}{3}, \frac{5\pi}{3}$ ✓

Question 11 (1 mark)

Given the graph of $y = f(x)$ below, sketch $y = f(-x)$ on the same number plane.

1



R/W

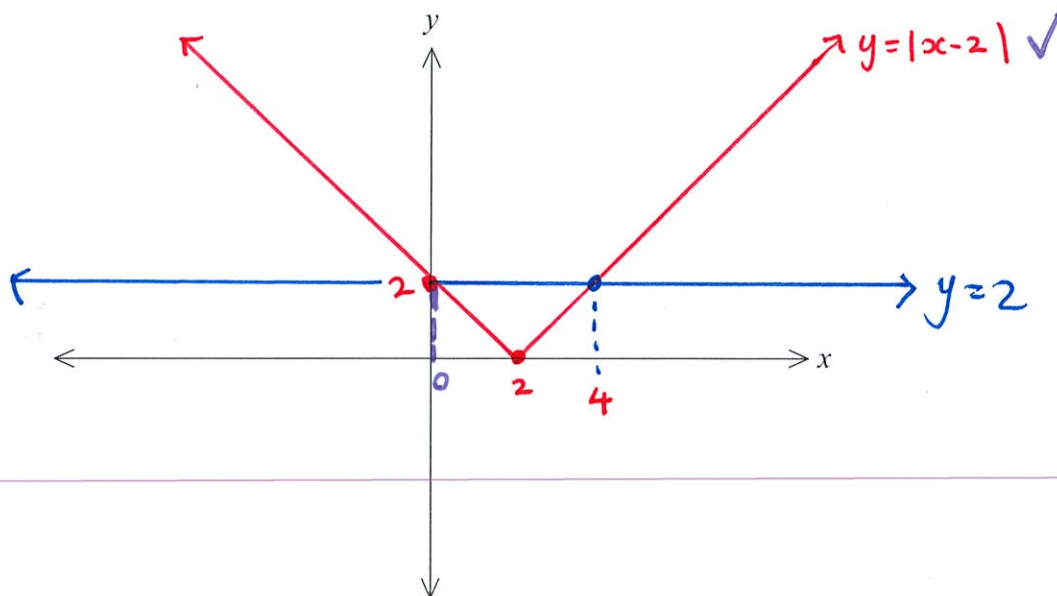
1 | Correct graph of $y = |x-2|$
 2 | Correct graphs showing intersection points

Marks

Question 12 (4 marks)

- (a) Sketch the graphs of $y = |x-2|$ and $y = 2$ on the same number plane.
 Clearly show the point/s of intersection.

2



- (b) Hence, or otherwise, solve $|x-2| = 2$.

1

..... $x = 0, x = 4$

.....

.....

R/W

- (c) Given the more general equation $|x-2| = k$, for what values of k would there be no solutions?

1

..... $k < 0$

.....

R/W

Question 13 (2 marks)

Find the exact value of $2\sin 315^\circ - 1$.

2

$$= 2(-\sin 45^\circ) - 1$$

$$= \frac{-2}{\sqrt{2}} - 1$$

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

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

$$= -\sqrt{2} - 1$$

1	$\sin 45^\circ$ or $-\sin 45^\circ$
2	$-\frac{2}{\sqrt{2}} - 1$

Question 14 (3 marks)

Show that $\frac{1+\cos\theta}{\sin\theta} + \frac{\sin\theta}{1+\cos\theta} = 2\operatorname{cosec}\theta$.

3

$$\text{LHS} = \frac{1+\cos\theta}{\sin\theta} + \frac{\sin\theta}{1+\cos\theta}$$

$$= \frac{(1+\cos\theta)^2 + \sin^2\theta}{(1+\cos\theta)(\sin\theta)}$$

$$= \frac{1 + \cos\theta + \cos\theta + \cos^2\theta + \sin^2\theta}{(1+\cos\theta)(\sin\theta)}$$

$$= \frac{2 + 2\cos\theta}{(1+\cos\theta)(\sin\theta)}$$

$$= \frac{2(1+\cos\theta)}{(1+\cos\theta)\sin\theta}$$

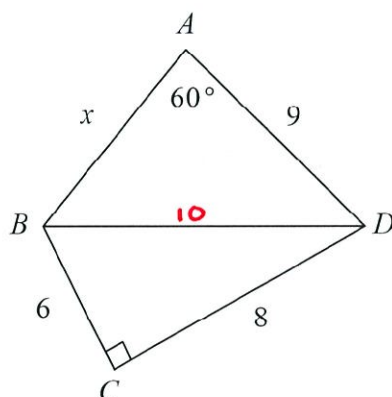
$$= \frac{2}{\sin\theta}$$

$$= 2\operatorname{cosec}\theta$$

$$= \text{RHS}$$

- | | |
|---|----------------------------|
| 1 | Combines fractions |
| 2 | Simplifies numerator |
| 3 | Completes proof correctly. |

Question 15 (5 marks)



NOT TO SCALE

In the above diagram, $AB = x$ cm, $BC = 6$ cm, $AD = 9$ cm and $DC = 8$ cm.
 BC is perpendicular to DC and $\angle BAD = 60^\circ$.

- (a) Use the given information to show that $x^2 - 9x - 19 = 0$.

$$BD^2 = 6^2 + 8^2$$

$$= 100$$

$$BD = 10$$

$$10^2 = x^2 + 9^2 - 2(x)(9)\cos 60^\circ \checkmark$$

$$100 = x^2 + 81 - 18x\left(\frac{1}{2}\right) \checkmark$$

$$100 = x^2 + 81 - 9x$$

$$x^2 - 9x - 19 = 0 \checkmark$$

$$BD = 10 \quad 3$$

$$1. \quad \begin{array}{l} \text{Works towards} \\ 10^2 = x^2 + 9^2 - 2(x)(9)\cos 60^\circ \end{array}$$

$$2. \quad \cos 60^\circ = \frac{1}{2}$$

$$3. \quad \text{Correct proof to } x^2 - 9x - 19 = 0$$

- (b) Hence, show the area of figure $ABCD$ is approximately 66 cm^2 .

$$\text{Area} = \left(\frac{1}{2} \times 6 \times 8\right) + \frac{1}{2}(x)(9)\sin 60^\circ \checkmark$$

$$= 24 + 4.5x\left(\frac{\sqrt{3}}{2}\right)$$

$$= 65.952365 \dots$$

$$\approx 66 \text{ cm}^2 \checkmark$$

$$x^2 - 9x - 19 = 0$$

$$x = \frac{9 \pm \sqrt{81 + 76}}{2}$$

$$x = 10.7649 \dots$$

$$x = -1.76498 \dots$$

$$\rightarrow x > 0 \therefore x = 10.7649 \dots$$

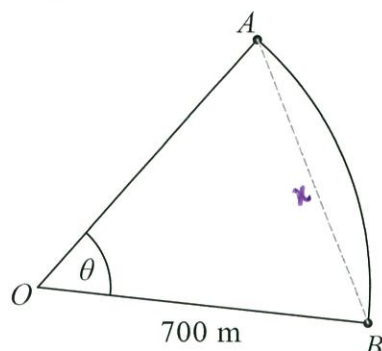
$$\left(x = \frac{9 + \sqrt{157}}{2} \right)$$

$$1. \quad \text{Correct area composition}$$

$$2. \quad \text{Correct working to give } 66 \text{ cm}^2$$

Question 16 (4 marks)

The diagram below illustrates sector AOB .



NOT TO SCALE

- (a) Let A = area of the sector and l = length of arc AB .

2

Given that $A:l^2 = 9:4\pi$, show that $\theta = \frac{2\pi}{9}$.

$$A = \frac{1}{2}r^2\theta \quad | \quad l = r\theta$$

$$\frac{A}{l^2} = \frac{9}{4\pi} \Rightarrow \frac{\frac{1}{2}r^2\theta}{r^2\theta^2} = \frac{9}{4\pi}$$

$$\frac{\frac{1}{2}}{\theta} = \frac{9}{4\pi}$$

$$9\theta = \frac{1}{2} \times 4\pi$$

$$\theta = \frac{2\pi}{9}$$

1 Works towards line 1 of eq'n
2 Correct proof to $\theta = \frac{2\pi}{9}$

- (b) Find the length of the chord AB , correct to three significant figures.

2

$$\frac{2\pi}{9} \times \frac{180}{\pi} = 40^\circ$$

$$x^2 = 700^2 + 700^2 - 2(700)(700) \cos 40^\circ \quad \checkmark$$

$$= 229276.445$$

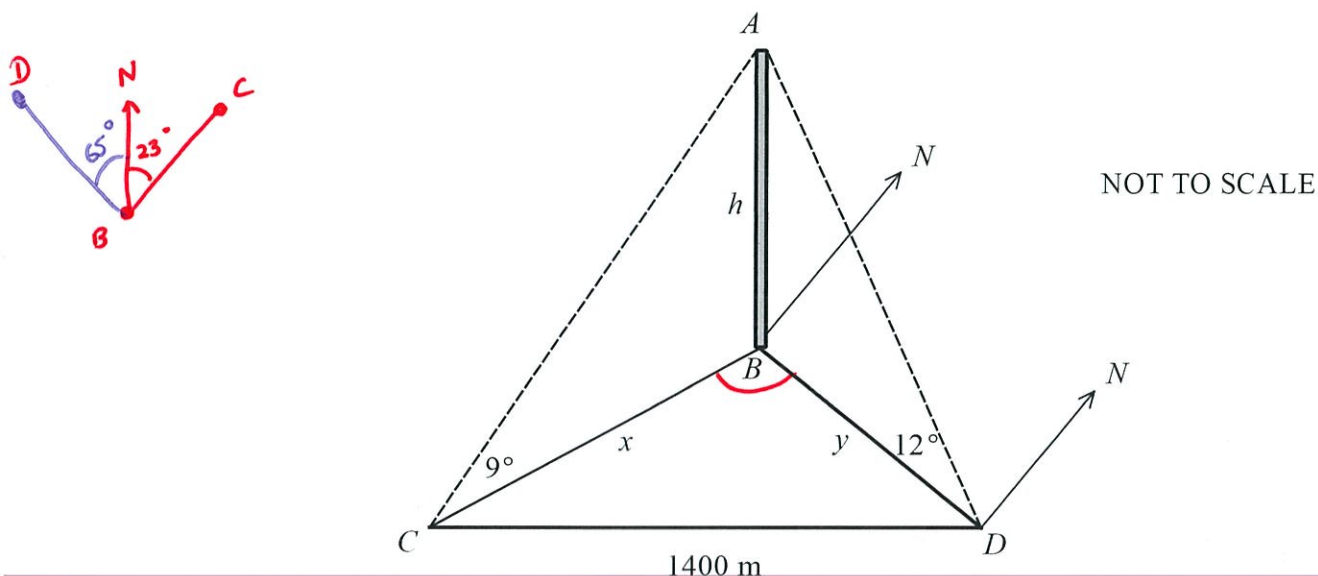
$$x = \sqrt{229276.445}$$

$$= 478.828 \quad \checkmark$$

$$\approx 479 \text{ m (3 s.f.)}$$

1 Correct subst. into Cosine Rule
2 Works towards 479 m (disregard rounding)

Question 17 (5 marks)



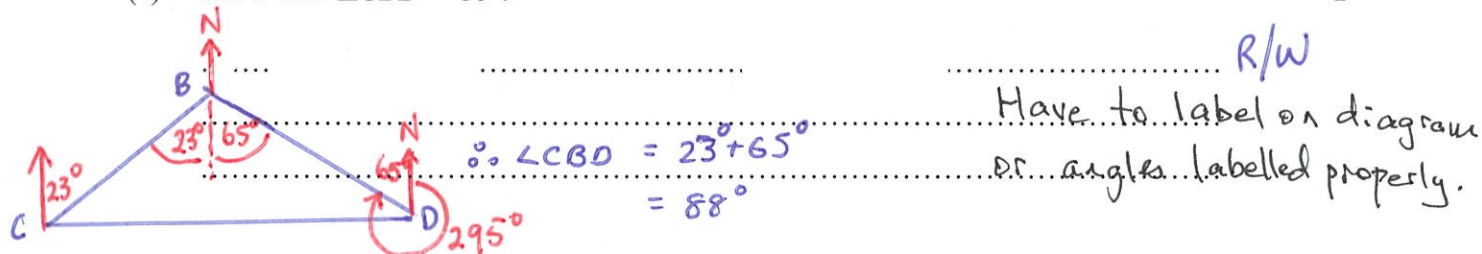
In the diagram above, AB is a tower and CD is a road. A person observes the tower AB , from point C , at a bearing of 023° , with an angle of elevation of 9° .

After travelling 1400 metres along the road to D , a person observes the tower from D at a bearing of 295° and an angle of elevation 12° .

Let $CB = x$, $BD = y$ and $AB = h$.

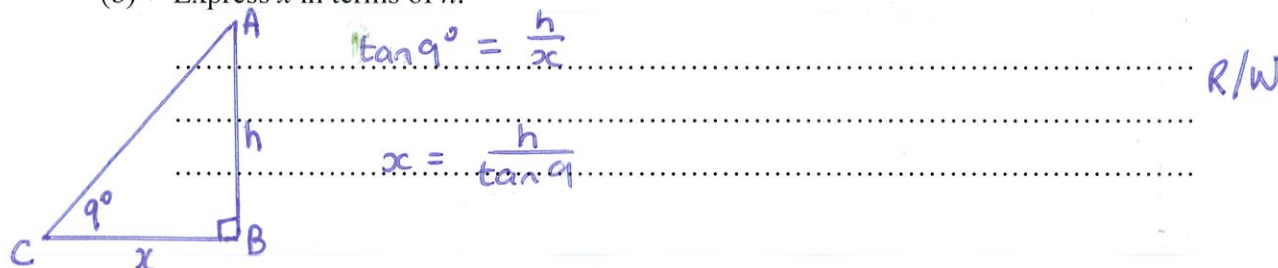
- (a) Show that $\angle CBD = 88^\circ$.

1



- (b) Express x in terms of h .

1



Question 17 continues on next page

Question 17 continued.

Marks

(c) Hence, show that the equation required to evaluate h is

3

$$h = \sqrt{\frac{1400^2}{\frac{1}{\tan^2 9^\circ} + \frac{1}{\tan^2 12^\circ} - \frac{2 \cos 88^\circ}{\tan 9^\circ \tan 12^\circ}}}$$

$$\tan 12 = \frac{h}{y}$$

Similarly, $y = \frac{h}{\tan 12}$

$$1400^2 = x^2 + y^2 - 2(x)(y) \cos 88$$

$$1400^2 = \left(\frac{h}{\tan 9}\right)^2 + \left(\frac{h}{\tan 12}\right)^2 - 2\left(\frac{h}{\tan 9}\right)\left(\frac{h}{\tan 12}\right) \cos 88$$

$$1400^2 = \frac{h^2}{\tan^2 9} + \frac{h^2}{\tan^2 12} - \frac{2h^2 \cos 88}{\tan 9 \tan 12} \quad \checkmark \quad \boxed{1}$$

$$1400^2 = h^2 \left(\frac{1}{\tan^2 9} + \frac{1}{\tan^2 12} - \frac{2 \cos 88}{\tan 9 \tan 12} \right) \quad \checkmark$$

$$h^2 = \frac{1400^2}{\frac{1}{\tan^2 9} + \frac{1}{\tan^2 12} - \frac{2 \cos 88}{\tan 9 \tan 12}}$$

$$h = \sqrt{\frac{1400^2}{\frac{1}{\tan^2 9} + \frac{1}{\tan^2 12} - \frac{2 \cos 88}{\tan 9 \tan 12}}} \quad \checkmark$$

End of Assessment Task

1	Works towards 1
2	Takes h^2 out as common factor
3	Correct working to equation to find h .