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NAME: _____

CLASS: 11MTA____ or 11MTX____

MARK: ____/70

CHERRYBROOK TECHNOLOGY HIGH SCHOOL



**2018
YEAR 11**

Mathematics AP1 Examination

*Time allowed: 2 hours
Reading Time: 5 minutes*

DIRECTIONS TO CANDIDATES:

- ◇ Write your name and class in the space provided at the top of this page.
- ◇ Attempt all questions.
- ◇ NESA approved calculators may be used.
- ◇ All necessary working should be shown. Full marks may not be awarded for careless or badly arranged work.
- ◇ A reference sheet is provided
- ◇ Write in blue or black pen only

Total marks: 70

Section I – 10 marks

Allow about 15 minutes for this section

Section II – 60 marks

Allow about 1 hour 45 minutes for this section

Section I

10 marks

Attempt Questions 1–10

Allow about 15 minutes for this section

Use the multiple-choice answer sheet for Questions 1–10.

- 1 What is 12.4825 correct to three significant figures?
- (A) 12.482
(B) 12.483
(C) 12.4
(D) 12.5
- 2 What is 0.006 84 written in scientific notation?
- (A) 684×10^2
(B) 684×10^{-5}
(C) 6.84×10^3
(D) 6.84×10^{-3}
- 3 Which of the following is a solution of $y = 3x^4 + 2x^3 - 8$
- (A) $(-2, -72)$
(B) $(-4, 632)$
(C) $(0, 817992)$
(D) $(-5, -753)$
- 4 What is the solution to the equation $10 = -3x + 2$
- (A) $x = -\frac{3}{8}$
(B) $x = 4$
(C) $x = 11$
(D) $x = -\frac{8}{3}$

5 What is the solution of $|x| \leq 5$?

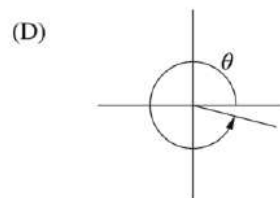
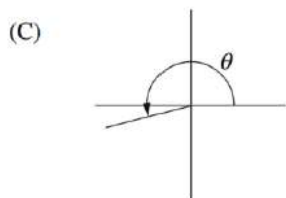
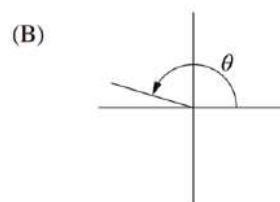
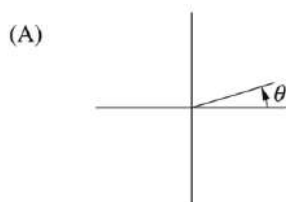
- (A) $x = \pm 5$
- (B) $x \leq \pm 5$
- (C) $-5 \leq x \leq 5$
- (D) $x \leq -5$ or $x \geq 5$

6 Which of the following is equal to $\frac{1}{3\sqrt{7}-\sqrt{11}}$

- (A) $\frac{3\sqrt{7} + \sqrt{11}}{52}$
- (B) $\frac{3\sqrt{7} + \sqrt{11}}{-15}$
- (C) $\frac{3\sqrt{7} - \sqrt{11}}{10}$
- (D) $\frac{3\sqrt{7} - \sqrt{11}}{320}$

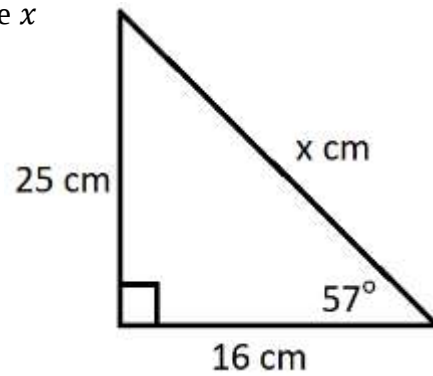
7 For the angle θ , $\sin\theta = -\frac{6}{10}$ and $\tan\theta = \frac{6}{8}$

Which diagram best shows the angle θ ?



- 8 Which equation would be used to calculate x in the triangle to the right?

- (A) $x = \frac{\cos 57^\circ}{16}$
(B) $x = \frac{\sin 57^\circ}{25}$
(C) $x = 16 \cos 57^\circ$
(D) $x = \frac{25}{\sin 57^\circ}$



NOT TO SCALE

- 9 Solve $\sin \theta = 1$ $-360 \leq \theta \leq 360$

- (A) 90°
(B) $-90^\circ, 90^\circ$
(C) $-270^\circ, 90^\circ$
(D) $-270^\circ, -90^\circ, 90^\circ, 270^\circ$

- 10 Round $124^\circ 41' 5.44''$ to the nearest second

- (A) $124^\circ 41'$
(B) $124^\circ 41' 5''$
(C) $124^\circ 41' 6''$
(D) $124^\circ 42'$

End of Section 1

Section II

60 marks

Attempt Questions 11–14

Allow about 1 hour and 45 minutes for this section

Answer each question in the appropriate writing booklet. Start a new writing booklet for each question. Extra writing booklets are available.

In Questions 11–14, your responses should include relevant mathematical reasoning and/or calculations.

Question 11 (15 marks) Use a SEPARATE writing booklet.

- (a) Vihaan wants to buy a new TV that is normally \$1200. 2
Myer has an advertised 15% off sale. Vihaan also has a 10% off voucher, which is applied after any advertised discounts.

What single percentage discount is this the same as?
- (b) Convert $3.\dot{4}6\dot{7}$ to a fraction 2
- (c) Write without a fractional indice $16x^{3/4}$ 1
- (d) Solve: $|x + 2| = 2x + 7$ 2
- (e) Expand and simplify:
- (i) $6a(4a^3 - 7) + 12a$ 2
- (ii) $(2m - 9)^2$ 1
- (f) By first factorising, fully simplify $\frac{4x+10}{x^3-5x^2-7x+35} \div \frac{4x^2-25}{2x^2-15x+25}$ 3
- (g) Solve by completing the square $x^2 + 10x - 7 = 0$ 2
Give your answer in exact form.

End of Question 11

Question 12 (15 marks) Use a SEPARATE writing booklet.

(a) Solve simultaneously : $y = 2x + 6$ and $2y + 3x - 5 = 0$ 3

(b) Solve each inequality and plot on a separate number line:

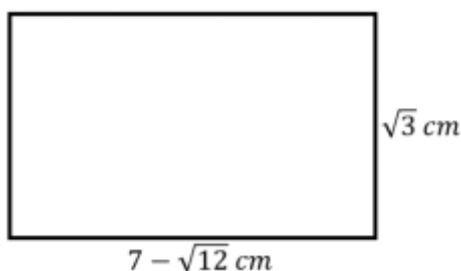
(i) $-5x - 4 \leq 11$ 2

(ii) $y^2 + 8y + 12 > 0$ 3

(c) The surface area of a cylinder is given by the formula $SA = 2\pi r(r + h)$. 3
where SA = Surface Area, r = radius and h = height

Evaluate r correct to 1 decimal place if $SA = 100$ and $h = 10$

(d) A rectangle has side lengths of lengths $\sqrt{3} \text{ cm}$ and $7 - \sqrt{12} \text{ cm}$, as shown below. 2
Find the perimeter in fully simplified form:



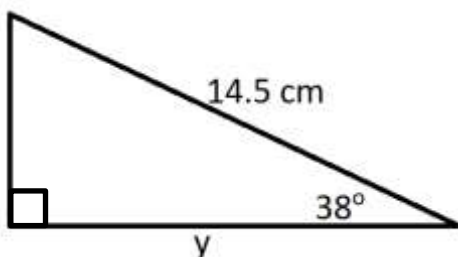
(e) Find a and b if: $\frac{\sqrt{3}}{2\sqrt{5}} = \frac{\sqrt{a}}{b}$ 2

End of Question 12

Question 13 (15 marks) Use a SEPARATE writing booklet.

- (a) Find the value of y in the triangle below, correct to 2 decimal places

1



- (b) If $\sin\theta = \frac{4}{7}$, find the exact value of:

(i) $\operatorname{cosec}\theta$

1

(ii) $\tan\theta$

2

- (c) Fully simplify:

(i) $\sin 80^\circ \times \operatorname{cosec} 80^\circ$

2

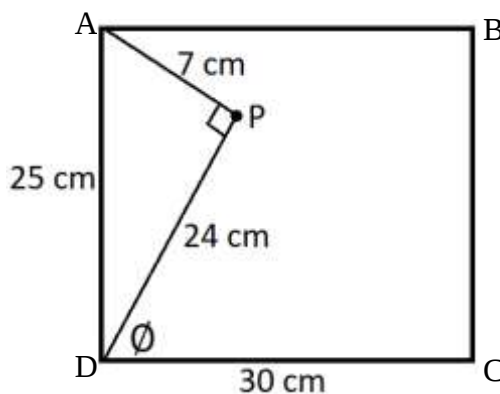
(ii) $\frac{\sin 33^\circ + \cos 57^\circ}{\cos 57^\circ}$

2

- (d) James has a rectangular piece of wood with side lengths 25 cm and 30 cm.

He needs to cut a hole in the wood at a point P that is 7 cm from one corner and 24 cm from an adjacent corner such that a right angled-triangle is formed, as shown in the diagram below.

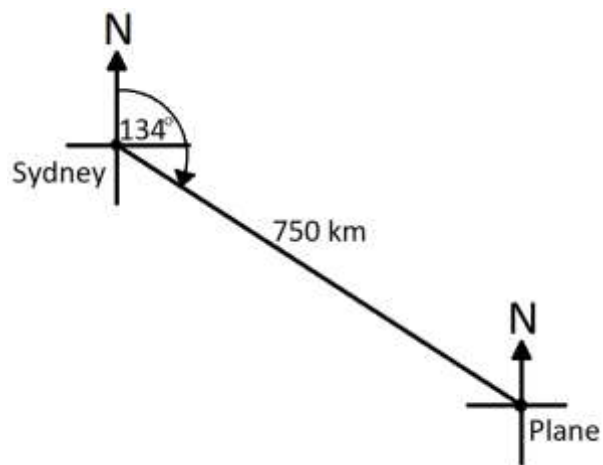
To locate the point P he needs to know the size of the angle θ shown in the diagram.



Find the size of θ to the nearest degree.

3

- (e) A plane leaves Sydney and travels 750km on an angle of 134° , as shown in the diagram below.



- (i) How far south of Sydney is the plane? Answer to one decimal place. 2
- (ii) What is the bearing of Sydney from the plane? 2

End of Question 13

Question 14 (15 marks) Use a SEPARATE writing booklet.

(a) Find exact ratio of:

(i) $\sin 45^\circ$ 1

(i) $\cos 150^\circ$ 2

(b) Solve $\sin x = \frac{1}{\sqrt{2}}$ $0 \leq x \leq 360$ 2

(c) (i) Solve $\sqrt{3}\tan x - 1 = 0$ $0 \leq \theta \leq 90$ 1

(ii) Hence or otherwise, solve $\sqrt{3}\tan 2\theta - 1 = 0$ $-180 \leq \theta \leq 360$ 3

(d) Sketch the graph of $y = \cot x$ $0 \leq x \leq 360$ 2

(e) (i) Sketch the graph of $y = \cos \theta$ $-360 \leq \theta \leq 360$ 2

(ii) Hence or otherwise, sketch the graph of:
 $y = 2\cos \theta + 3$ $-360 \leq \theta \leq 360$ 2

End of paper

$$1) 12.4\overline{25}$$

$$= 12.5$$

(D)

$$2) 6.84 \times 10^{-3}$$

(D)

3) Test solutions by substitution 4) $10 = 3x + 2$

$$3(-4)^4 + 2(-4)^3 - 8$$

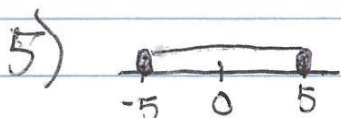
$$= 632$$

(B)

$$8 = -3x$$

$$x = -8/3$$

(D)



$$-5 \leq x \leq 5$$

(C)

$$6) \frac{1}{3\sqrt{7} - \sqrt{11}} \times \frac{3\sqrt{7} + \sqrt{11}}{3\sqrt{7} + \sqrt{11}}$$

$$= \frac{3\sqrt{7} + \sqrt{11}}{63 - 11}$$

$$= \frac{3\sqrt{7} + \sqrt{11}}{52}$$

(A)

7)

S	A
$\sqrt{T}$	C

sin = negative
tan = positive

(C)

$$8) \sin 57 = \frac{25}{x}$$

$$x = \frac{25}{\sin 57}$$

(D)

$$10) 124^{\circ} 41' 5.44''$$

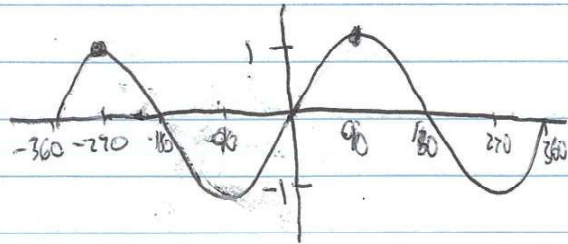
$$124^{\circ} 41' 5''$$

(B)

$$9) \sin \theta = 1$$

$$\theta = \sin^{-1}(1)$$

$$= 90$$



(C)

$$11) a) \$1200 \times 0.85 \times 0.9$$

$$= \$918$$

$$1200 - 918 = \$282 \text{ off}$$

$$\frac{282}{1200} \times 100 = 23.5\%$$

$$b) \text{ Let } x = 3.\dot{4}6\dot{7} \quad \text{--- ①}$$

$$1000x = 3467.\dot{4}6\dot{7} \quad \text{--- ②}$$

$$\therefore \quad \text{②} - \text{①}$$

$$999x = 3464$$

$$x = \frac{3464}{999}$$

$$\therefore 3.\dot{4}6\dot{7} = \frac{3464}{999}$$

$$c) 16x^{\frac{3}{4}} = 16\sqrt[4]{x^3} \quad \text{OR} \quad 16(\sqrt[4]{x})^3$$

d) $|x+2| = 2x+7$

① $x+2 = 2x+7$ or ② $-(x+2) = 2x+7$
 $x = -5$.

Sub $x = -5$, $|-5+2| = 2(-5)+7$

$|-3| = -3$ X

$\therefore x = -5$ is not a solution

② $-x-2 = 2x+7$

$3x = -9$

$x = -3$

Sub $x = -3$, $|-3+2| = 2(-3)+7$

$|-1| = 1$ ✓

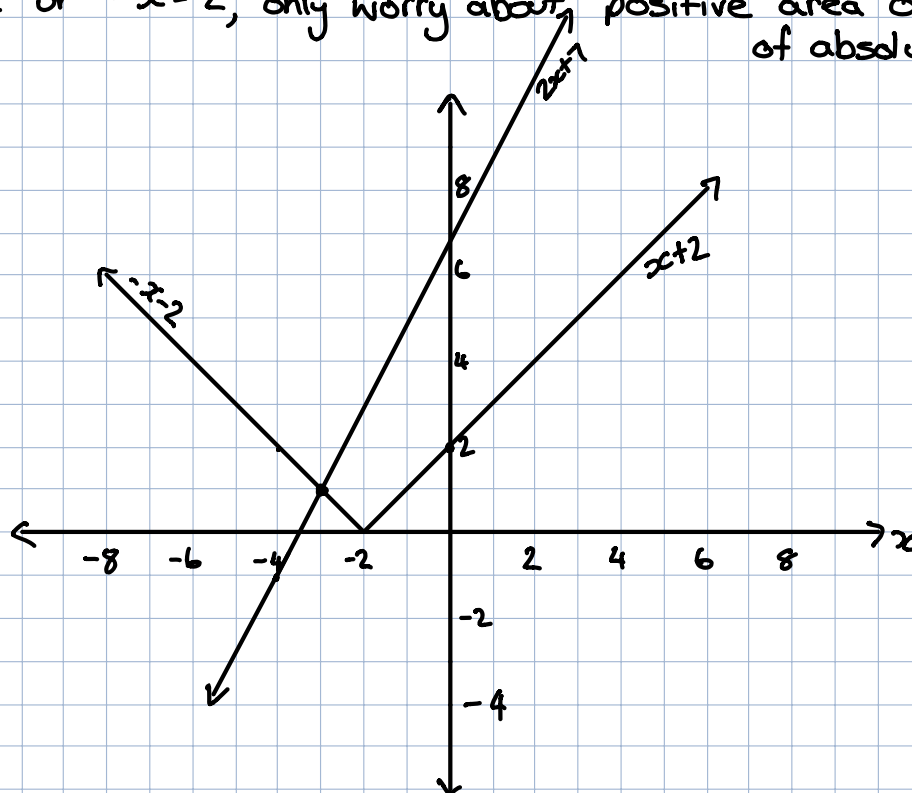
$\therefore x = -3$ is the only solution.

OR

$|x+2| = 2x+7$

$|x+2| = x+2$ or $-x-2$, only worry about positive area of graph because of absolute value.

$\therefore x = -3$ is the only solution.



$$11) e) i) 6a(4a^3-7) + 12a$$

$$= 24a^4 - 42a + 12a$$

$$= 24a^4 - 30a$$

$$ii) (2m-9)^2$$

$$= 4m^2 - 36m + 81$$

$$f) \frac{4x+10}{x^3-5x^2-7x+35} \cdot \frac{4x^2-25}{2x^2-15x+25}$$

$$= \frac{2(2x+5)}{x^2(x-5)-7(x-5)} \times \frac{2x^2-10x-5x+25}{(2x-5)(2x+5)}$$

$$= \frac{2(2x+5)}{(x^2-7)(x-5)} \times \frac{(2x-5)(x-5)}{(2x-5)(2x+5)}$$

$$= \frac{2}{x^2-7}$$

$$g) x^2 + 10x - 7 = 0$$

$$x^2 + 10x + 25 = 25 + 7$$

$$(x+5)^2 = 32$$

$$x+5 = \pm\sqrt{32}$$

$$x = \pm\sqrt{32} - 5$$

$$12) a) y = 2x + 6 \quad \text{--- (1)}$$

$$2y + 3x - 5 = 0 \quad \text{--- (2)}$$

(1) into (2)

$$2(2x + 6) + 3x - 5 = 0$$

$$4x + 12 + 3x - 5 = 0$$

$$7x = -7$$

$$x = -1$$

sub into (1)

$$y = 2(-1) + 6$$

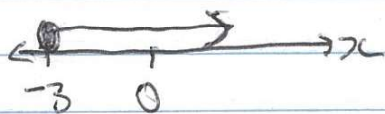
$$y = 4$$

$$(-1, 4)$$

b) i) $-5x - 4 \leq 11$

$$-5x \leq 15$$

$$x \geq -3$$

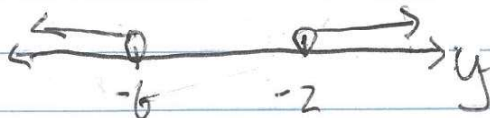
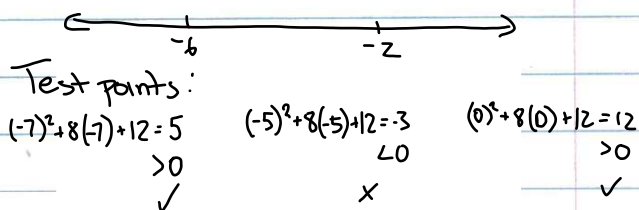


ii) $y^2 + 8y + 12 > 0$

$$y^2 + 8y + 12 = 0$$

$$(y + 6)(y + 2) = 0$$

$$y = -6 \text{ or } -2$$



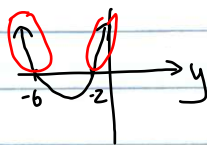
$$y < -6 \text{ or } y > -2$$

ALTERNATE SOLUTION

$$y^2 + 8y + 12 = 0$$

$$(y + 6)(y + 2) = 0$$

$$y = -6 \text{ or } -2$$



$$y < -6 \text{ or } y > -2$$



$$c) 100 = 2\pi r(r+10)$$

$$100 = 2\pi r^2 + 20\pi r$$

$$2\pi r^2 + 20\pi r - 100 = 0$$

OR

$$\frac{2\pi r^2}{2\pi} + \frac{20\pi r}{2\pi} - \frac{100}{2\pi} = \frac{0}{2\pi}$$

$$r^2 + 10r - \frac{50}{\pi} = 0$$

$$r^2 + 10r + 25 = \frac{50}{\pi} + 25$$

$$(r+5)^2 = \frac{50}{\pi} + 25$$

$$r+5 = \pm \sqrt{\frac{50}{\pi} + 25}$$

$$r = -5 \pm \sqrt{\frac{50}{\pi} + 25}$$

$$= 14 \text{ or } -11.4$$

$$\therefore 1.4 \text{ cm}$$

$$r = \frac{-20\pi \pm \sqrt{(20\pi)^2 - 4 \times 2\pi \times -100}}{2 \times 2\pi}$$

$$= -11.397 \text{ or } 1.397$$

can't be negative

$$r = 1.4 \text{ cm}$$

$$d) P = 2(\sqrt{3} + 7 - \sqrt{12})$$

$$= 2(\sqrt{3} + 7 - 2\sqrt{3})$$

$$= 2(-\sqrt{3} + 7)$$

$$= 14 - 2\sqrt{3} \text{ cm}$$

$$e) \frac{\sqrt{3}}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$$

$$= \frac{\sqrt{15}}{2 \times 5}$$

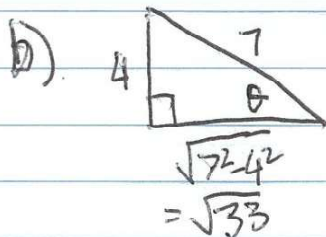
$$= \frac{\sqrt{15}}{10}$$

$$\therefore a = 15 \quad b = 10$$

$$Q13) a) \cos 38 = \frac{y}{14.5}$$

$$y = 14.5 \cos 38$$

$$= 11.43 \text{ cm}$$



$$i) \operatorname{cosec} \theta = \frac{7}{4}$$

$$ii) \tan \theta = \frac{4}{\sqrt{33}}$$

$$c) i) \sin 80 \times \operatorname{cosec} 80$$

$$= \sin 80 \times \frac{1}{\sin 80}$$

$$= 1$$

$$ii) \frac{\sin 33 + \cos 57}{\cos 57}$$

$$= \frac{\sin 33}{\cos 57} + \frac{\cos 57}{\cos 57}$$

$$\text{OR} \quad \frac{\cos(90-33) + \cos 57}{\cos 57}$$

$$= \frac{\sin 33}{\sin(90-57)} + \frac{\cos 57}{\cos 57}$$

$$= \frac{\cos 57 + \cos 57}{\cos 57}$$

$$= \frac{\sin 33}{\sin 33} + \frac{\cos 57}{\cos 57}$$

$$= \frac{2 \cos 57}{\cos 57}$$

$$= 1 + 1$$

$$= 2$$

$$= 2$$

d) Let $\angle ADP = x$

$$\tan x = \frac{7}{24}$$

$$x = \tan^{-1}\left(\frac{7}{24}\right)$$

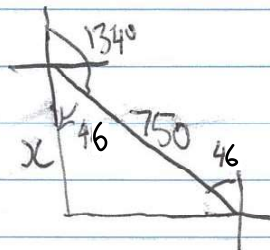
$$= 16^\circ$$

$$\begin{aligned}\theta &= 90 - 16 \\ &= 74^\circ\end{aligned}$$

e) i) $180 - 134 = 46^\circ$

$$\cos 46 = \frac{x}{750}$$

$$\begin{aligned}x &= 750 \cos 46 \\ &= 521.0 \text{ km}\end{aligned}$$

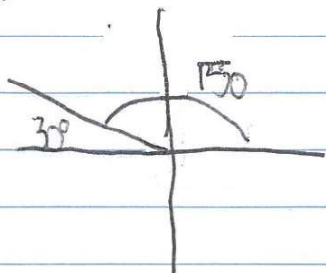


ii) $180 - 134 = 44^\circ$

$$360 - 44 = 316^\circ \text{ T}$$

$$14) a) i) \sin 45^\circ = \frac{1}{\sqrt{2}}$$

$$ii) \cos 150^\circ$$



$$\cos 30 = \frac{\sqrt{3}}{2}$$

$$\therefore \cos 150 = -\frac{\sqrt{3}}{2}$$

$$b) i) \sin x = \frac{1}{\sqrt{2}}$$

$$0 \leq x \leq 360$$

$$x = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$$

$$= 45^\circ$$

$$x = 45^\circ, 135^\circ$$

S ✓	A ✓
T	C

$$c) i) \sqrt{3} \tan x - 1 = 0$$

$$\tan x = \frac{1}{\sqrt{3}}$$

$$x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$$

$$= 30^\circ$$

$$ii) \therefore 2\theta = 30^\circ \quad -180 \leq \theta \leq 360$$

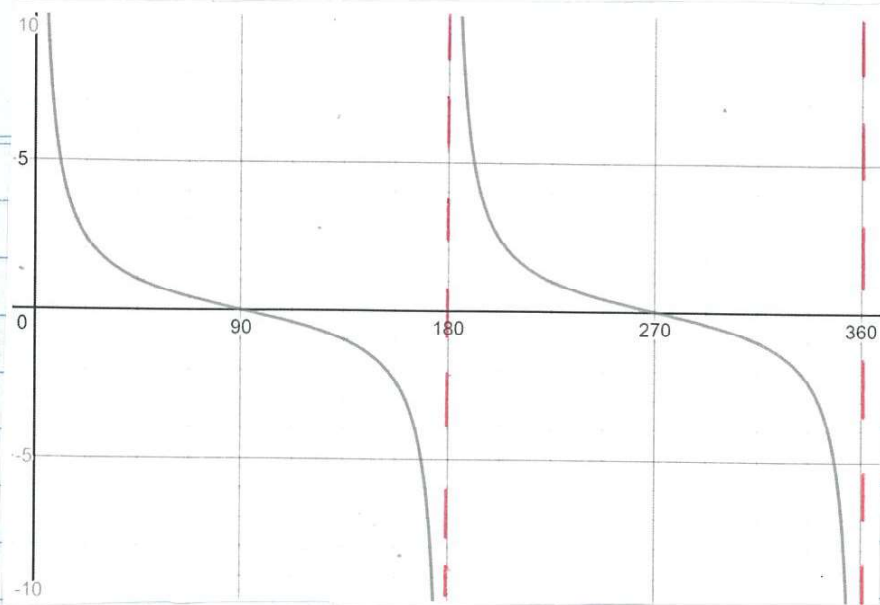
$$-360 \leq 2\theta \leq 720$$

$$2\theta = 30, 210, 390, 570, -150, -330$$

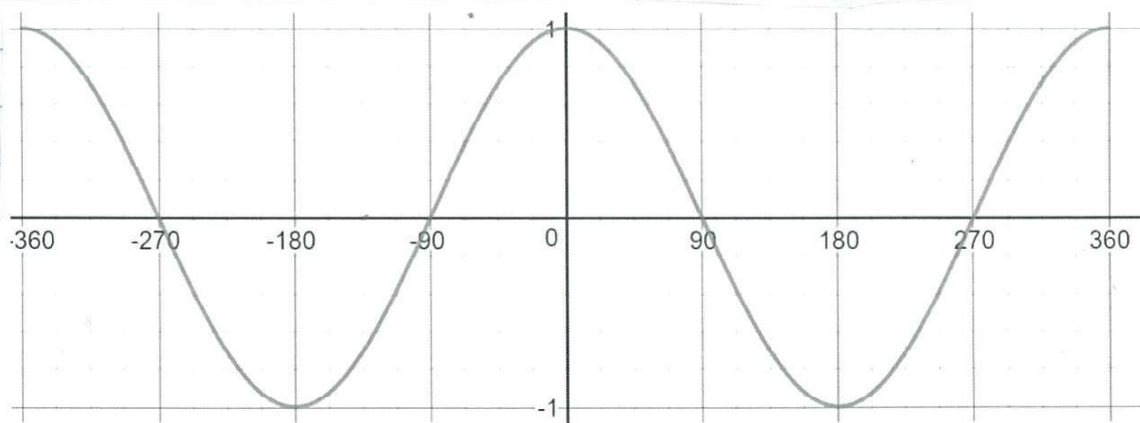
$$\theta = 15, 105, 195, 285, -75, -165$$

S	A ✓
✓ T	C

14)d)



e) i)



ii)

