

Preliminary Course Task 2 Half Yearly

Mathematics

General Instructions

- Working time – 90 minutes
- Write using black or blue pen
- Board-approved calculators may be used
- All necessary working should be shown on every question

	Question 1-5	Question 6	Question 7	Question 8	Total
Number					
Algebra					
Functions					
Trigonometry					
	/5	/15	/15	/15	/50

Multiple Choice Questions- Use answer sheet provided. (5 Marks)

1. The value of $\frac{4.56+1.78}{\sqrt{3.09}-2.05}$ is closest to:

- (A) 10 (B) 6
(C) 4 (D) 9

2. Simplify $\frac{4a^2-ab}{16a^2-b^2}$

- (A) $\frac{a}{(4a-b)}$ (B) $\frac{4a-b}{(16a+b)}$
(C) $\frac{4a-b}{(16a-b)}$ (D) $\frac{a}{(4a+b)}$

3. What is the solution to the equation $8(a-1)=4(a+8)$?

- (A) $a=0.4$ (B) $a=2.25$
(C) $a=6$ (D) $a=10$

4. What is the domain and range of the function $f(x)=\sqrt{9-x^2}$?

- (A) Domain: $-3 \leq x \leq 3$, Range: $0 \leq y \leq 3$
(B) Domain: $-3 \leq x \leq 3$, Range: $-3 \leq y \leq 3$
(C) Domain: $0 \leq x \leq 9$, Range: $-9 \leq y \leq 9$
(D) Domain: $0 \leq x \leq 9$, Range: $0 \leq y \leq 9$

5. What is solution to the equation $2 \cos \beta = -\sqrt{3}$ for $0^\circ \leq \beta \leq 360^\circ$?

- (A) $\beta = 30^\circ$ or 330°
(B) $\beta = 60^\circ$ or 300°
(C) $\beta = 150^\circ$ or 210°
(D) $\beta = 120^\circ$ or 240°

End of Multiple Choice

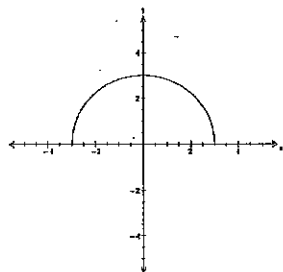
Question 6 (15 Marks) - Start a New Page

Marks

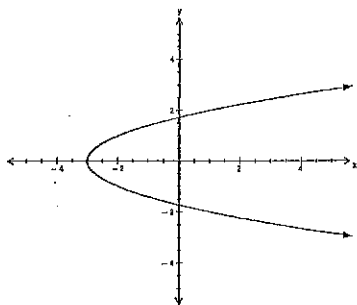
(a) State whether the following are a functions or relations.

2

(i)



(ii)



(b) Show whether the function $f(x) = \frac{4x}{16-x^2}$ is even, odd, or neither.

2

(c) On separate sets of axes, sketch the following curves, showing all important features,

2

(i) $y = 3^x$

2

(ii) $y = |x+3|$

2

(iii) $y = x^3 + 3$

(d) Given $f(x) = x^3 - 4x^2 + 3x$

(i) Find $f(-3)$

1

(ii) Find the values of x if $f(x) = 0$

2

(iii) Sketch $y = f(x)$, clearly showing all important features.

2

Question 6 continued on Page 4

Question 7 (15 Marks) - Start a New Page

Marks

(a) Sketch $y = -\frac{2}{x+1}$, and state the range: 3

(b) Sketch $f(x) = \begin{cases} 2 & x < -3 \\ x & -3 \leq x \leq 1 \\ -x^2 + 1 & x > 1 \end{cases}$ 3

(c) Show the region defined by these inequalities: 3

$$y < |x-1| \text{ and } y \geq x^2$$

(d) Find integers a and b such that 2

$$(3 - \sqrt{2})^2 = a - b\sqrt{2}$$

(e) Find the values of x for which $|2x+1| < 3$. 2

(f) Solve the pair of simultaneous equations: 2

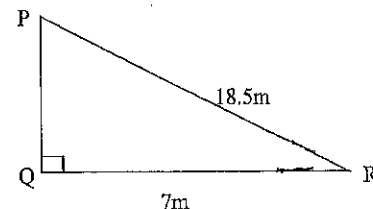
$$\begin{aligned} x - y &= 2 \\ 3x + 2y &= 1 \end{aligned}$$

Question 8 (15 marks) - Start a New Page

Marks

(a)

1



Find the size of $\angle PRQ$ to the nearest degree.

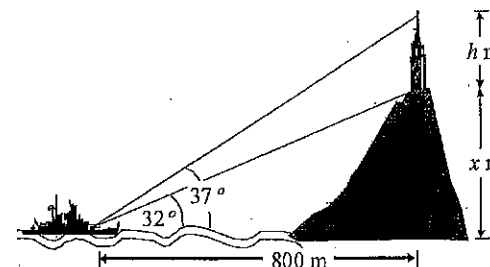
(b) If $\cos x > 0$ and $\sin x = \frac{-15}{17}$, find the exact value of $\tan x$. 2

(c) Solve the equation $2\sin 2x - \sqrt{3} = 0$ for $0^\circ \leq x \leq 360^\circ$ 2

(d) Prove $\sin^2 \theta + \tan^2 \theta = \sec^2 \theta - \cos^2 \theta$ 2

(e) A lighthouse h metres high stands on top of a cliff x metres above sea level. 3

From a ship 800 metres from the base of the cliff, the angle of elevation of the top of the cliff is 32° and the angle of elevation of the top of the lighthouse is 37° .
Find to (the nearest metre) the height h of the lighthouse.

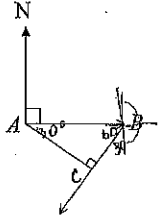


Question 8 continued on Page 6

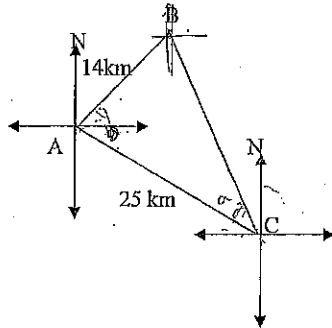
Detach this sheet and Hand Up Separately

- (f) A sailing boat travels due east from A to B .
It then turns and sails on a bearing of 210° .
What is the boat's bearing from A when the boat is closest to A ?

2



- (g) The diagram shows three towns A, B, and C. B lies 14km north-east of A and C lies 25km south-east of A.



- (i) Find the distance from B to C correct to one decimal place. 1
(ii) Find the bearing of B from C correct to the nearest minute. 2

End of Task

Multiple Choice Answer Sheet

Name : _____ Teacher Name: _____

Select Your Answers

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

Question 6

- a) i) Function ✓
 ii) relation ✓

(2)

$$b) f(a) = \frac{4a}{16-a^2}$$

$$= \frac{4a}{16-a^2}$$

$$f(-a) = \frac{-4a}{16-a^2}$$

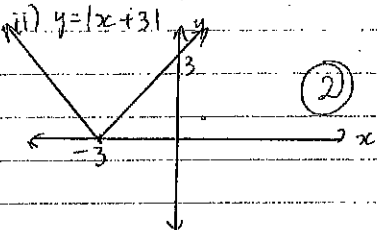
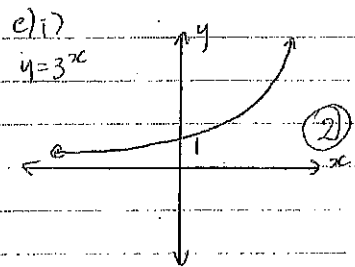
$$= -\frac{4a}{16-a^2}$$

$$-f(a) = -\frac{4a}{16-a^2}$$

$$\therefore f(-a) = -f(a)$$

odd.

(2)

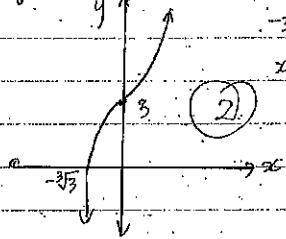


ii) $y = x^3 + 3$

$$0 = x^3 + 3$$

$$-3 = x^3$$

$$x = -\sqrt[3]{3}$$



d) i) $f(-3) = (-3)^3 - 4(-3)^2 + 3(-3)$

$$f(-3) = -27 - 36 - 9$$

$$= -72$$

(1)

ii) $0 = x^3 - 4x^2 + 3x$

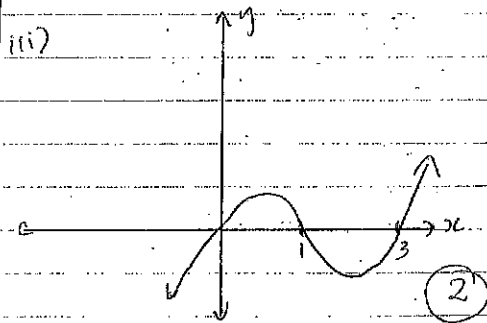
$$0 = x(x^2 - 4x + 3)$$

$$0 = x(x-3)(x-1)$$

$$x = 0, 3 \text{ or } 1$$

(2)

iii)



e) $\tan 32 = \frac{x}{800}$

$$x = 499.895$$

$\tan 37 = \frac{x+h}{800}$

$$x+h = 602.843$$

$$h = 103 \text{ m}$$

f) $\angle ABC = 60^\circ$
 $\angle CAB = 30^\circ$

bearing from A = 120°

g) i) $BC^2 = 14^2 + 25^2$
 $BC = 28.7 \text{ km}$

ii) $\tan a = \frac{14}{25}$

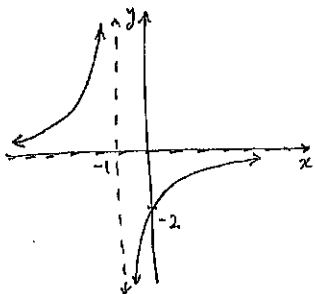
$$a = 29^\circ 15'$$

$$270 + 29^\circ 15' + 45^\circ$$

$$= 344^\circ 15'$$

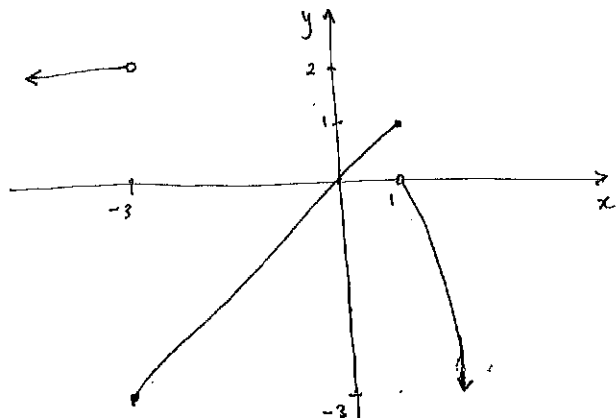
Question 7

a)

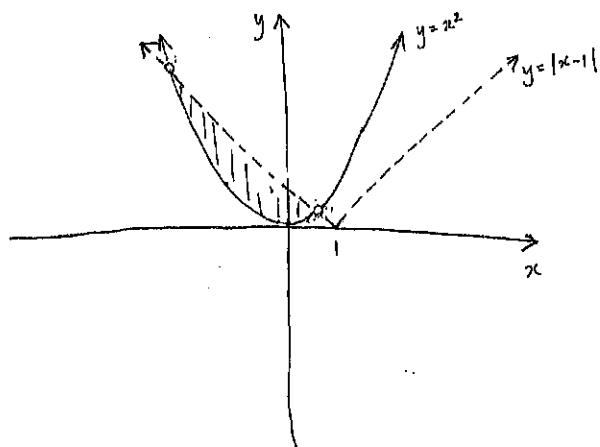


Range: $y \in \mathbb{R}, y \neq 0$.

b)



c)



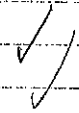
$$d) (3 - \sqrt{2})(3 + \sqrt{2})$$

$$= 9 - 3\sqrt{2} - 3\sqrt{2} + 2$$

$$= 11 - 6\sqrt{2}$$

$$a = 11$$

$$b = 6$$



$$e) -3 < 2x + 1 < 3$$

$$-4 < 2x < 2$$

$$-2 < x < 1$$



$$f) x = 2 + y$$

$$3(2 + y) + 2y = 1$$

$$6 + 3y + 2y = 1$$

$$5y = -5$$

$$y = -1$$

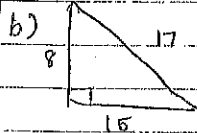
$$x = 1$$



Question 8

a) $\cos \theta = \frac{7}{18-5}$ ✓

$\theta = 68^\circ$



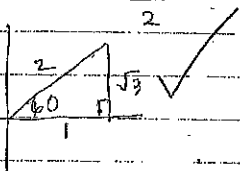
$17^2 = 15^2 + x^2$

$x = 8$ ✓✓

$\tan \alpha = \frac{15}{8}$

c) $2 \sin 2x = \sqrt{3}$

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



$2x = 60^\circ, 120^\circ, 420^\circ, 480^\circ$ ✓
 $x = 30^\circ, 60^\circ, 210^\circ, 240^\circ$

d) $RHS = \sec^2 \theta - \cos^2 \theta$

$= \frac{1}{\cos^2 \theta} - \cos^2 \theta$

$= \frac{1 - \cos^4 \theta}{\cos^2 \theta}$

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

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

$= \frac{\cancel{\sin^2 \theta} + \sin^2 \theta \cos^2 \theta}{\cos^2 \theta}$

$= \tan^2 \theta + \sin^2 \theta = LHS$