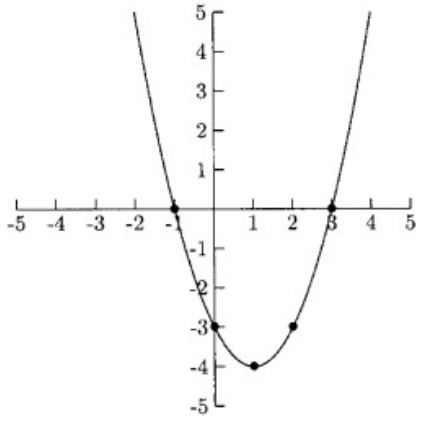
PRELIMINARY MATHEMATICS ASSESSMENT TASK 2 (PRELIMINARY)

SECTION A: Multiple Choice (4 marks)

Question 1

What type of function is shown by the graph below?



a) Linear

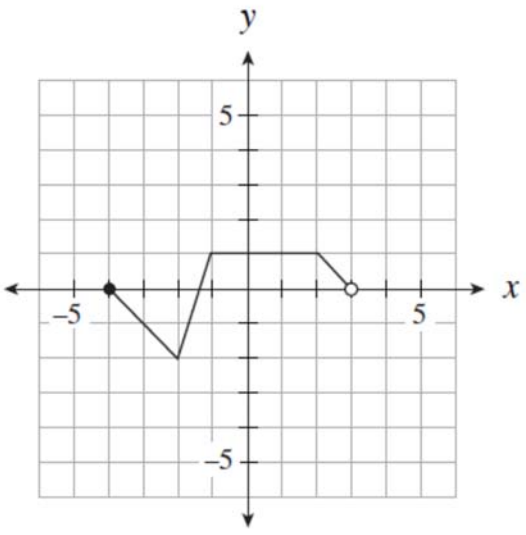
b) Quadratic

c) Cubic

d) Exponential

Question 2

Determine the **domain** of the following relation



a) $-4 < x \leq 3$

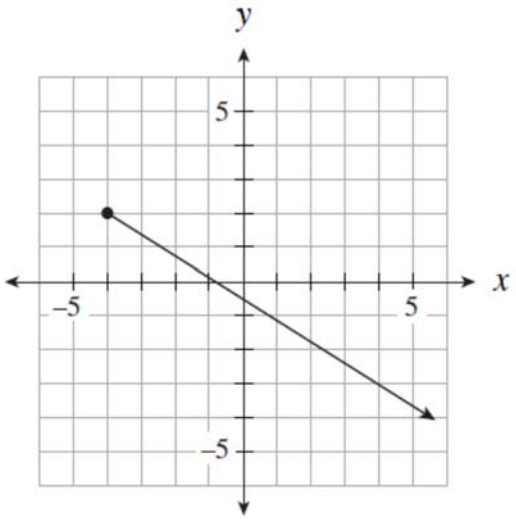
b) $-4 \leq x \leq 3$

c) $-2 \leq y \leq 1$

d) $-4 \leq x < 3$

Question 3

Determine the **range** of the following function



a) $x \geq -4$

b) $y \geq -4$

c) $y \geq 2$

d) $y \leq 2$

Question 4

Consider the graph of the function $y = 2^{x-1} - 1$. At what point will this graph intersect the x-axis?

a) $(0, 0)$

b) Never intersects the x-axis

c) $(1, 0)$

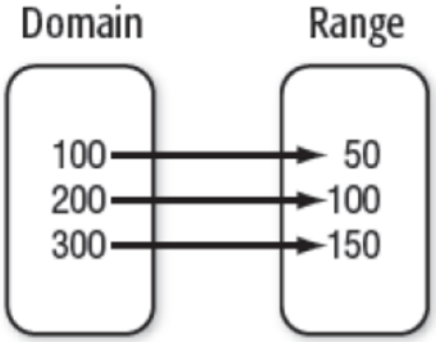
d) $(2, 0)$

SECTION B

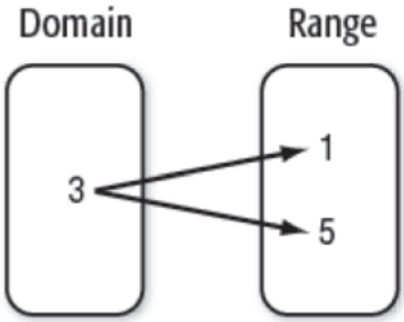
Question 5 (10 marks) **Marks**

(a) For the following graphs, determine whether the following relations are functions **4**

(i)



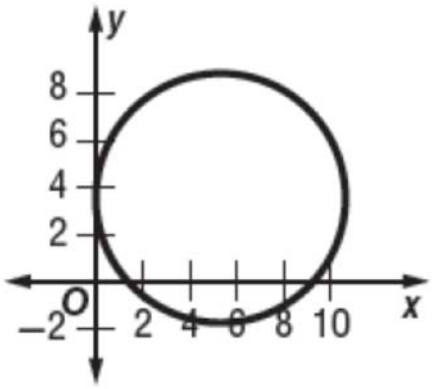
(ii)



(iii)

x	y
1	2
2	4
3	6

(iv)



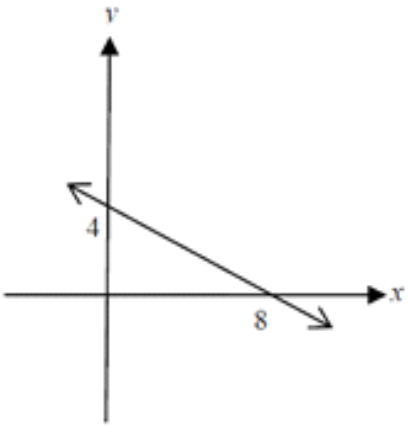
(b) Consider the function $f(x) = 3x^2 - x$, and $g(x) = 2 - x$.

(i) Evaluate $f(-1)$ **1**

(ii) Evaluate $g(b)$ **1**

(iii) Find a if $f(a+1) = f(a-1)$ **2**

(c) Write down the equation of the line represented in the diagram: **2**



Question 6 (9 marks) **Marks**

On separate diagrams, sketch the graphs of the following, showing **essential features**

(a) $3x - 2y + 12 = 0$ **2**

(b) $y = x^2 - 4x + 3$ **3**

(c) $y = |x + 2|$ **2**

(d) $y = \sqrt{9 - x^2}$ **2**

Question 7 (9 marks) **Marks**

(a) State the **domain** and **range** of each of the following functions.

(i) $y = \sqrt{2 - x}$ **2**

(ii) $x^2 + 3 = y$ **2**

(iii) $y = 3^x$ **2**

(b) Given the function $y = \dfrac{2}{x^2 - 1}$

(i) Find the **vertical** asymptote(s) **2**

(ii) Find the **horizontal** asymptote(s) **1**

Question 8 (9 marks) **Marks**

(a) State whether the following are ODD, EVEN or NEITHER. Justify your answer.

(i) $f(x) = 1 - x^2$ **2**

(ii) $f(x) = \dfrac{x}{1 + x^2}$ **2**

(iii) $f(x) = -3|x|$ **2**

(b) Find the centre and radius of the circle **3**

$x^2 + y^2 - 4x + 6y - 3 = 0$

Question 9 (12 marks) **Marks**

(a) A function $f(x)$ is defined by

$$f(x) = \begin{cases} 0, & x < -2 \\ -1, & -2 < x < 0 \\ x, & x \geq 0 \end{cases}$$

(i) Find $f(-4) + f\left(-\frac{1}{2}\right) + f(0)$ **2**

(ii) Sketch the graph of $y = f(x)$ **2**

(b) If $y = \frac{1}{3-x} + 1$

Explain how the above function is transformed from the curve $y = \frac{1}{x}$ **3**

(c) Find the **range** of $f(x) = 3 + 2x - x^2$, $0 \leq x < 5$ **3**

(d) If $f(x) = x^2 - 4$ and $g(x) = x - 2$, find in simplest form $f(g(x))$ **2**

End of Examination

2013 Preliminary 2 unit Solutions

1. B. 2. D. 3. D 4. C

Q5.

a) i) Function (1) ii) Not Function (1) iii) Function (1) iv) Not Function (1)

b) i) $f(-1) = 3(-1)^2 - (-1)$

$= 3 + 1$

$= 4$ (1)

ii) $g(b) = 2 - b$ (1)

iii) $f(a+1) = 3(a+1)^2 - (a+1)$

$= 3(a^2+2a+1) - (a+1)$

$= 3a^2+6a+3-a-1$

$= 3a^2+5a+2$

$f(a-1) = 3(a-1)^2 - (a-1)$ (1)

$= 3(a^2-2a+1) - (a-1)$

$= 3a^2-6a+3-a+1$

$= 3a^2-7a+4$

$\therefore f(a+1) = f(a-1)$

$3a^2+5a+2 = 3a^2-7a+4$

$12a = 2$ (1)

$a = \frac{1}{6}$

c) y int: 4

x int: 8.

$y = mx + b$ where $b = 4$ (1).

$\therefore y = mx + 4$

when $x = 8$ $y = 0$

$\therefore m = -\frac{1}{2}$ (1)

$\therefore y = -\frac{1}{2}x + 4.$

/10

Question 6

a) $3x - 2y + 12 = 0$

x int: $3x + 12 = 0$

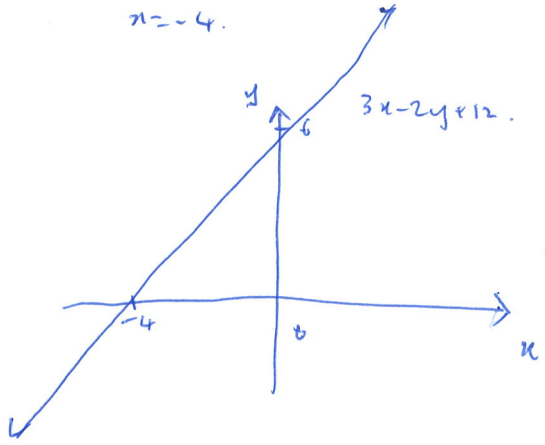
$3x = -12$

$x = -4$.

y int: $-2y + 12 = 0$

$2y = 12$

$y = 6$.



(2)

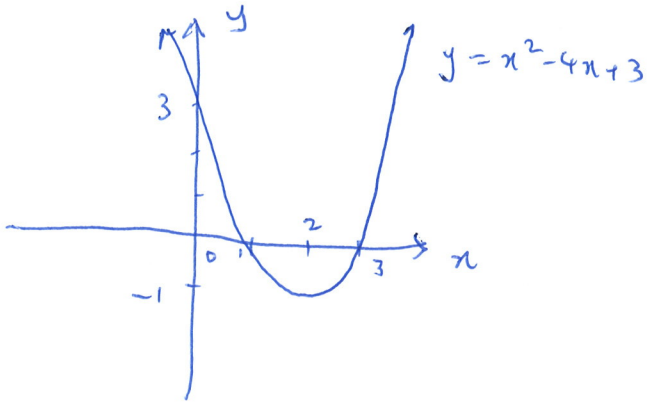
b) $y = x^2 - 4x + 3$

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

$\therefore$ x int: $x = 3$, $x = 1$

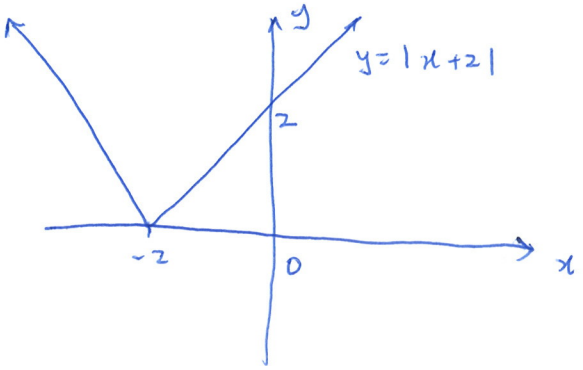
y int: $y = 3$.

vertex at $x = 2$ $\therefore$ $V(2, -1)$



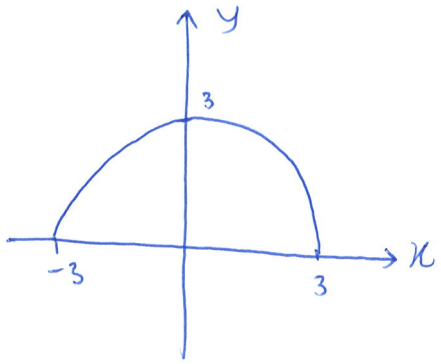
(3)

c)



(2)

d)



✓✓

Question 7

a) i) Domain: $2 - x \geqslant 0$

$x \leqslant 2$ ✓

Range. $y \geqslant 0$ ✓

ii) Domain: All real x ✓

Range.: $y \geqslant 3$ ✓

iii) Domain: All real x ✓

Range: $y > 0$ ✓

b) $$y = \frac{2}{(x-1)(x+1)}.$$

i) vertical asymptote at

$x = 1$, $x = -1$ ✓✓

ii) horizontal asymptote

$x \to \infty$ $y \to 0$.

$\therefore$ $y = 0$ is horizontal asymptote ✓

Question 8

a) i) $f(x) = 1 - x^2$

$f(-x) = 1 - (-x)^2$ (✓)

$= 1 - x^2$

$= f(x)$

$\therefore$ even (✓)

ii) $f(x) = \dfrac{x}{1+x^2}$

$f(-x) = \dfrac{-x}{1+(-x)^2}$ (✓)

$= -\dfrac{x}{1+x^2}$

$= -f(x)$

$\therefore$ odd. (✓)

iii) $f(x) = -3|x|$

$f(-x) = -3|-x|$

$= -3|x|$

$= -f(x)$ (✓)

$=$ even (✓)

b) $x^2 + y^2 - 4x + 6y - 3 = 0$

$x^2 - 4x + y^2 + 6y = 3$

$x^2 - 4x + 4 + y^2 + 6y + 9 = 3 + 4 + 9$. (✓)

$(x-2)^2 + (y+3)^2 = 16$. (✓)

$\therefore$ centre $(2, -3)$ radius 4. (✓)

Question 9

a) i) $f(-4) = 0$

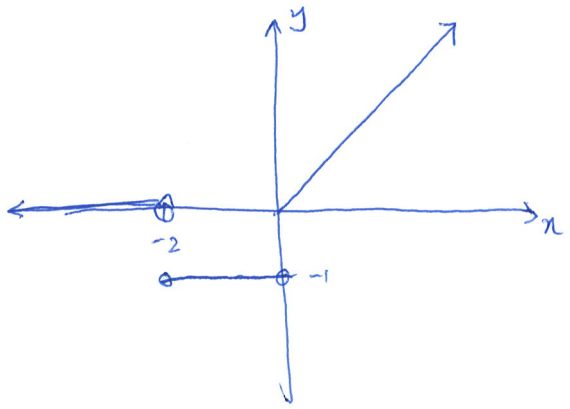
$f(-\frac{1}{2}) = -1$

$f(0) = 0$

$\therefore f(-4) + f(-\frac{1}{2}) + f(0) = 0 - 1 + 0$

$= -1$

ii)



b) $y = \frac{1}{3-x} + 1$

$= \frac{1}{-(x-3)} + 1$

$y = \frac{1}{x} \rightarrow y = \frac{1}{-x}$

$\rightarrow y = \frac{1}{-(x-3)}$

$y = \frac{1}{-(x-3)} + 1$

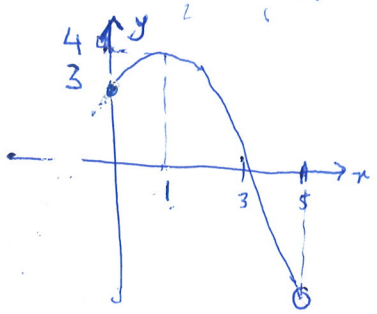
reflect about x / y-axis.

shift right by 3 units

move up by 1 unit.

c) $f(x) = -(x^2 - 2x - 3)$

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



$-1 \quad 3$

$\therefore$ range $-12 \leq f(x) \leq 4$

d) $f(x) = (x-2)^2 - 4$

$= x^2 - 4x + 4 - 4$

$= x^2 - 4x$

$= x(x-4)$