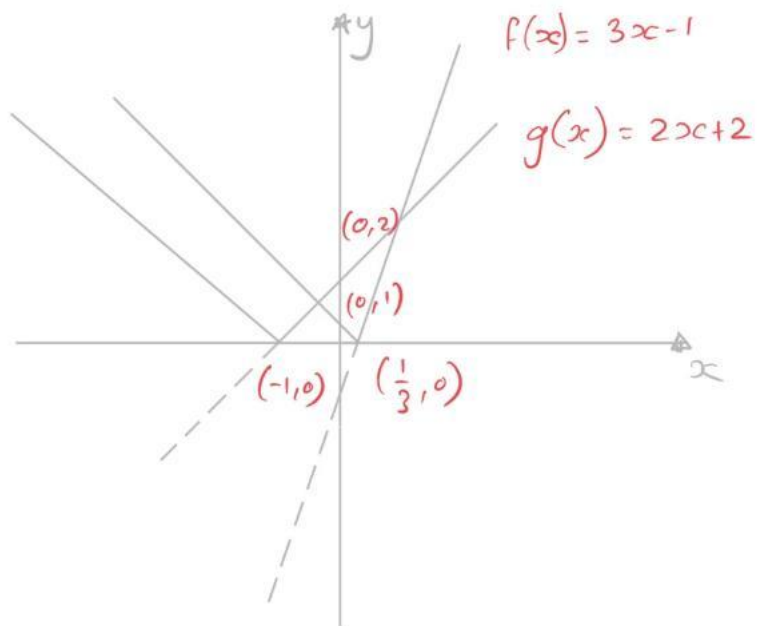


Q1a

a)



Q1b

b) EQUATE EQUATIONS FROM GRAPH

$$|3x-1| = 2x+2$$

$$3x-1 = 2x+2$$

$$x = 3$$

$$3x-1 = -(2x+2)$$

$$3x-1 = -2x-2$$

$$5x = -1$$

$$x = -\frac{1}{5}$$

OR

SQUARE MOD FUNCTION TO MAKE POSITIVE QUADRATIC

$$|3x-1| = |2x+2|$$

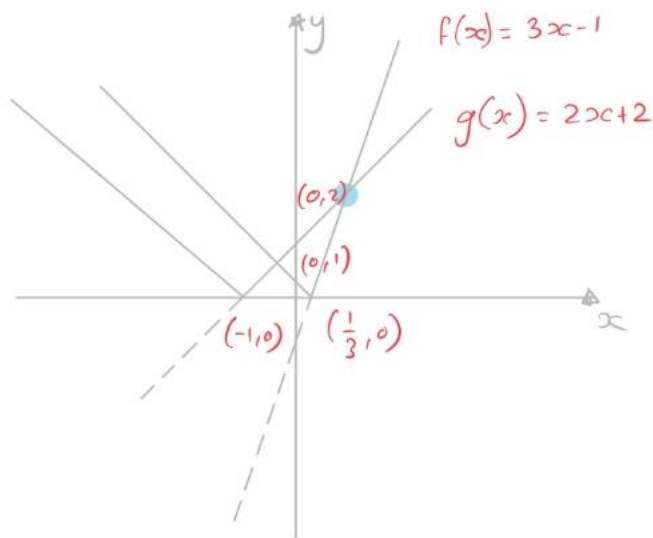
$$(3x-1)^2 = (2x+2)^2$$

$$9x^2 - 6x + 1 = 4x^2 + 8x + 4$$

$$5x^2 - 14x - 3 = 0$$

$$x = 3 \quad x = -\frac{1}{5}$$

Q1c



c)

$$x = 3$$

Q2a

a)

$f(x)$ IS A MANY TO ONE FUNCTION
THEREFORE $f^{-1}(x)$ CANNOT EXIST
AS IT NEEDS TO BE A ONE TO ONE
FUNCTION

Q2b

b)

CLOSEST TO ZERO

$$3x - 2 = 0$$

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

$$x \in \mathbb{R} \quad x \geq \frac{2}{3}$$

OR

$$x \in \mathbb{R} \quad x \leq \frac{2}{3}$$

Q2c

c) FROM PART (b)

$$x \geq \frac{2}{3} \quad \text{or} \quad x \leq \frac{2}{3}$$

INVERSE

$$y = 3x - 2$$

$$y + 2 = 3x$$

$$\frac{y+2}{3} = x$$

$$f^{-1}(x) = \frac{x+2}{3}$$

or $\frac{1}{3}(x+2)$

$$\text{DOMAIN } x \geq 0$$

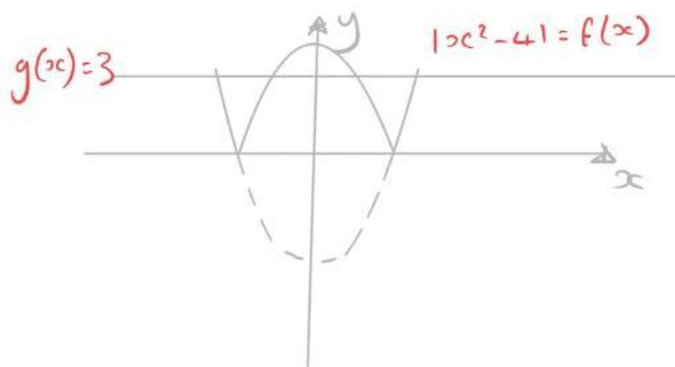
$$x \leq 0$$

$$\text{RANGE } f(x) \geq \frac{2}{3}$$

or

$$f(x) \leq \frac{2}{3}$$

Q3



$$|x^2-4|=3$$

$$x^2-4=3$$

$$x^2=7$$

$$x = \pm\sqrt{7}$$

$$x^2-4=-3$$

$$x^2=1$$

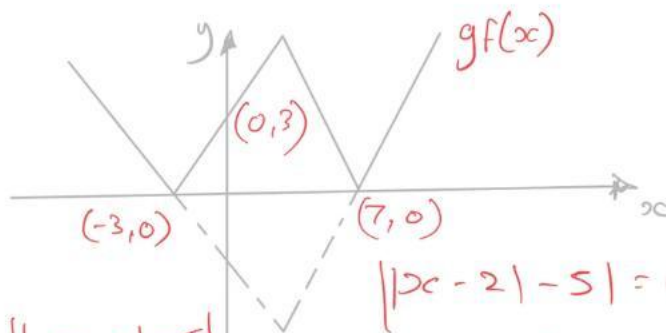
$$x = \pm 1$$

Q4a

a) $gf(x) = ||x-2|-5|$

$x = /$ RIGHT 2 MOD REFLECT V

$|x-2|=V$ DOWNS MOD REFLECT W



$gf(0) = ||0-2|-5|$
 $= |-3|$
 $= 3$

$(0, 3)$

$||x-2|-5| = 0$

$|x-2|-5 = 0$

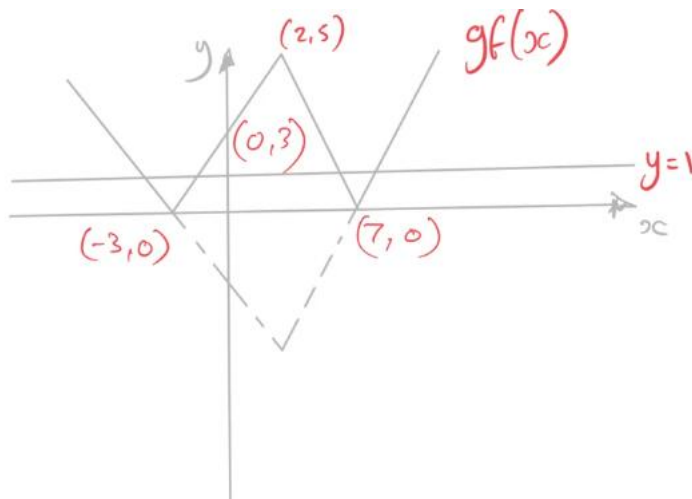
$|x-2| = 5$

$x-2 = \pm 5$

$x = -3 \quad x = 7$

$(-3, 0) \quad (7, 0)$

Q4b

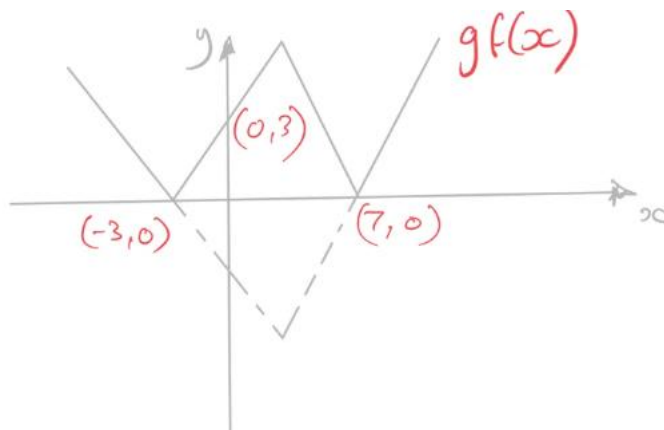


b)

i) 4 SOLUTIONS

ii) 2 SOLUTIONS

Q4c



c) SOLVING USING PAIRS OF EQUATIONS FROM LINES WITH GRADIENT 1 AND -1

OR

SOLVE MODULUS EQUATION

$$||x-2|-5|=2$$

$$|x-2|-5 = \pm 2$$

$$|x-2| = 7$$

$$|x-2| = 3$$

$$x-2 = \pm 7$$

$$x-2 = \pm 3$$

$$x = 9$$

$$x = 5$$

$$x = -5$$

$$x = -1$$

Q5a

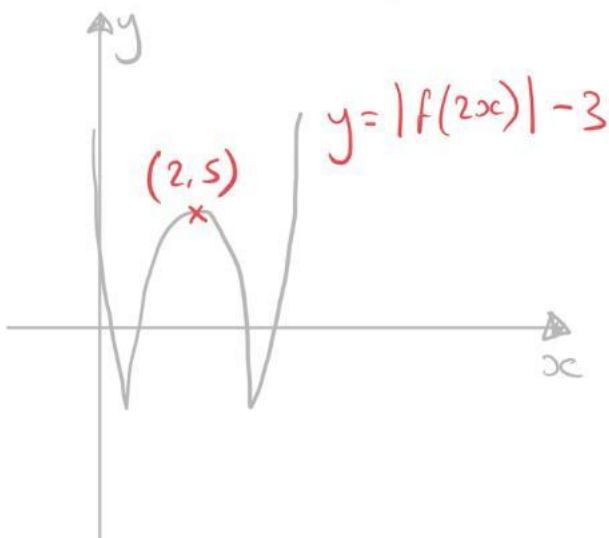
a)

HORIZONTAL STRETCH SF $\frac{1}{2}$

REFLECT ABOVE X AXIS

TRANSLATE $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$

$$(4, -8) \Rightarrow (2, 5)$$



Q5b

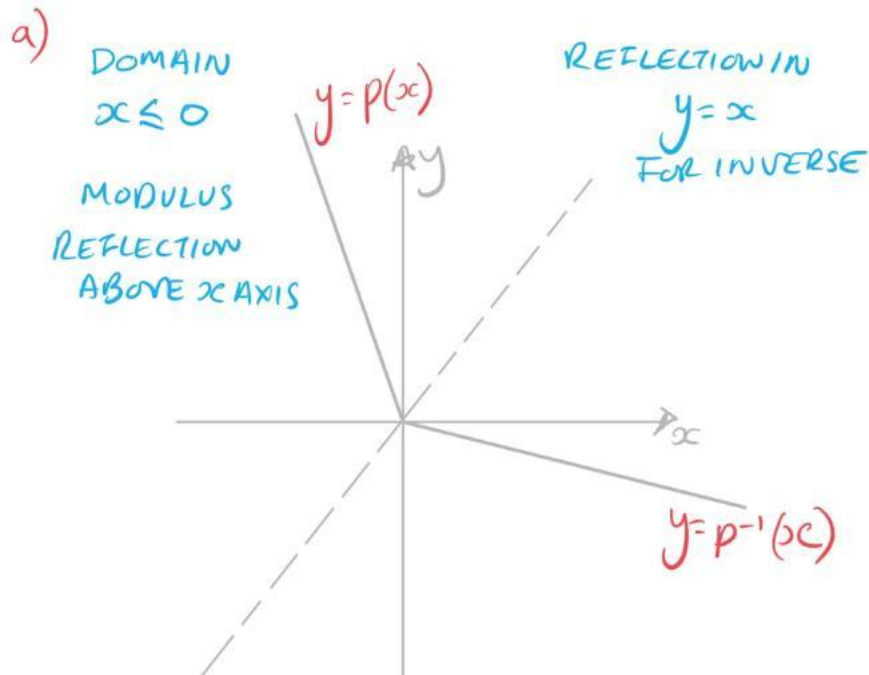
b) DISTANCE = PYTHAGORAS

$$\text{MIN} = (4, -8) \quad \text{MAX} = (2, 5)$$

$$\sqrt{(2-4)^2 + (5+8)^2}$$

$$\boxed{\sqrt{173} \text{ UNITS}}$$

Q6a



Q6b

b)

$$\text{LET } y = |2x|$$

AS DOMAIN IS

$$y = -2x$$

$$x \leq 0$$

$$-\frac{y}{2} = x$$

$$p^{-1}(x) = -\frac{1}{2}x$$

$$\text{DOMAIN } x \geq 0$$

Q6c

c)

$$-\frac{1}{2}p\left(-\frac{1}{2}x\right) = -\frac{1}{2}\left|2\left(-\frac{1}{2}x\right)\right|$$

$$= -\frac{1}{2}\left|-x\right| \quad x \leq 0$$

$$p^{-1}(x) = -\frac{1}{2}x \quad x \geq 0$$

BECAUSE OF THE GIVEN DOMAINS

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

Q7a

$$a) \quad t = 0$$

$$x(0) = 10 \sin(0) = 0$$

$$h(0) = 12 - 10 |\cos(0)| = 12 - 10 = 2$$

INITIAL POSITION = (0, 2)

Q7b

$$b) \quad -10 \leq x \leq 10 \quad y = 12$$

$$i) \quad (-10, 12) \quad \text{AND} \quad (10, 12)$$

$$ii) \quad x = 10$$

$$10 \sin\left(\frac{\pi}{5}t\right) = 10$$

$$\sin\left(\frac{\pi}{5}t\right) = 1$$

$$\frac{\pi}{5}t = \sin^{-1}(1) = \frac{\pi}{2} \quad \downarrow \div \frac{\pi}{5}$$

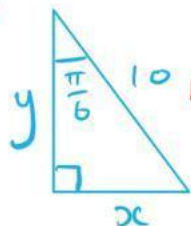
$$t = \frac{5}{2}$$

USING $+2\pi$ FOR NEXT TIME OR SYMMETRY

$$\frac{5}{2} \cdot 2 = 5 \text{ SECONDS}$$

Q7c

c)



$$x = 10 \times \sin\left(\frac{\pi}{6}\right) = 5 \text{ m}$$

$$12 - y = 12 - 10 \cos\left(\frac{\pi}{6}\right)$$

$$= 12 - 5\sqrt{3}$$

USING SOH CAH TOA $= 3.33974\dots$

$$= 3.34 \text{ m}$$

POSITION (5, 3.34)

USING $x = 5$

$$10 \sin\left(\frac{\pi}{5}t\right) = 5$$

$$\sin\left(\frac{\pi}{5}t\right) = \frac{1}{2}$$

$$\frac{\pi}{5}t = \sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6} \quad \downarrow \div \frac{\pi}{5}$$

$$t = \frac{5}{6} \text{ SECONDS}$$