

K/U	APP	THK	COMM
20 /21	17 /19	4 /8	6 /6

Be sure to show all work of good form for full marks. Good luck!



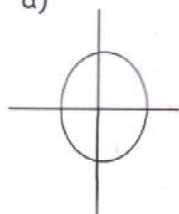
Part A: Knowledge and understanding

/21

1. Determine if the following relations are functions or not.

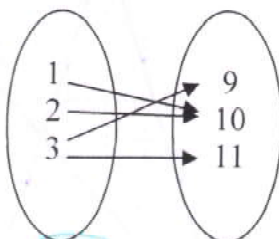
(4 marks)

a)



not function

b)



Function

NF

c) $\frac{1}{y} = x$

function

d) $y^2 = x + 3$

not a function

2. Given the two functions $f(x) = \frac{2x-1}{3}$ and $g(x) = 6 - x^2$, determine:

(6 marks)

a) $3f(-7)$

$$f(-7) = \frac{2(-7)-1}{3} = -5$$

$$3f(-7) = 3(-5) = -15$$

(2)

b) simplify $f(g(4))$

(2)

$$g(x) = 6 - x^2 \\ = 6 - (4)^2 \\ = 6 - (16) \\ = -10$$

$$f(g(4)) = \frac{2(-10)-1}{3} = -7$$

c) if $f(x) = -4$, find the value of x

(2)

$$f(x) = \frac{2x-1}{3} \\ -4 = \frac{2x-1}{3}$$

$$-4 + \frac{1}{3} = \frac{2x}{3}$$

$$-\frac{12}{3} + \frac{1}{3} = \frac{2x}{3}$$

$$-\frac{11}{3} = \frac{2x}{3} \\ 2x = -11 \\ x = -5.5$$

3. State the domain and range of the function $g(x) = -\sqrt{-x-3}$. (2 marks)

$$D: \{x \in \mathbb{R} \mid x \leq -3\}$$

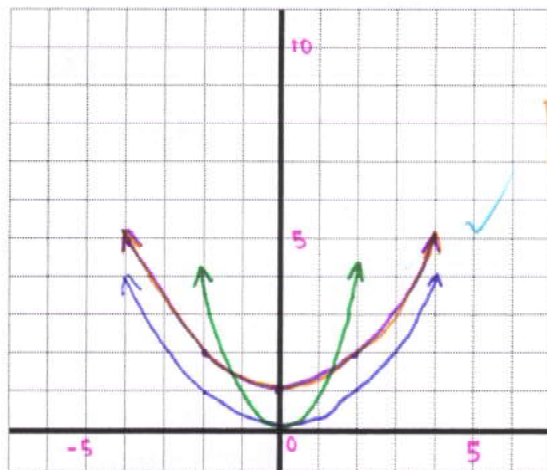
$$R: \{y \in \mathbb{R} \mid y \leq 0\}$$

$$= -\sqrt{-(x+3)}$$

4. Graph and label each of the following functions. Label at least three major points on each sketch. (6 marks)

a) $y = \left(-\frac{1}{2}x\right)^2 + 1$

(3)



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

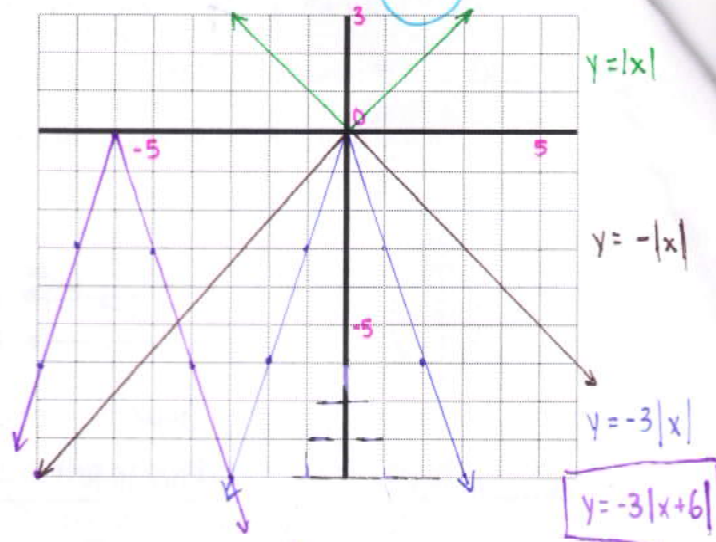
$$y = \left(\frac{1}{2}x\right)^2 + 1$$

$$y = x^2$$

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

b) $y = -3|x + 6|$

(3)



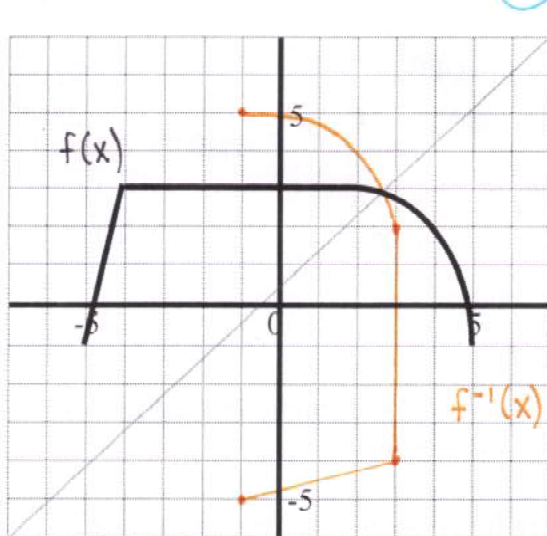
$$y = |x|$$

$$y = -|x|$$

$$y = -3|x|$$

$$y = -3|x + 6|$$

5. Given $f(x)$, graph and label the inverse relation. (3 marks)



$$f(x) = \{(-5, -1), (-4, 3), (2, 3), (5, -1)\}$$

$$f^{-1}(x) = \{(-1, -5), (3, -4), (3, 2), (-1, 5)\}$$

Part B: Application

/19

6. Find the inverse function of $f(x)$. Restrict the domain if necessary. (4 marks)

$$f(x) = (3x - 9)^2 + 2$$

$$y = (3x - 9)^2 + 2$$

$$x = (3y - 9)^2 + 2$$

$$x - 2 = 3(y - 3)^2$$

$$\sqrt{\frac{x-2}{3}} = \sqrt{3(y-3)^2}$$

$$\pm \sqrt{\frac{x-2}{3}} = y - 3$$

Not a function.

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

↑
not a function

$$D: \{x \in \mathbb{R} \mid x \geq 3\}$$

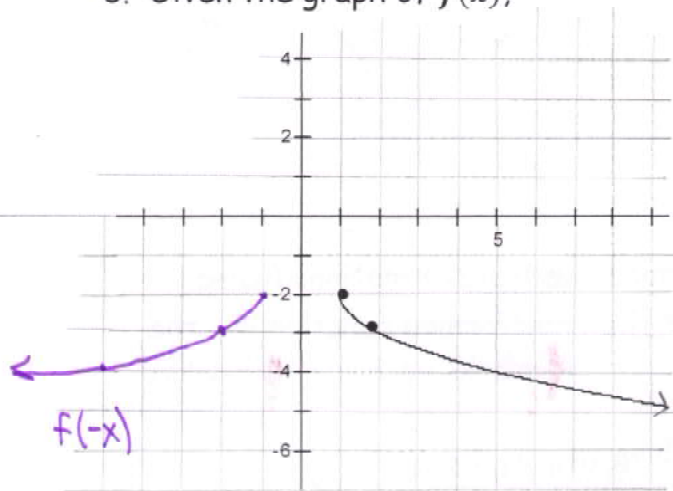
The graph of $y = f(x)$ has been reflected in the x-axis, horizontally compressed by a factor of $\frac{1}{4}$, shifted up one unit, and shifted to the right two units. What is the equation of this transformed function in proper function notation? (2 marks)

$$y = -f[4(x-2)] + 1$$

Uni

8. Given the graph of $f(x)$,

(6 marks)



a) Determine the equation of the function

$$f(x) = -\sqrt{x-1} - 2 \quad (2)$$

b) Graph $f(-x)$ on the same axes. (1)

c) State the domain and range of $f(-x)$ (2)

$$D: \{x \in \mathbb{R} \mid x \leq -1\}$$

$$R: \{y \in \mathbb{R} \mid y \leq -2\}$$

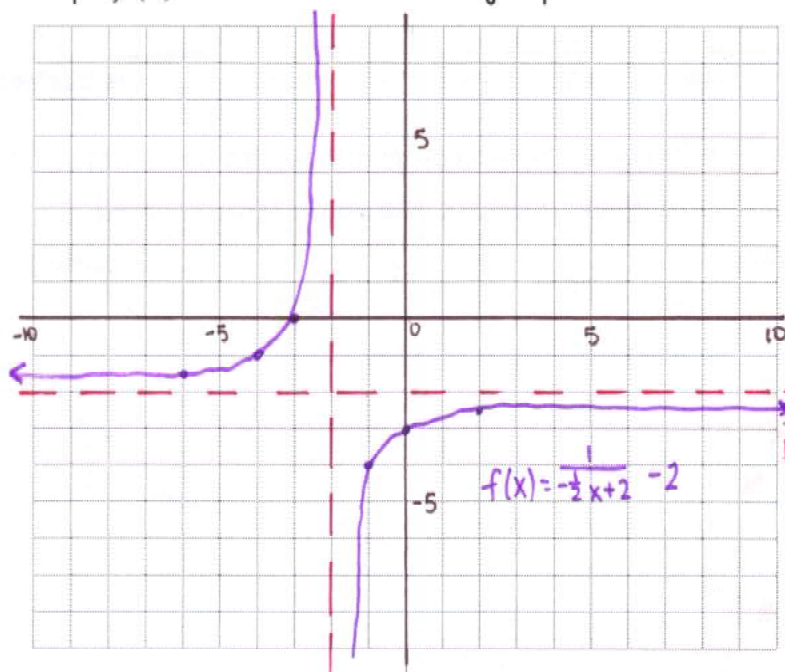
d) State any invariant point(s). (1)

nope

9. For the function $f(x) = \frac{1}{\frac{1}{2}x+2} - 2$,

(7 marks)

Graph $f(x)$. Label at least 6 major points and the asymptotes.



$$(x, y) \rightarrow (-2x-2, y-2)$$

$$(-2, -0.5) \rightarrow (2, -2.5)$$

$$(-1, -1) \rightarrow (0, -3)$$

$$(-0.5, -2) \rightarrow (-1, -4)$$

$$(0.5, -2) \rightarrow (-1, -4)$$

$$(1, -1) \rightarrow (-2, -3)$$

$$(2, -0.5) \rightarrow (-3, -2.5)$$

New
HA = -2

HA

$$y = -2$$

New
VA = -2

VA

$$x = -4$$

11. A function $f(x)$ has a domain of $\{x \geq -2, x \in \mathbb{R}\}$ and range $\{y < 1, y \in \mathbb{R}\}$. Determine the domain and range of each function: (2 marks each $\times 2 = 4$ marks)

a) $y = 3f(x)$

D: $\{x \in \mathbb{R} \mid x \geq -2\}$

R: $\{y \in \mathbb{R} \mid y < 1\}$

b) $y = f(x-4) - 2$

D: $\{x \in \mathbb{R} \mid x \geq 2\}$

R: $\{y \in \mathbb{R} \mid y < -1\}$

3

12. Consider the function $f(x) = (x-3)(2x+1)$. Determine the transformations (using proper terminology) that may have taken place if the transformed function has the following zeroes: $f(x) = 2(x-1.25)^2 - 6.125$ (2 marks each $\times 2 = 4$ marks)

a. (6, 0) and (-1, 0)

HT 1.25 units right

VC by factor of $\frac{1}{2}$

HS by 2

b. (0, 0) and (-3.5, 0)

HT 3 units left

1/2

Part D: Communication

(including /3 marks for equal signs, formal set notation, graphs labeled)

12. Explain when and why a vertical stretch/compression can produce the same effect as a horizontal stretch/compression (i.e. they will produce the same transformed graph). Be sure to include an example. (3 marks)

