

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

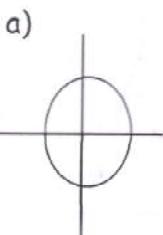
Be sure to show all work of good form for full marks. Good luck!



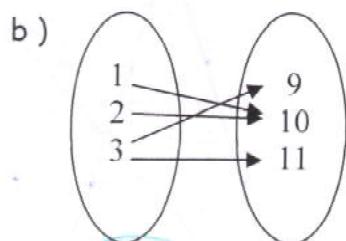
Part A: Knowledge and understanding

/21

1. Determine if the following relations are functions or not. (4 marks)

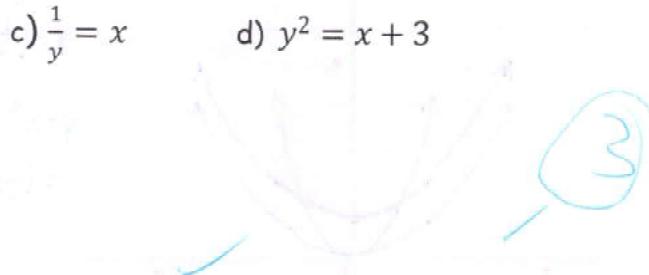


not function ✓



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 $f(g(4))$

$$\begin{aligned} g(x) &= 6 - x^2 \\ &= 6 - (4)^2 \\ &= 6 - (16) \\ &= -10 \end{aligned}$$

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

(2)

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

$$\begin{aligned} f(x) &= \frac{2x-1}{3} \\ -4 &= \frac{2x-1}{3} \\ -4 + \frac{1}{3} &\stackrel{?}{=} \frac{2x}{3} \\ -\frac{12}{3} + \frac{1}{3} &\stackrel{?}{=} \frac{2x}{3} \end{aligned}$$

(2)

$$\begin{aligned} -\frac{11}{3} &= \frac{2x}{3} \\ 2x &= -11 \\ x &= -5.5 \end{aligned}$$

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

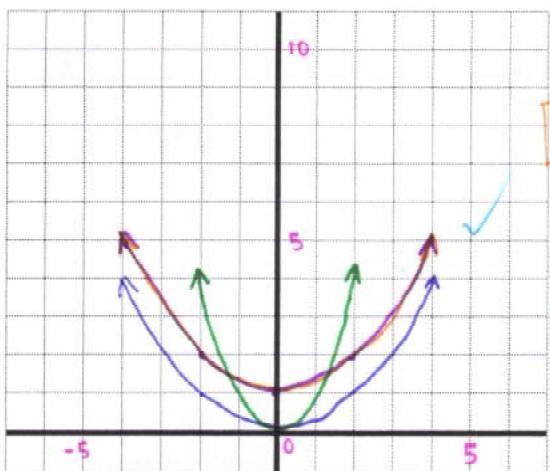
D: $\{x \in \mathbb{R} \mid x \leq -3\}$

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

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

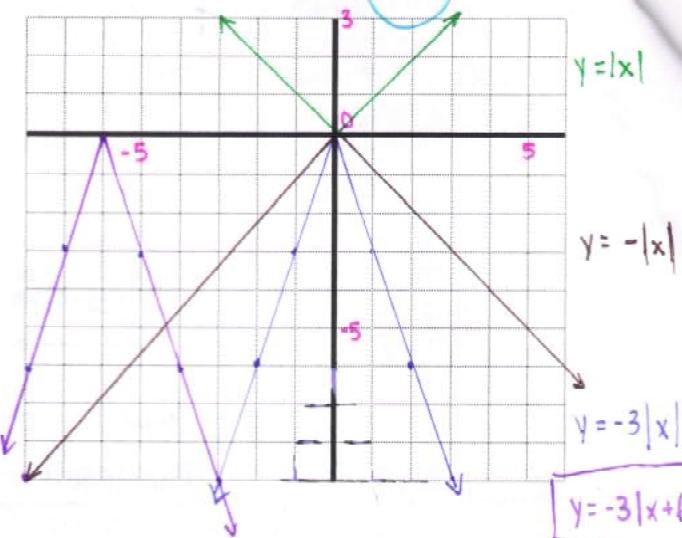
4. Graph and label each of the following functions. Label at least three major points. (6 marks)

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



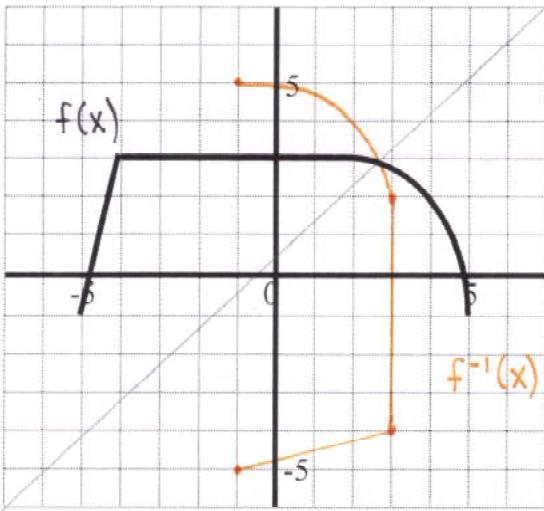
(3)

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



(3)

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



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

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

$f^{-1}(x)$

Part B: Application

/19

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

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

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

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

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

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

$$\pm y - 2 = \sqrt{\frac{x-2}{3}} + 3 \quad \text{Not a function.}$$

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

↑
not a
function

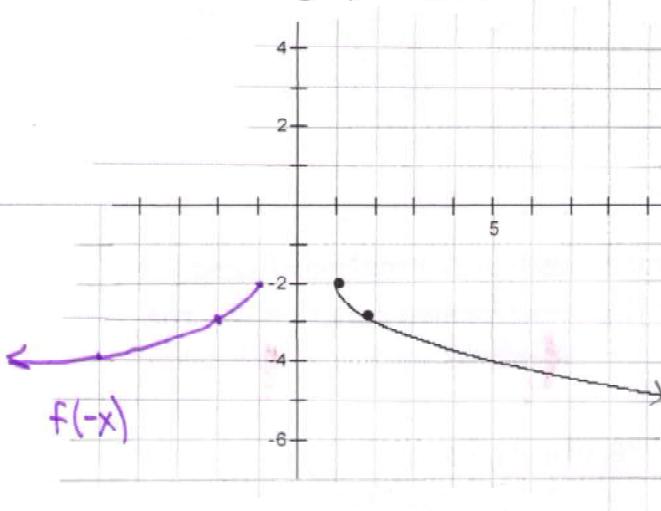
$$D: \{x \in \mathbb{R} \mid x \geq 3\}$$

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

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

(2)

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

(1)

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

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

(2)

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

(1)

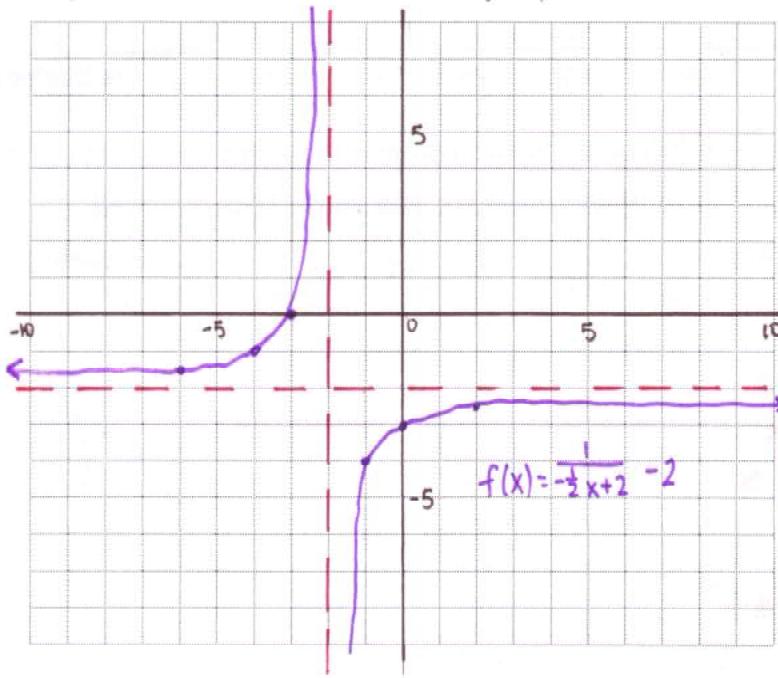
d) State any invariant point(s).

nope

9. For the function $f(x) = \frac{1}{-\frac{1}{2}x+2} - 2$, (7 marks)

~~factor out!~~

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



(x, y)	\rightarrow	$(-2, -2, y-2)$
$(-2, -0.5)$	\rightarrow	$(2, -2.5)$
$(-1, -1)$	\rightarrow	$(0, -3)$
$(-0.5, -2)$	\rightarrow	$(-1, -4)$
$(0.5, 2)$	\rightarrow	$(-3, 0)$
$(1, 1)$	\rightarrow	$(-4, -1)$
$(2, 0.5)$	\rightarrow	$(-6, -1.5)$

factor

6

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

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

$\{x \in \mathbb{R} | x \geq -2\}$

$\{y \in \mathbb{R} | y < 1\}$

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

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

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

(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

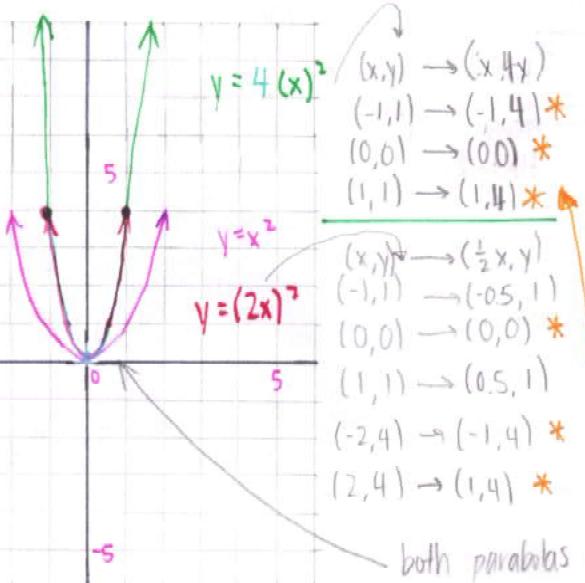
(1)

Part D: Communication

/6

(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.



$$4(x)^2 = (2x)^2$$

vertical stretch by factor of 4

horizontal compression by factor of $\frac{1}{2}$

(3 marks)

When you put 4 into bracket, its $(2x)^2$

When you put 2 outside of bracket, its $4(x)^2$

(3)

both parabolas are the same. * same points