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Unit 4 Review

STATION 1

Function	Base Function	Transformation(s)
$f(x)=\dfrac{-1}{x-4}+6$		
$h(x)=-\lvert 2x-6\rvert+1$		
$j(x)=\dfrac{1}{2}\sqrt{-x-3}+5$		
$m(x)=-3(2)^{4x}-3$		

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STATION 1

Function	Base Function	Transformation(s)
$f(x)=\frac{-1}{x-4}+6$	$f(x)=\frac{1}{x}$ RECIPROCAL	① R ITxA ② horizontal shift 4 right ③ vertical shift up 6
$h(x)=-\lvert 2x-6\rvert+1$ $\boxed{h(x)=-\lvert 2(x-3)\rvert+1}$	$f(x)=\lvert x\rvert$ ABSOLUTE VALUE	① R ITXA ② horiz. compression bafo $\frac{1}{2}$ ③ horiz. shift 3 right ④ vertical shift up 1
$j(x)=\frac{1}{2}\sqrt{-x-3}+5$ $\boxed{j(x)=\frac{1}{2}\sqrt{-(x+3)}+5}$	$f(x)=\sqrt{x}$ SQUARE ROOT	① vertical compression bafo $\frac{1}{2}$ ② R ITYA ③ horiz. shift 3 left ④ vert. shift up 5
$m(x)=-3(2)^{4x}-3$	$f(x)=2^{x}$ EXPONENTIAL (BASE 2)	① R ITXA ② Vertical stretch bafo 3 ③ horizontal compression bafo $\frac{1}{4}$ ④ vertical shift down 3

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STATION 2

Function	Domain	Range
$f(x) = -2\|x-3\|+7$		
$g(x) = \dfrac{1}{x-2} + 4$		
$j(x) = \sqrt{-(x+4)} + 3$		
$p(\vartheta) = -2\cos\left(\frac{1}{2}\vartheta + 30°\right) - 1$		
$m(x) = -3(2)^{4x} - 3$		

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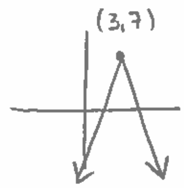
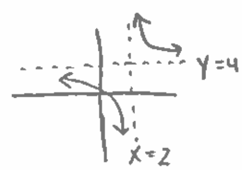
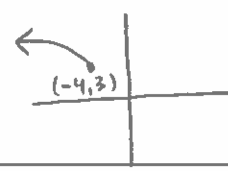
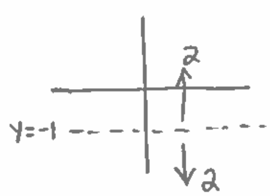
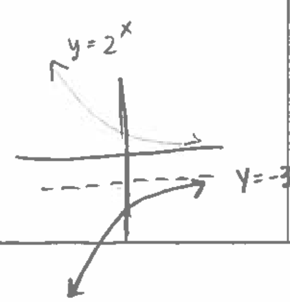
STATION 2

Function	Domain	Range
$f(x) = -2\|x-3\|+7$	$\{x \in \mathbb{R}\}$ 	$\{y \in \mathbb{R} \mid y \leq 7\}$
$g(x) = \dfrac{1}{x-2} + 4$	$\{x \in \mathbb{R} \mid x \neq 2\}$ 	$\{y \in \mathbb{R} \mid y \neq 4\}$
$j(x) = \sqrt{-(x+4)} + 3$	$\{x \in \mathbb{R} \mid x \leq -4\}$ 	$\{y \in \mathbb{R} \mid y \geq 3\}$
$p(\vartheta) = -2\cos(\frac{1}{2}\vartheta + 30°) - 1$	$\{x \in \mathbb{R}\}$ 	$\{y \in \mathbb{R} \mid -3 \leq y \leq 1\}$
$m(x) = -3(2)^{4x} - 3$	$\{x \in \mathbb{R}\}$ 	$\{y \in \mathbb{R} \mid y < -3\}$

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STATION 3

a) State the transformations that have been applied to the base function $f(x)$

$$g(x) = 2f\left(-\frac{1}{3}x + 2\right) - 5$$

b) Rewrite the function $g(x)$ if the base function is $f(x) = \sqrt{x}$.

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STATION 3

a) State the transformations that have been applied to the base function $f(x)$

$$g(x) = 2f\left(-\frac{1}{3}x + 2\right) - 5$$

Factor first because there is both k & d!

$$\boxed{g(x) = 2f\left[-\frac{1}{3}(x-6)\right] - 5}$$

1. vertical stretch bafo 2
2. RITYA
3. horizontal stretch bafo 3
4. horizontal translation 6 right
5. vertical translation 5 down

b) Rewrite the function $g(x)$ if the base function is $f(x) = \sqrt{x}$.

$$\boxed{g(x) = 2\sqrt{-\frac{1}{3}(x-6)} - 5}$$

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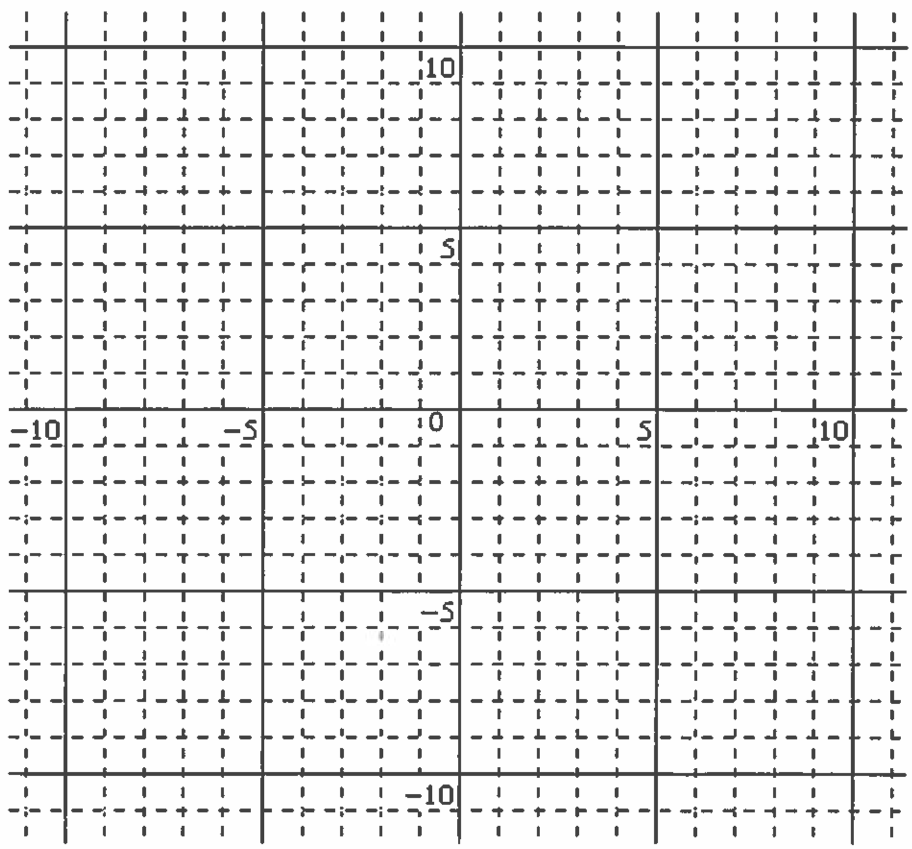
STATION 4

Graph using Transformations

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



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STATION 4

Graph using Transformations

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

mapping rule :

$(x, y) \to (\frac{1}{k}x + d, ay + c)$

$a = -1$

$k = 2$

$d = +3$

$c = +4$

$(x, y) \to (\frac{1}{2}x + 3, -y + 4)$

parent function is $f(x) = \frac{1}{x}$

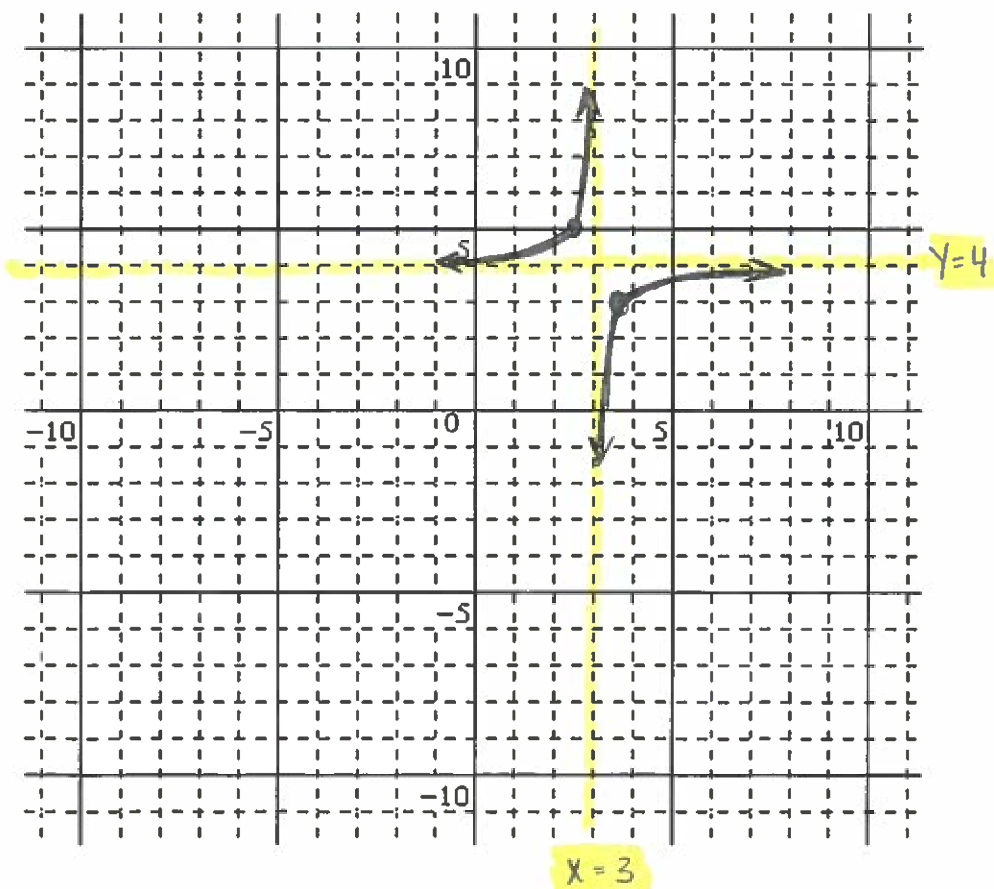
main points :

$(1, 1) \to (\frac{1}{2}(1) + 3, -(1) + 4) \to (3.5, 3)$

$(-1, -1) \to (\frac{1}{2}(-1) + 3, -1(-1) + 4) \to (2.5, 5)$

$x = 0 \to x = \frac{1}{2}(0) + 3 \to x = 3$

$y = 0 \to y = -(0) + 4 \to y = 4$



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STATION 5

Given $f(x) = k(3 - x)$, determine the value of k if $f^{-1}(6) = 1$.

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STATION 5

Given $f(x) = k(3 - x)$, determine the value of k if $f^{-1}(6) = 1$.

OPTION 1

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

$y = k(3-x)$ ← switch x & y

$x = k(3-y)$ ← isolate for y

$\frac{x}{k} = 3-y$

$y = 3 - \frac{x}{k}$

sub in (6, 1):

$1 = 3 - \frac{6}{k}$

$1-3 = -\frac{6}{k}$

$-2 = -\frac{6}{k}$

$-2k = -6$

$k = \frac{-6}{-2}$

$\boxed{k=3}$

OPTION 2

since $f^{-1}(6) = 1$

$f(1) = 6$ ← because (x,y) becomes (y,x)

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

$6 = k(3-1)$

$6 = k(2)$

$\frac{6}{2} = k$

$\boxed{3=k}$

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STATION 6

Determine the inverse of the function

$$f(x) = 3x^2 - 18x - 10, \quad x \leq 3$$

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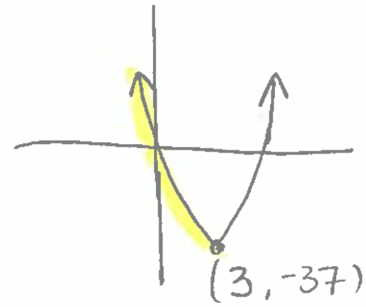
STATION 6



Determine the inverse of the function

$$f(x) = 3x^2 - 18x - 10, \quad x \leq 3$$ ← left branch

① complete the square to put it in vertex form:

$y = (3x^2 - 18x) - 10$

$y = 3(x^2 - 6x) - 10$

$y = 3(x^2 - 6x + 9 - 9) - 10$

$y = 3(x^2 - 6x + 9) - 27 - 10$

$\boxed{y = 3(x-3)^2 - 37}$

2) switch x and y and then isolate for y:

$x = 3(y-3)^2 - 37$

$x + 37 = 3(y-3)^2$

$\frac{x+37}{3} = (y-3)^2$

lower branch → $\pm\sqrt{\frac{x+37}{3}} = y - 3$

$-\sqrt{\frac{x+37}{3}} + 3 = y$

$\boxed{-\sqrt{\frac{x+37}{3}} + 3 = f^{-1}(x)}$

or, if you ever need to describe the transformations, it would be a good idea to tweak it so it is easy to see what k and d are:

$f^{-1}(x) = -\sqrt{\frac{1}{3}x + \frac{37}{3}} + 3$

$f^{-1}(x) = -\sqrt{\frac{1}{3}(x + \frac{37}{3} \div \frac{1}{3})} + 3$

$\boxed{f^{-1}(x) = -\sqrt{\frac{1}{3}(x+37)} + 3}$

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STATION 7

Graph $f(\theta) = -2\sin(3\theta + 60°) + 4$

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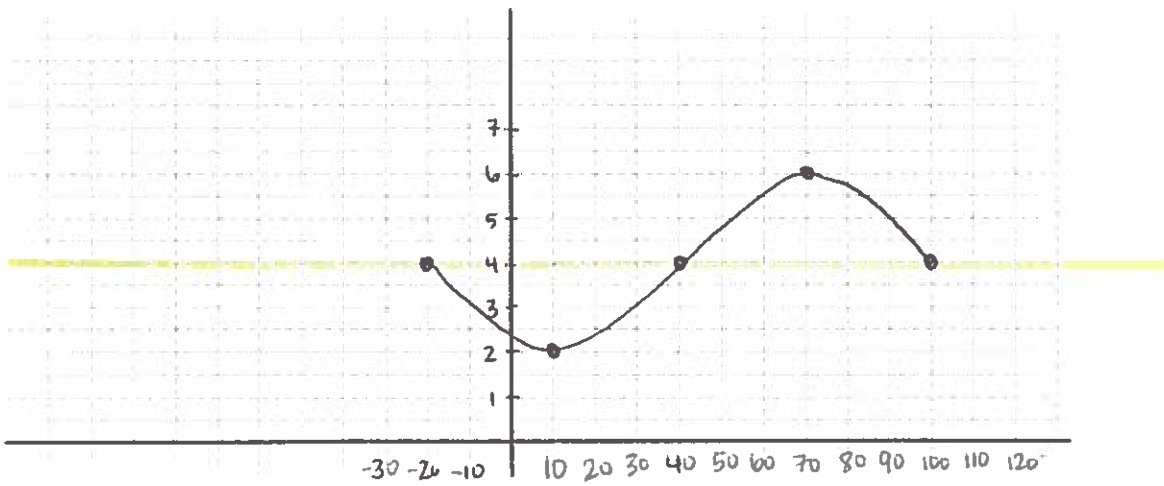
STATION 7

$a = -2$
$k = 3$
$d = -20°$
$c = +4$

over the base domain of: $0° \leq x \leq 360°$

Graph $f(\theta) = -2\sin(3\theta + 60°) + 4$

Factor First: $\boxed{f(x) = -2\sin[3(x + 20°)] + 4}$



Mapping Rule: $(x, y) \rightarrow (\frac{1}{k}x + d, ay + c)$

$(x, y) \rightarrow (\frac{1}{3}x - 20°, -2y + 4)$

Main points:

$(0, 0) \rightarrow (\frac{1}{3}(0) - 20°, -2(0) + 4) \rightarrow (-20°, 4)$

$(90°, 1) \rightarrow (\frac{1}{3}(90°) - 20°, -2(1) + 4) \rightarrow (10°, 2)$

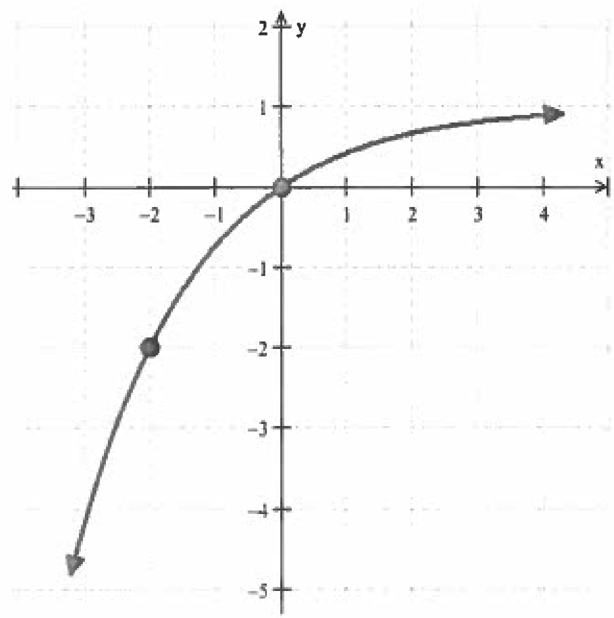
$(180°, 0) \rightarrow (\frac{1}{3}(180°) - 20°, -2(0) + 4) \rightarrow (40°, 4)$

$(270°, -1) \rightarrow (\frac{1}{3}(270°) - 20, -2(-1) + 4) \rightarrow (70°, 6)$

$(360°, 0) \rightarrow (\frac{1}{3}(360°) - 20, -2(0) + 4) \rightarrow (100°, 4)$

STATION 8

The graph shown has been obtained by applying a horizontal dilation, a vertical shift, and one or more reflection(s) to the graph of $f(x) = \left(\frac{1}{3}\right)^{x}$. Determine an equation to represent the graph.



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STATION 8

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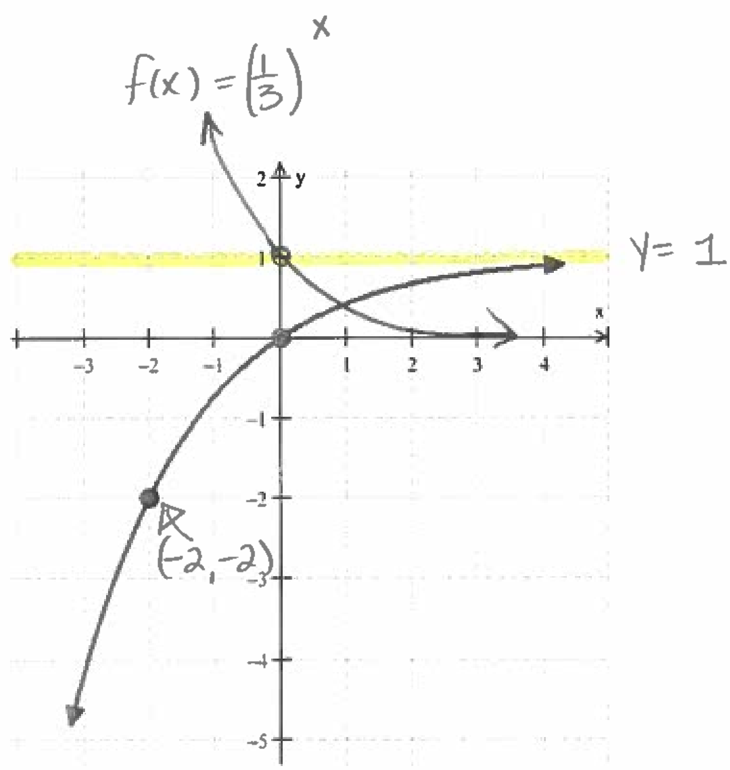

parent: exponential, base $\frac{1}{3}$

$f(x) = \left(\frac{1}{3}\right)^x$

$g(x) = -\left(\frac{1}{3}\right)^{kx} + c$

you can assume d = 0 because the question doesn't say a horizontal shift

asymptote

I figured out by looking at the orientation of the graph compared to the parent.

Pick a point and solve for k:

$-2 = -\left(\frac{1}{3}\right)^{-2k} + 1$

$-2 - 1 = -\left(\frac{1}{3}\right)^{-2k}$

$-3 = -\left(\frac{1}{3}\right)^{-2k}$

$3 = \left(\frac{1}{3}\right)^{-2k}$

$\left(\frac{1}{3}\right)^{-1} = \left(\frac{1}{3}\right)^{-2k}$

$\therefore -1 = -2k$

$\frac{-1}{-2} = k$

$\frac{1}{2} = k$

$$\boxed{g(x) = -\left(\frac{1}{3}\right)^{\frac{1}{2}x} + 1}$$

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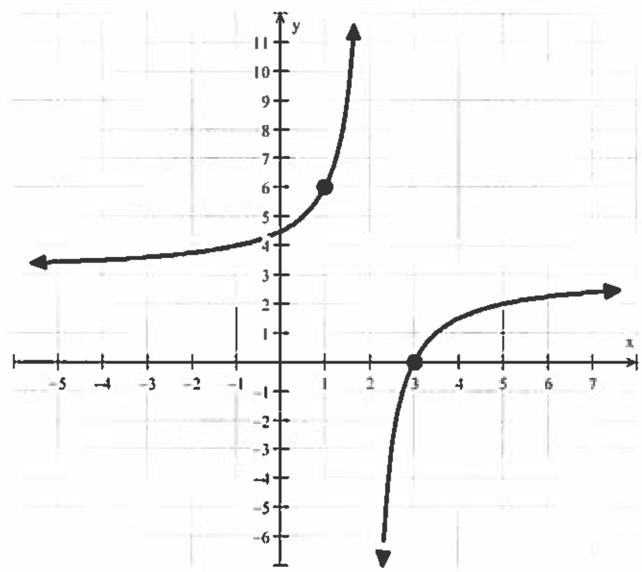
STATION 9

The graph shown has undergone a transformation in the form $g(x) = af(x-d)+c$. Determine the **equation** of the transformed function.



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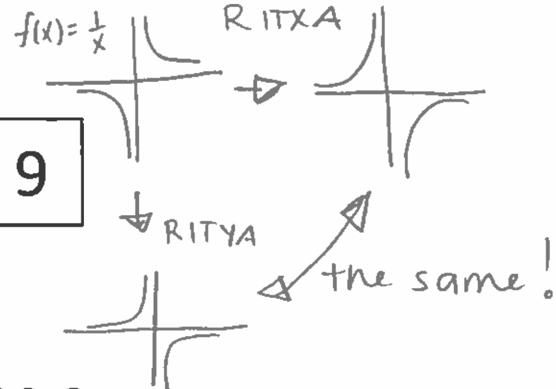
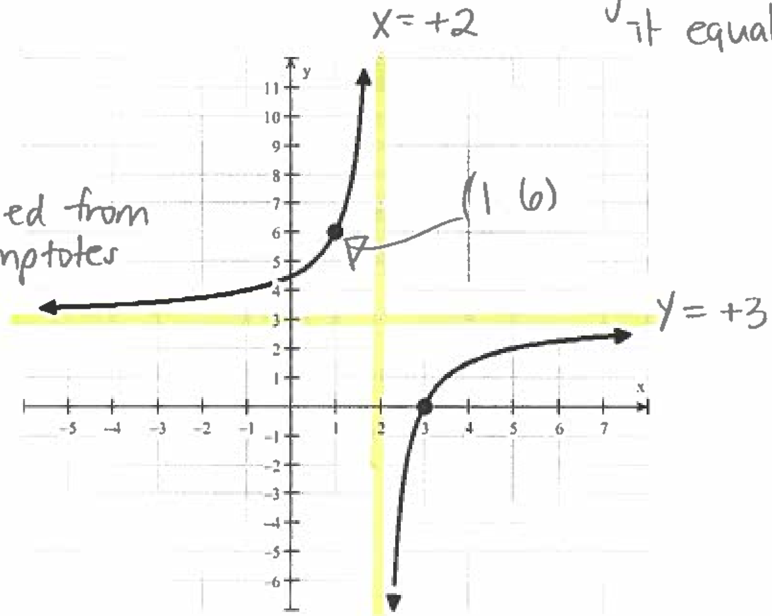
STATION 9



The graph shown has undergone a transformation in the form $g(x) = af(x-d)+c$.

because there is no mention of k, you can assum it equals 1.

Determine the **equation** of the transformed function.



parent : $f(x) = \frac{1}{x}$

shift : up 3 $\quad c = +3$
right 2 $\quad d = +2$
determined from the asymptotes

Reflections : yes

$g(x) = \frac{-a}{(x-d)} + c$

ick a oint to olve for a :

$6 = \frac{-a}{(1-2)} + 3$

$6-3 = \frac{a}{-1}$

$3 = -a$

$\boxed{-3 = a}$

$$\boxed{g(x) = \frac{-3}{(x-2)} + 3}$$