U3D7_T Transformations WITH STRETCHES

Monday, March 18, 2019 6:45 PM

U3D7_T Transfor...

U3D7 MCR 3UI **Transformations Including Stretches and Compressions**

Recall: State the characteristics of $y = -3(x-2)^2 + 4$.

Vertex (2, 4) Domain $\{x \in \mathbb{R}\}$

Direction of opening down

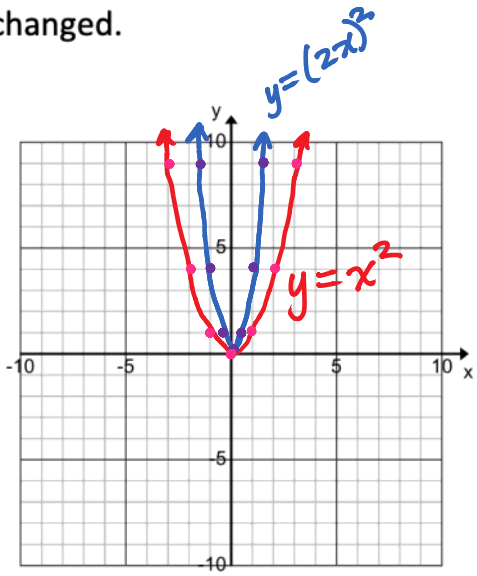
Axis of symmetry $x = 2$ Range $\{y \leq 4\}$

What would the graph of $y = (2x)^2$ look like?

Using algebra, it simplifies to $y = 2^2x^2$ or $y = 4x^2$... this horizontal change was simplified to look like a vertical stretch factor 4.

Let's look at a table of values to see how x changed.

x	$y=x^2$
0	0
1	1
2	4
3	9



x	$y=(2x)^2$	$y=4x^2$
0	0	0
½	1	$4\left(\frac{1}{2}\right)^2 = 1$
1	4	$4(1)^2 = 4$
$\frac{3}{2}$	9	$4\left(\frac{3}{2}\right)^2 = 4\left(\frac{9}{4}\right) = 9$

Notice: to get the same y-values, x is half as much when there is a two in front of the x.

Try $y = \left(\frac{1}{3}x\right)^2$

x	$y=x^2$
0	0
1	1
2	4
3	9

x	$y=\left(\frac{1}{3}x\right)^2$
0	0
3	1
6	4
9	9

Notice: to get the same y-values, x is three times as much when there is a one-third in front of the x.

In General: $y = a\,f[b(x-h)] + k$

a is: a reflection in the x-axis when a < 0
a vertical stretch when |a| > 1,
a vertical compression when 0<|a|<1

b is: a reflection in the y-axis when b < 0
a horizontal stretch factor $\frac{1}{b}$ when 0<|b|<1
a horizontal compression factor $\frac{1}{b}$ when |b|>1
(or a horizontal compression by b when |b|>1)

$\frac{1}{b}$ is the reciprocal of b.

Horizontal is opposite to what it looks like…
When $b = 3$, it is a horizontal compression by 3 or a horizontal compression factor 1/3 (divide by 3 or multiply by a third).
When $b = \frac{1}{3}$, it is a horizontal stretch factor 3.

Applying the transformations you have learned to the **Root Function**.

a:	y = a f(x)	or	y = $a\sqrt{x}$
b:	y = a f(bx)	or	y = $a\sqrt{bx}$
h:	y = a f[b(x-h)]	or	y = $a\sqrt{b(x-h)}$
k:	y = a f[b(x-h)] + k	or	y = $a\sqrt{b(x-h)}+k$

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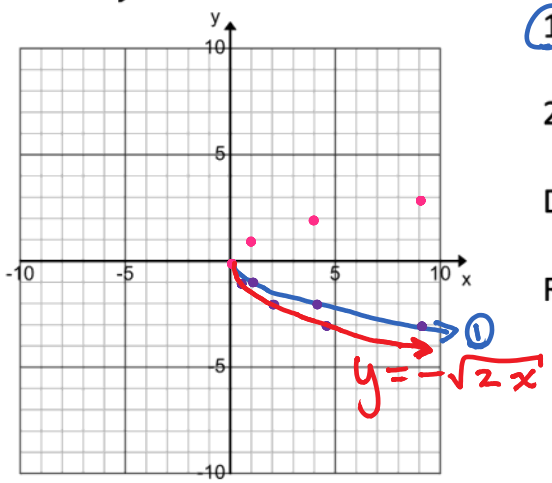
Describe the transformations to the Root function and apply them as necessary to graph the following equations. State the domain and range. ***Remember: When applying transformations, stretches and reflections must always be done before shifts.***

1. $y = -\sqrt{2x}$



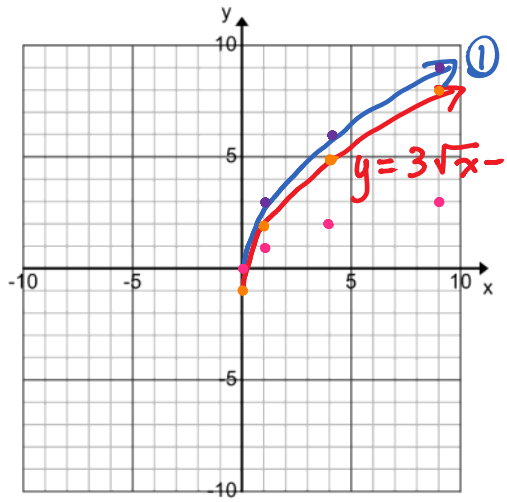
① reflection in x-axis

2. H. Comp. factor $\frac{1}{2}$

D: { $x \geq 0$ }

R: { $y \leq 0$ }

2. $f(x) = 3\sqrt{x} - 1$



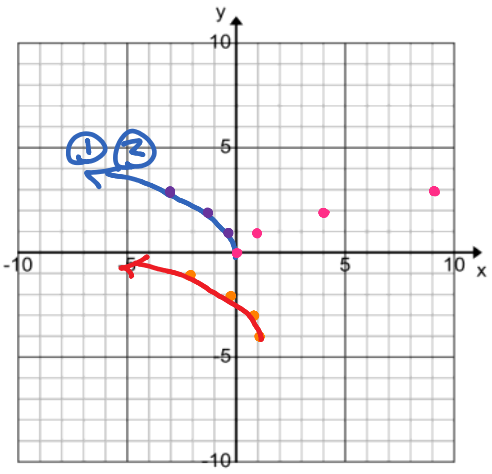
1. V. Stretch factor 3 y times 3 → $3y$

2. Shift down 1 -1

D: { $x \geq 0$ }

R: { $y \geq -1$ }

3. $y = -4 + \sqrt{3 - 3x}$



$y = \sqrt{-3x+3} - 4$

$y = \sqrt{-3(x-1)} - 4$

* must have b factored out.

① reflection in y-axis } $-\frac{1}{3}(x)$

② H. Comp. factor $\frac{1}{3}$ }

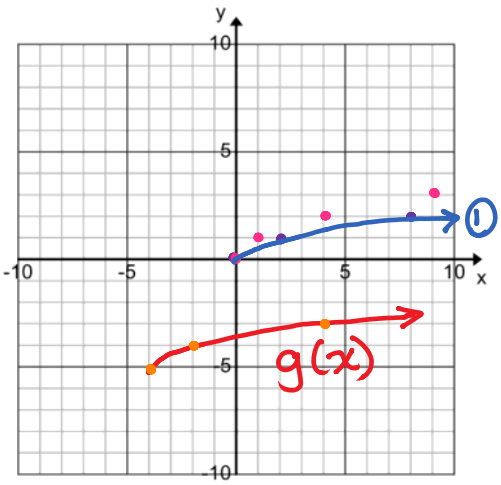
3. shift right 1 }

4. shift down 4 }

D: { $x \leq 1$ }

R: { $y \geq -4$ }

4. $g(x) = \sqrt{\frac{1}{2}(x+4)} - 5$



1. H. stretch factor 2 $(2 \cdot x)$

2. shift left 4

3. shift down 5

D: { $x \geq -4$ }

R: { $y \geq -5$ }

State the domain and range for the following without graphing.

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

$4x$ $y+2$

D: $\{x \geq 0\}$

R: $\{y \geq 2\}$

2. $g(x) = 3 - \sqrt{x-2}$

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

$-y+3$ $x+2$

D: $\{x \geq 2\}$

R: $\{y \leq 3\}$

3. $h(x) = \sqrt{3x-6}$

$h(x) = \sqrt{3(x-2)}$

$\frac{1}{3}x + 2$

D: $\{x \geq 2\}$

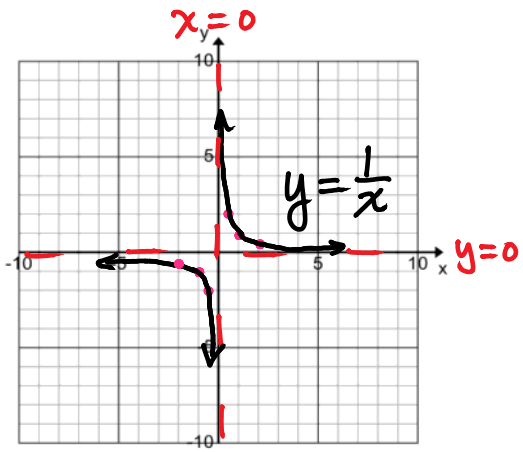
R: $\{y \geq 0\}$

Applying the transformations you have learned to the **Reciprocal Function** $f(x) = \frac{1}{x}$

a:	y = a f(x)	or	$y = a\left(\frac{1}{x}\right) = \frac{a}{x}$
b:	y = a f(bx)	or	$y = \frac{a}{bx}$ note: same as $y = \left(\frac{a}{b}\right)\left(\frac{1}{x}\right)$
h:	y = a f[b(x-h)]	or	$y = \frac{a}{b(x-h)}$
k:	y = a f[b(x-h)] + k	or	$y = \frac{a}{b(x-h)} + k$

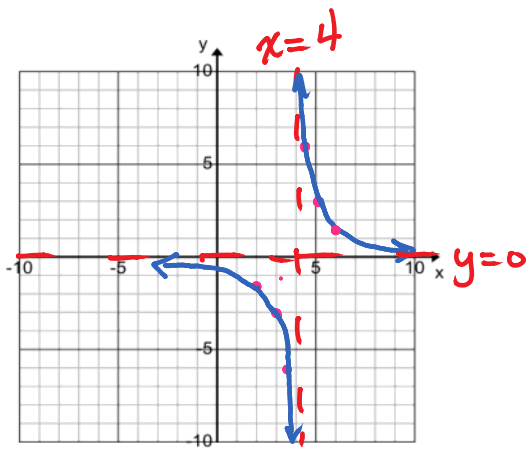
Remember the graph of

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



Describe the transformations to the Reciprocal function and apply them as necessary to graph the following equations. State the domain and range.

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

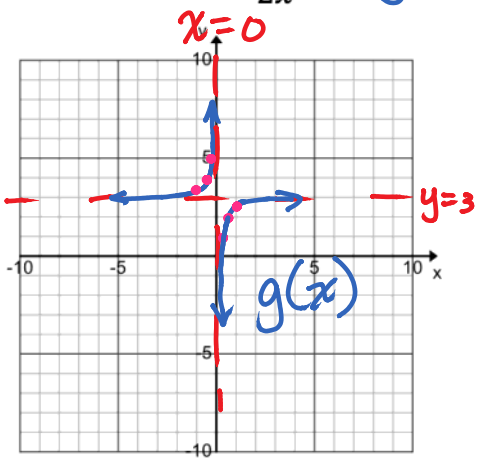


1. Vertical Stretch factor 3
2. shift right 4

D:{ $x \neq 4$ }

R:{ $y \neq 0$ }

2. $g(x) = 3 - \frac{1}{2x}$ $g(x) = \frac{-1}{2x} + 3$



1. reflection in x-axis
2. H. Compression factor $\frac{1}{2}$
3. shift up 3

D:{ $x \neq 0$ }

R:{ $y \neq 3$ }

State the domain and range for the following without graphing.
(Remember: asymptotes only move with shifts (L/R, U/D)

1. $y = \frac{1}{x+3} + 8$

D: $\{x \neq -3\}$

R: $\{y \neq 8\}$

2. $f(x) = \frac{5}{x-9} - 11$

D: $\{x \neq 9\}$

R: $\{y \neq -11\}$

3. $y = \frac{2}{5-3x} - 7$

$5 - 3x \neq 0$

$-3x \neq -5$

$x \neq \frac{5}{3}$

D: $\{x \neq \frac{5}{3}\}$

R: $\{y \neq -7\}$

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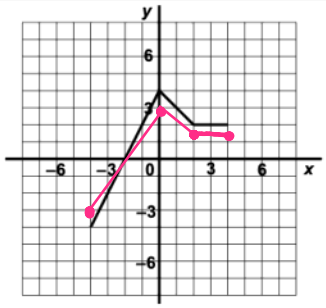
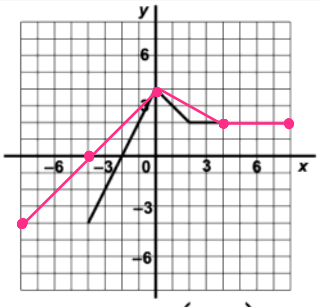
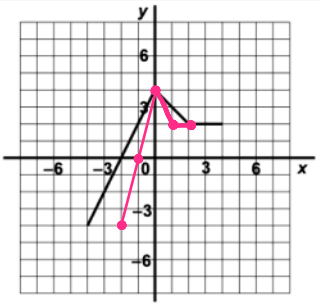
The function given in each graph below is f(x). Sketch the graph of the indicated new function. REMEMBER — Stretch and reflect FIRST, then slide LAST.

 $y = \frac{3}{4} f(x)$ V. Comp. factor $\frac{3}{4}$	 $y = f\left(\frac{1}{2}x\right)$ H. Stretch factor 2	 $y = f(2x)$ H. Comp. factor $\frac{1}{2}$ (OR) H. Comp. by 2

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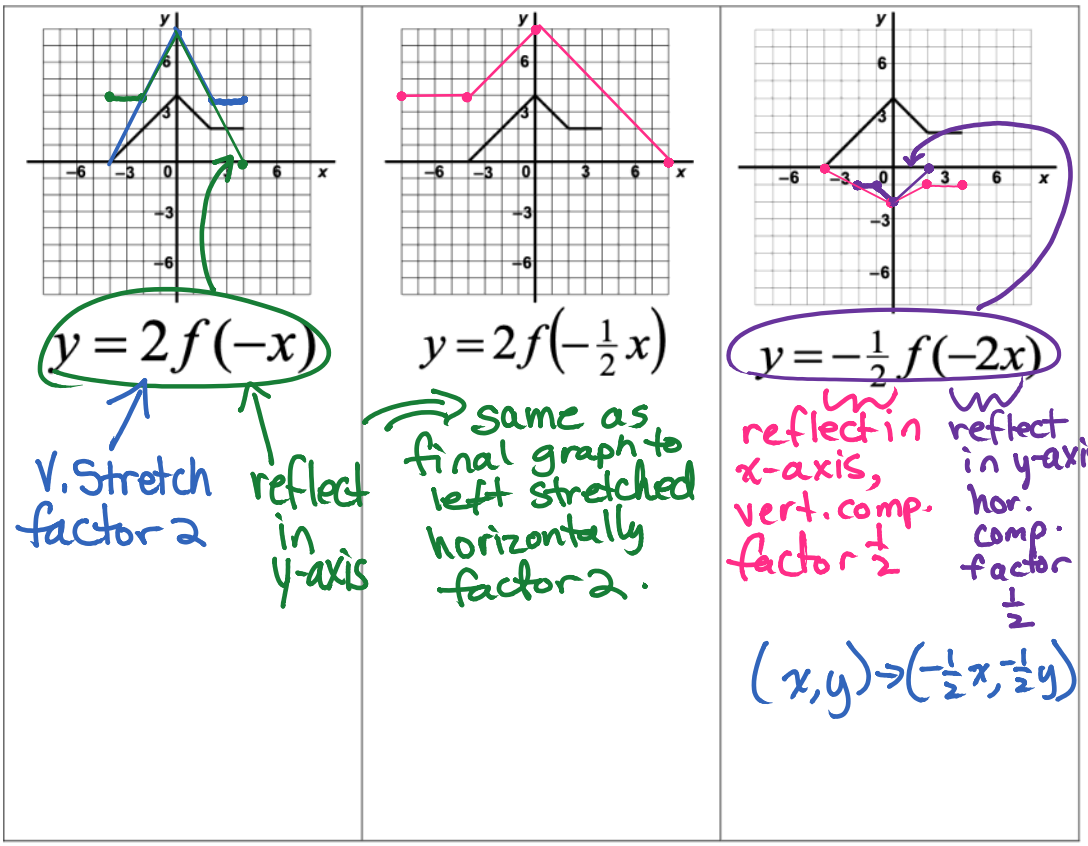

U3D7 Practice: p. 229 #3, 4ii, 5 (odds), 6 (odds), 7, 11 (odds)