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

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

Vertex | Domain
Direction of opening
Axis of symmetry | Range

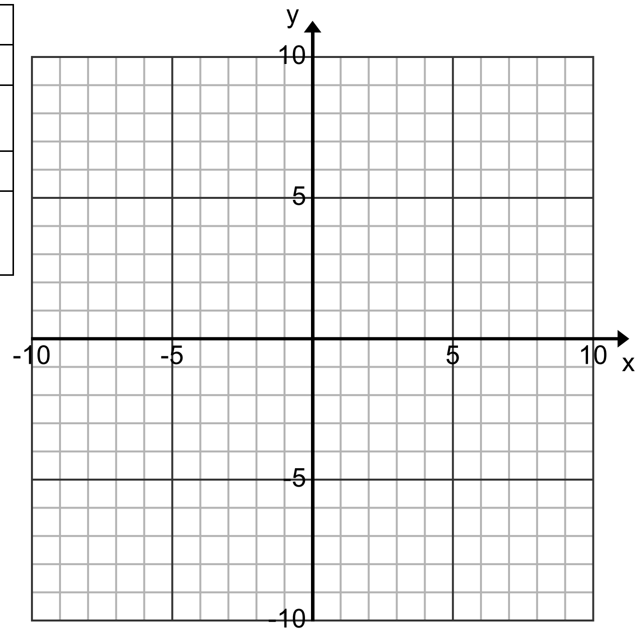
What would the graph of $y = (2x)^2$ look like?

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 __________ 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 __________________ 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

Horizontal is opposite to what it looks like…
When $b = 3$, it is a horizontal compression (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 =

h: $y = a\,f[b(x-h)]$ or y =

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

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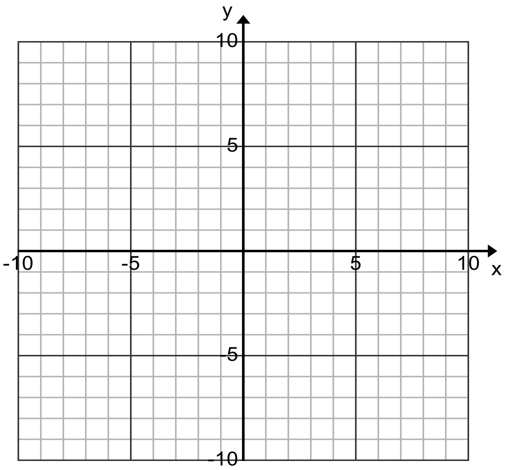
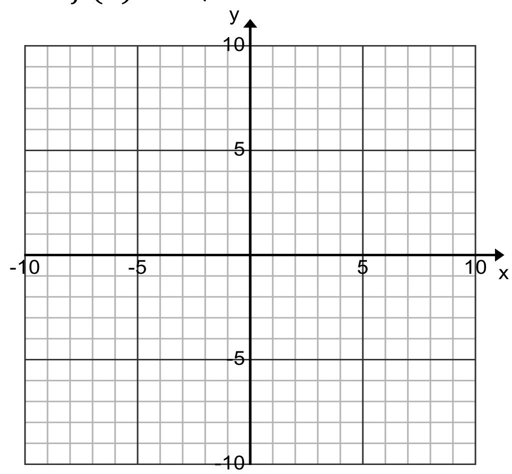
Describe the transformations to the Root function and apply them as necessary to graph the following equations. State the domain and range. ***Remember: When applying transformations, stretches and reflections must always be done before shifts.***

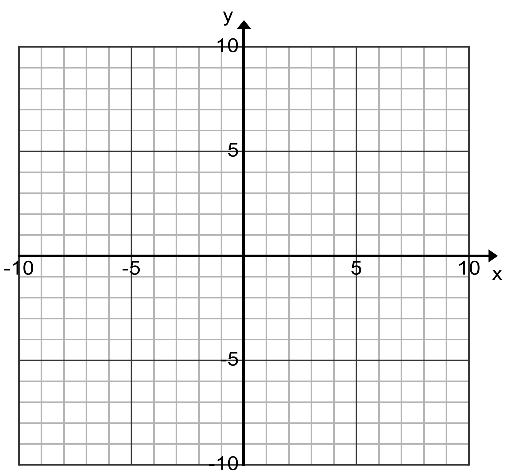
1. $y = -\sqrt{2x}$



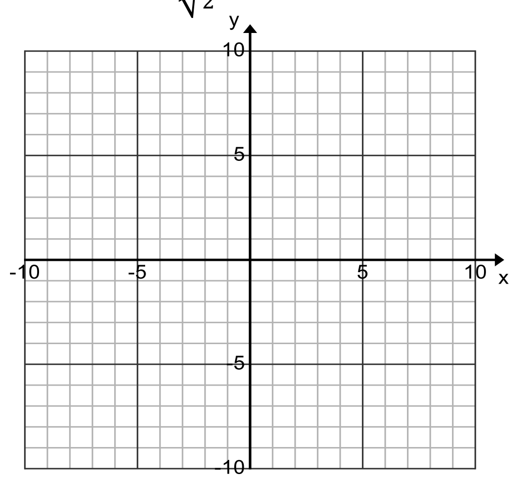
2. $f(x) = 3\sqrt{x} - 1$



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



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



State the domain and range for the following without graphing.

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

   $y = \sqrt{5 - x}$

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

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

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

a:	y = a f(x)	or	y =
b:	y = a f(bx)	or	y =
h:	y = a f[b(x-h)]	or	y =
k:	y = a f[b(x-h)] + k	or	y =

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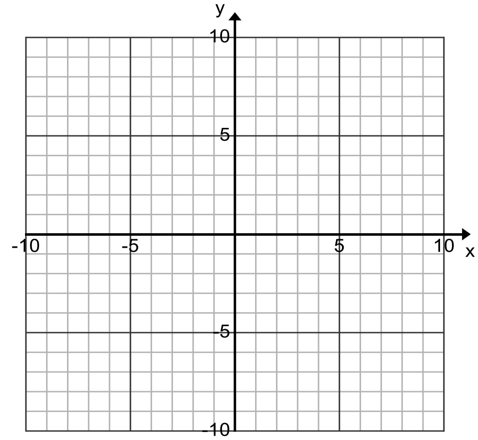
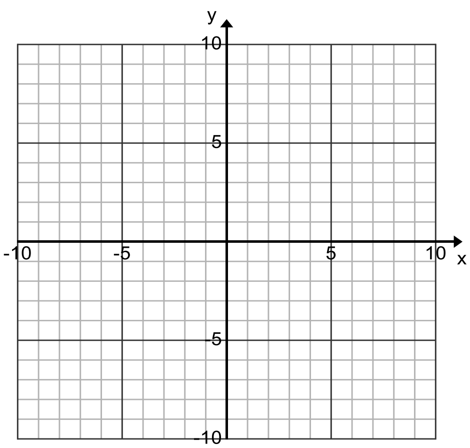
Remember the graph of

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

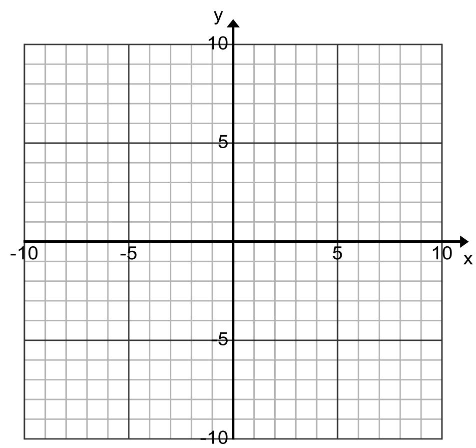


Describe the transformations to the Reciprocal function and apply them as necessary to graph the following equations. State the domain and range.

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



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



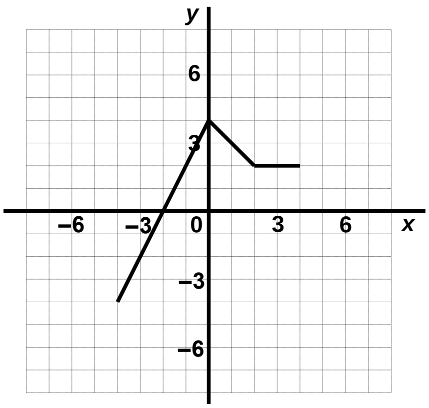
State the domain and range for the following without graphing. (Remember: asymptotes only move with shifts (L/R, U/D)

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

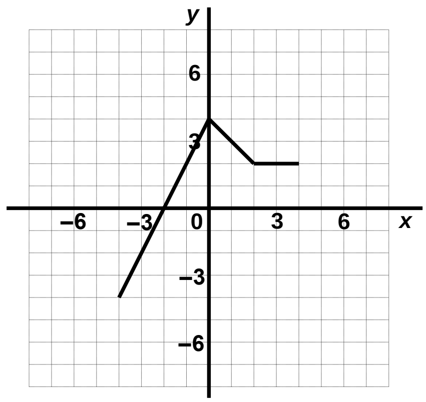
2. $f(x)=\frac{5}{x-9}-11$

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

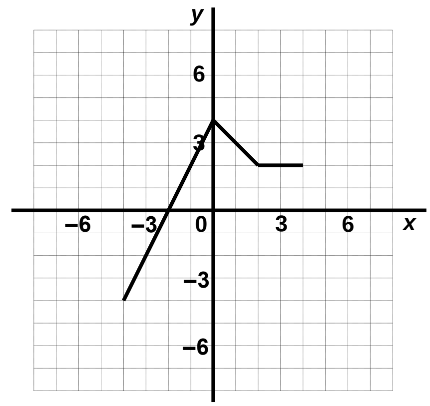
The function given in each graph below is f(x). Sketch the graph of the indicated new function. REMEMBER — Stretch and reflect FIRST, then slide LAST.



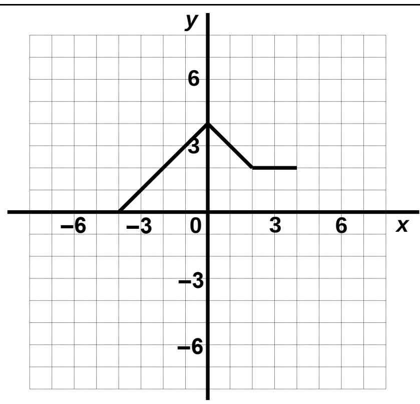
$y = \frac{3}{4} f(x)$



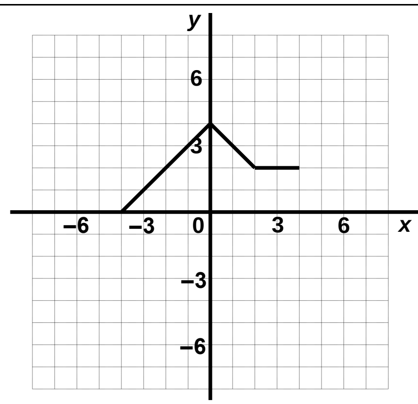
$y = f\left(\frac{1}{2}x\right)$



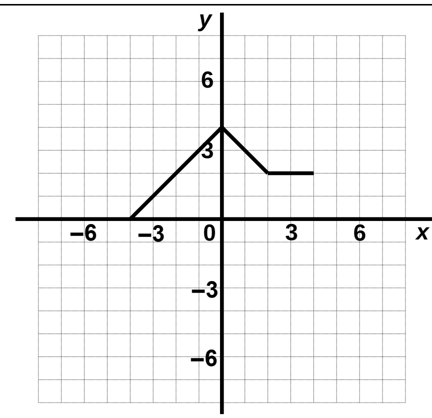
$y = f(2x)$



$y = 2f(-x)$



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



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

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