

Horizontal Reflection & Scaling

Sept 26/2013

Recall:

Quadratic Relation:
(vertex form)

$$y = a(x - h)^2 + k \quad V(h, k)$$

Function Notation:
(using a, h, k)

$$y = af(x - h) + k$$

Equivalent Notation:
(using a, p, q)

$$y = af(x - p) + q$$

Even if the letters (parameters) change, their meaning remains the same.

$$y = a f[k(x-p)] + q$$

↓
 input to
 function

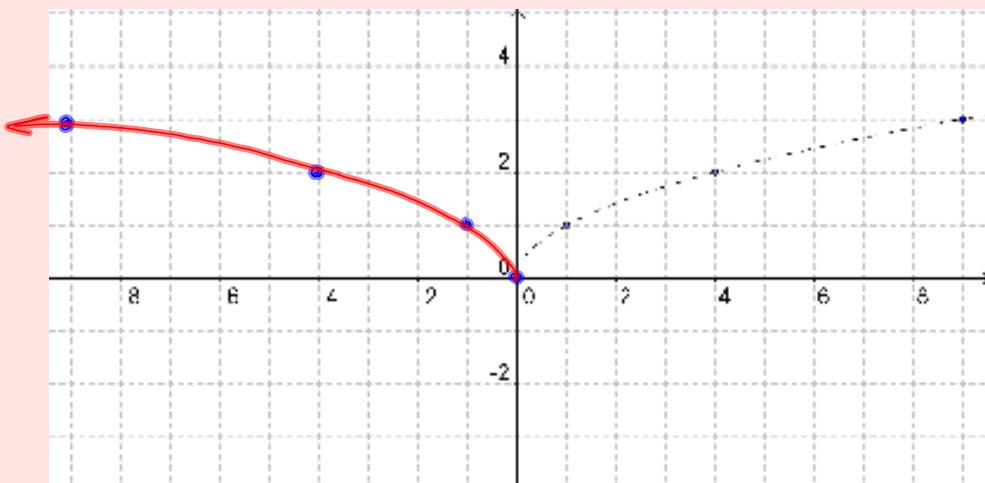
Feb 28-9:26 AM

Ex.1 TOV and Graph $y = f(-x)$ given $f(x) = \sqrt{x}$

x	\sqrt{x}	$\sqrt{-x}$
-9	inad	$\sqrt{-(-9)} = \sqrt{9} = 3$
-4	inad	$\sqrt{-(-4)} = \sqrt{4} = 2$
-1	inad	1
0	0	0
1	1	$\sqrt{-1}$ inad
4	2	inad
9	3	inad

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Ex.1 TOV and Graph $y = f(-x)$ given $f(x) = \sqrt{x}$



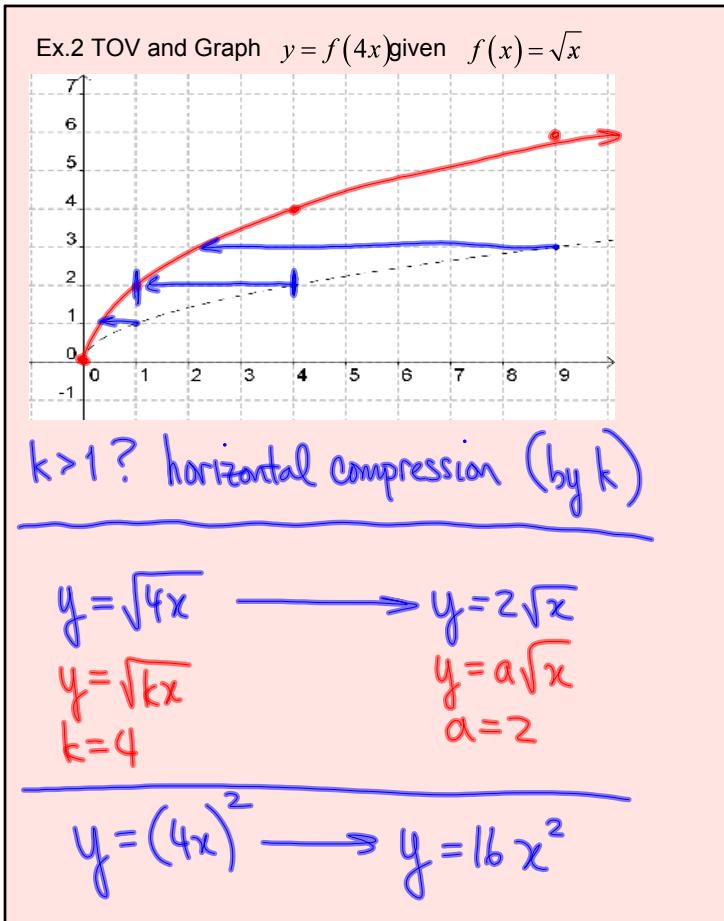
$k < 0$? horizontal reflection

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Ex.2 TOV and Graph $y = f(4x)$ given $f(x) = \sqrt{x}$

x	\sqrt{x}	$\sqrt{4x}$
0	0	$\sqrt{4(0)} = 0$
1	1	$\sqrt{4(1)} = 2$
4	2	$\sqrt{4(4)} = 4$
9	3	$\sqrt{4(9)} = 6$

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Ex.3 TOV and Graph $y = f(\frac{1}{4}x)$ given $f(x) = \sqrt{x}$

x	\sqrt{x}	$\sqrt{\frac{1}{4}x}$
0	0	$\sqrt{\frac{1}{4}(0)} = 0$
1	1	$\frac{1}{2}$
4	2	1
16	4	$\sqrt{\frac{1}{4}(16)} = \sqrt{4} = 2$

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Ex.3 TOV and Graph $y = f\left(\frac{1}{4}x\right)$ given $f(x) = \sqrt{x}$

$|k| < 1$? horizontal stretch (by $\frac{1}{k}$)

$$\frac{1}{\frac{1}{4}} = 1 \times 4 = 4$$

$$y = a(x-p)^2 + q$$

$$y = a f[k(x-p)] + q$$

transformations are opposite to intuition

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Homework:

p.229 # 2cde, 8, 11gof
 p.240 # 1ef, 2cd, 4dfgh, 5cef, 9cd

Note: Functions must be in the form (see 9d)

$$y = af[k(x-p)] + q$$

$$y = (3x-6)^2 + 2 \quad y = f(3x-6) + 2$$

$$y = [3(x-2)]^2 + 2 \quad = f[3(1x-2)] + 2$$

$$y = 9(1x-2)^2 + 2$$

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p. 229 #2e.

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

$$k = \frac{1}{2} \quad |k| < 1$$

$$\begin{aligned} \rightarrow \text{h. stretch by } \frac{1}{k} &= \frac{1}{\frac{1}{2}} \\ (x \times 2) &= 1 \times 2 \\ &= 2 \end{aligned}$$

$$\begin{aligned} (-3, 0) &\xrightarrow{x \times 2} (-6, 0) \\ (0, 3) &\rightarrow (0, 3) \\ (3, 9) &\rightarrow (6, 9) \end{aligned}$$

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p. 229 #11c

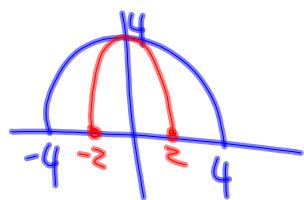
$$f(x) = \sqrt{16 - x^2}$$

$$(c) \quad y = f(2x)$$

$$k = 2 \quad |k| > 1$$

$$\begin{aligned} \text{h. compression by } k &= \frac{1}{2} \\ (\text{smaller!}) & \quad (x \div 2) \end{aligned}$$

$$\text{h. compression by } \frac{1}{2} \quad (x \times \frac{1}{2})$$



$$\begin{aligned} (-4, 0) &\rightarrow (-2, 0) \\ (0, 4) &\rightarrow (0, 4) \\ (4, 0) &\rightarrow (2, 0) \end{aligned}$$

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p. 229 #11d

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

h. stretch by 2

$$(x \times 2)$$

$$\begin{aligned}\frac{1}{k} &= \frac{1}{\frac{1}{2}} \\ &= 1 \times \frac{2}{1}\end{aligned}$$

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p. 240 9d

$$y = 2f(3x-9) + 1$$

* must have form

$$y = af[k(x-p)] + q$$

$$y = 2f\left[3\left(x-\frac{9}{3}\right)\right] + 1 \quad y = \sqrt{x}$$

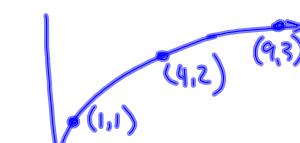
① v. stretch by 2

② h. compression by 3

③ h. shift right 3

④ v. shift up 1

$$(x, y) \xrightarrow{2y} \xrightarrow{x/3} \xrightarrow{x+3} \xrightarrow{y+1}$$



Sep 27-10:42 AM