

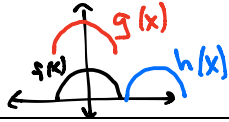
4.1 Transformations

Pre-Calculus

Write your questions here!

PARENT FUNCTION – Simplest form of a function $f(x)$

TRANSLATION – move function left/right and up/down



Vertical shift
 $g(x) = f(x) + 2$

Horizontal shift
 $h(x) = f(x - 2)$

Given parent function $y = x^2$

Describe translation $y = (x - 3)^2 - 5$

vertical shift down 5
horizontal shift right 3

Given parent function $f(x) = \sqrt{x}$

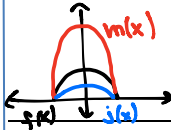
Write function with vertical shift up of 5 and horizontal shift left of 17

$$f(x) = \sqrt{x+17} + 5$$

Inside group symbol does opposite of your instruct

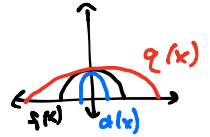
$a \cdot f(x)$
Stretch vertically if $|a| > 1$
Shrink vertically if $0 < |a| < 1$

SCALE – makes graph bigger or smaller



Vertical stretch/shrink
 $m(x) = 2f(x)$ $s(x) = \frac{1}{2}f(x)$

Horizontal stretch/shrink
 $e(x) = f(\frac{1}{2}x)$ $d(x) = f(2x)$



Given parent function $y = x^2$

Describe scale $y = 4(x - 3)^2 - 5$

vertical stretch of 4

Describe scale $y = (2x - 8)^2 - 5$

$$y = [2(x-4)]^2 - 5$$

horizontal shrink of $\frac{1}{2}$

Given parent function $f(x) = x^3$

Write function vertical shift down of 5 and horizontal shrink by a factor of $\frac{1}{3}$

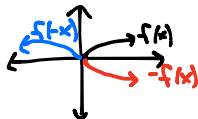
$$f(x) = (3x)^3 - 5$$

Write function horizontal shift right of 2, vertical shift up 3, and vertical stretch by factor of 4

$$f(x) = 4(x - 2)^3 + 3$$

$f(ax)$
Stretch horizontally if $0 < |a| < 1$
Shrink horizontally if $|a| > 1$

REFLECTIONS – Flipping graph



About x-axis $(x, -y)$
 $-f(x)$

About y-axis $(-x, y)$
 $f(-x)$

Given parent function $y = x^2$

Describe reflection $y = -4(x - 3)^2 - 5$

Reflect over x-axis
vertical reflection

Describe reflection $y = 2(4 - x)^2 - 5$

Reflect over y-axis
horizontal reflection
 $y = 2(-x+4)^2 - 5$
 $y = 2[-(x-4)]^2 - 5$

Given parent function $f(x) = |x|$

Write function vertical shift up of 1 and reflected about the x-axis

$$f(x) = -|x| + 1$$

Write function horizontal shift left of 2, vertical shrink by a factor of 5, and reflected about y-axis $\frac{1}{5}$

$$f(x) = \frac{1}{5}|-(x+2)|$$

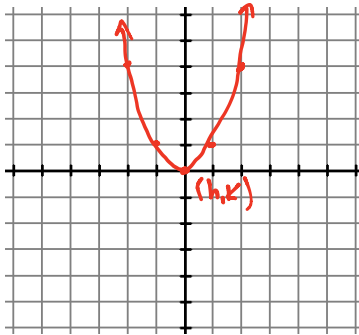
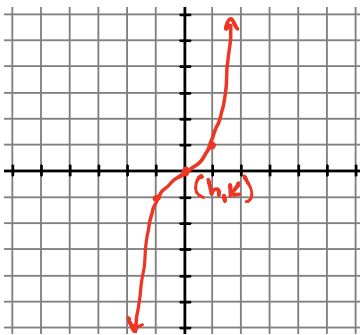
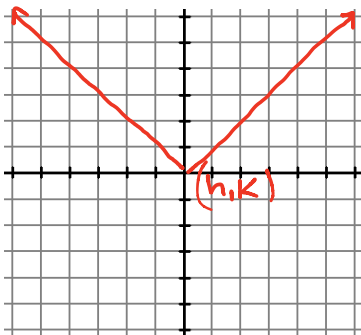
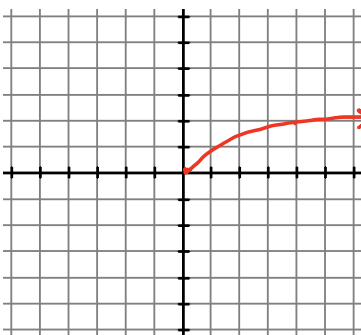
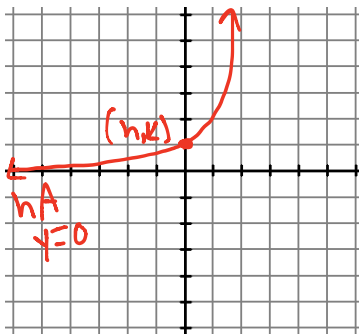
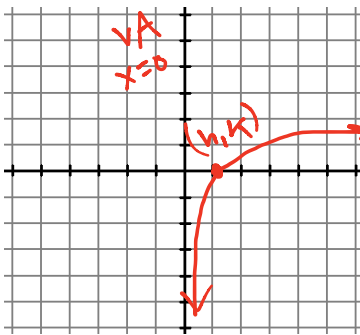
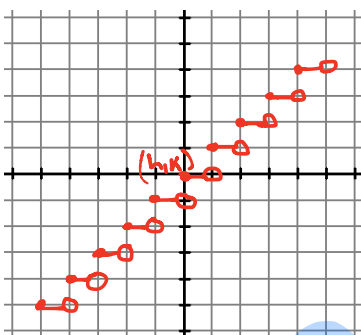
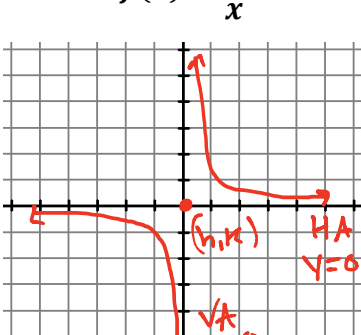
GENERAL EQUATION OF FUNCTIONS

a = vertical scale

b = horizontal scale

h = horizontal shift

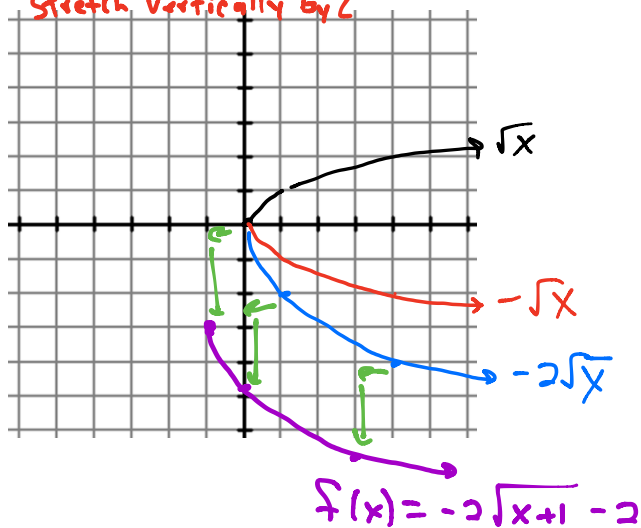
k = Vertical Shift

<p>Quadratic Function $f(x) = x^2$</p>  <p>$y = a(x - h)^2 + k$ $y = a[b(x-h)]^2 + k$</p>	<p>Cubic Function $f(x) = x^3$</p>  <p>$y = a(x - h)^3 + k$ $y = a[b(x-h)]^3 + k$</p>	<p>Absolute Value Function $f(x) = x$</p>  <p>$y = a x - h + k$ $y = a b(x-h) + k$</p>	<p>Square Root Function $f(x) = \sqrt{x}$</p>  <p>$y = a\sqrt{x - h} + k$ $y = a\sqrt{b(x-h)} + k$</p>
<p>Exponential Function $f(x) = 2^x$</p>  <p>$y = a \cdot 2^{(x-h)} + k$ $y = a \cdot 2^{b(x-h)} + k$</p>	<p>Logarithmic Function $f(x) = \log x$</p>  <p>$y = a \log(x - h) + k$ $y = a \log[b(x-h)] + k$</p>	<p>Greatest Integer Function $f(x) = \llbracket x \rrbracket$</p>  <p>$y = a \llbracket x - h \rrbracket + k$ $y = a \llbracket b(x-h) \rrbracket + k$</p>	<p>Rational Function $f(x) = \frac{1}{x}$</p>  <p>$y = \frac{a}{x - h} + k$ $y = \frac{a}{b(x-h)} + k$</p>

Graph the following, use a table of values to help out if necessary.

$f(x) = -2\sqrt{x+1} - 3$
 Translate left +1
 Translate down 3
 Stretch vertically by 2
 Reflect
 vertical Reflect

Rules:
Reflect
Stretch
Translate



SUMMARY:

Now, summarize your notes here!

Check

x	f(x)
-1	-3
0	-5
3	-7