Combination of Transformations applied to Relations

Mar 02/2011

Yesterday we reviewed the transformations that you studied in grade 10.

Recall (in function notation):

Reflection along the *x*-axis: $y = af(x),\ a < 0$

Vertical Scaling: $y = af(x),\ a > 0,\ a \neq 1$

vertical stretch: a > 1 (function becomes taller)

or vertical compression: 0 < a < 1 (function becomes shorter)

Vertical Translation: $y = f(x) + q$

vertical shift up: q > 0 (relation moves up)
or vertical shift down: q < 0 (relation moves down)

Horizontal Translation: $y = f(x - p)$

horizontal shift right: p > 0, like in $y = (x-3)^2$
or horizontal shift left: p < 0, like in $y = (x+2)^2$

order does not matter

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Ex: State the transformations, in the appropriate order, that $y = f(x)$ has undergone to obtain $y = f(x-1)+3$

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

① ② ③

transform left to right

① $a=1$, no reflect, no scaling

② $p=1$, shift right 1

③ $q=3$, shift up 3

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Using the example above, what if the parent function is a quadratic? Then $f(x) = x^2$!

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

Sketch the transformed parabola on the grid below.

(Use a table of values if you want to!)

transform key points:

$(x,y) \to (x+1,y)$

$\downarrow$

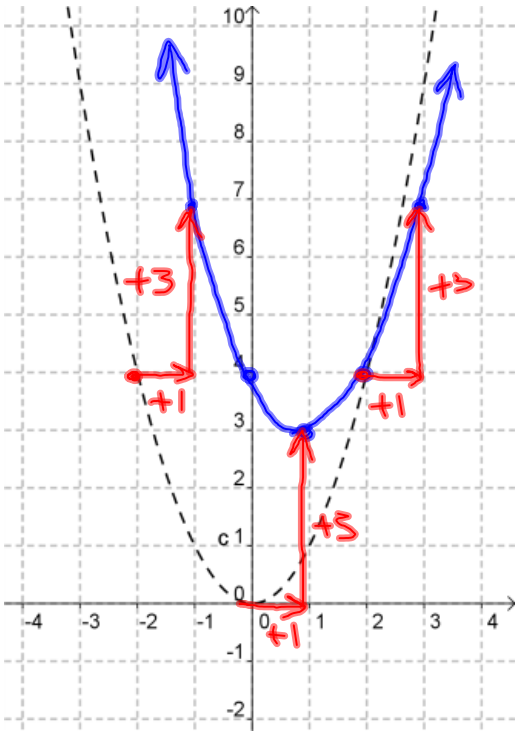
$(x+1, y+3)$

$x+1$ $\quad$ $y+3$

$(0,0) \to (1,0) \to (1,3)$

$(1,1) \to (2,1) \to (2,4)$

$(-1,1) \to (0,1) \to (0,4)$



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What if the parent function is a set of ordered pairs?

If $f(x) = \{(1, 2), (2, -3), (-5, 7)\}$?

What would $y = f(x-1)+3$ be?

(Use a table of values and/or graph if you want to!)

$(1,2) \to (2,2) \to (2,5)$

$(2,-3) \to (3,-3) \to (3,0)$

$(-5,7) \to (-4,10)$

∴ the transformed points are . . .

OR

$f(x-1)+3 = \{(2,5), (3,0), (-4,10)\}$

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What if the parent function is the square root function?

Then $f(x)=\sqrt{x}$!

What would $y=f(x-1)+3$ be?

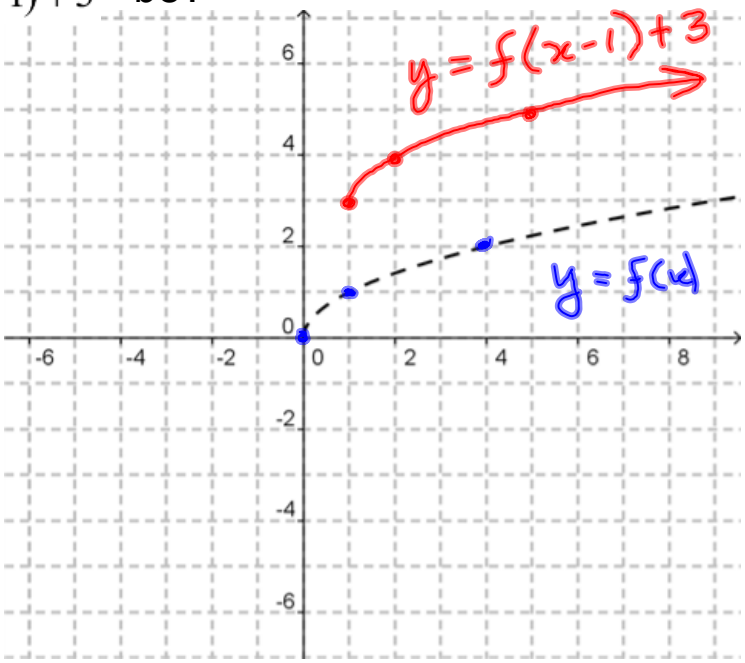
(Use a table of values and/or graph it you want to!)

$(0,0)\to(1,0)\to(1,3)$

$(1,1)\to(2,1)\to(2,4)$

$(4,2)\to(5,2)\to(5,5)$

$y=\sqrt{x-1}+3$



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What if the parent function is the reciprocal function?

Then $f(x)=\frac{1}{x}$!

What would $y=f(x-1)+3$ be?

(Use a table of values and/or graph it you want to!)

$(1,1)\to(2,1)\to(2,4)$

$(-1,-1)\to(0,-1)\to(0,2)$

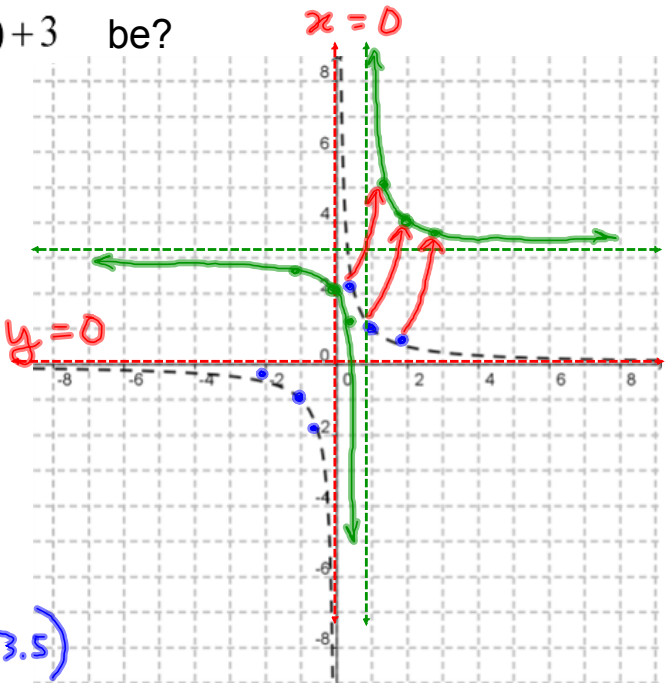
asymptotes:

$x=0\to x=1$

$y=0\to y=3$

extra points:

$(2,0.5)\to(3,1.5)\to(3,3.5)$



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Ex: Given $y = 2f(x) + 3$ describe the transformations and apply them to the square root function.

(Use a table of values and/or graph if you want to!)

① $a = 2$, vertical stretch by 2

$(x, y) \to (x, 2y)$

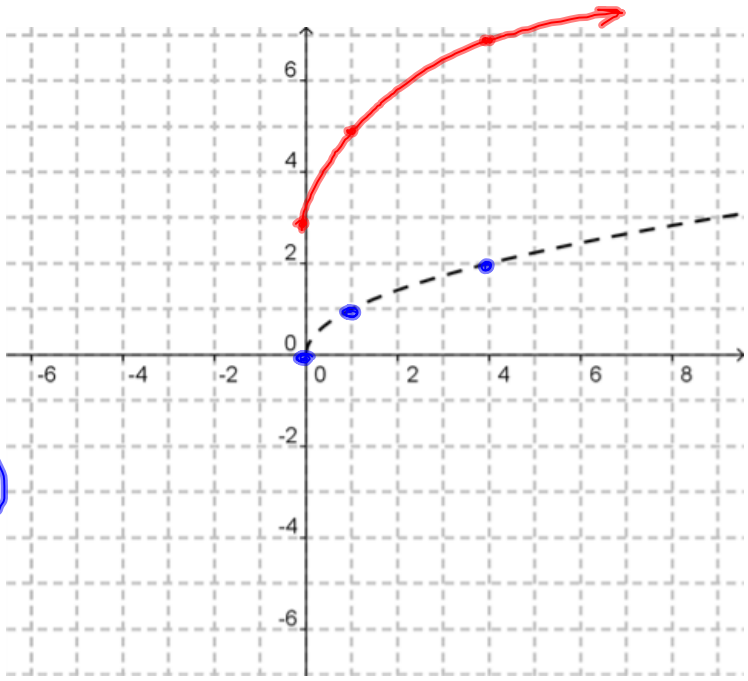
② $q = 3$, shift up by 3

$(x, 2y) \to (x, 2y + 3)$

$(0,0) \to (0,0) \to (0,3)$

$(1,1) \to (1,2) \to (1,5)$

$(4,2) \to (4,4) \to (4,7)$



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Ex: Given $y = 0.4f(x + 1)$, describe the transformations and apply them to the reciprocal function.

(Use a table of values and/or graph if you want to!)

① $a = 0.4$

Vertical scaling by 0.4

Vert. compression by 2.5

$\frac{1}{0.4} = 2.5$

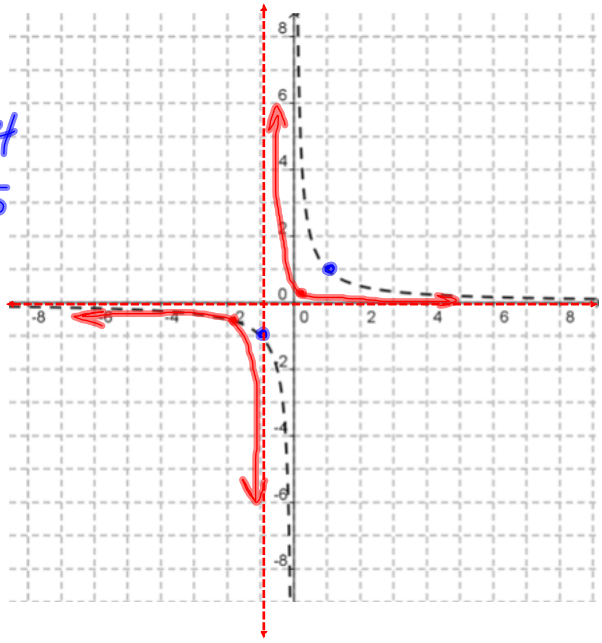
② $p = -1$, shift left by 1

VA: $x = 0 \to x = -1$

HA: $y = 0 \to y = 0$

$(1,1) \to (1, 0.4) \to (0, 0.4)$

$(-1,-1) \to (-1,-0.4) \to (-2,-0.4)$



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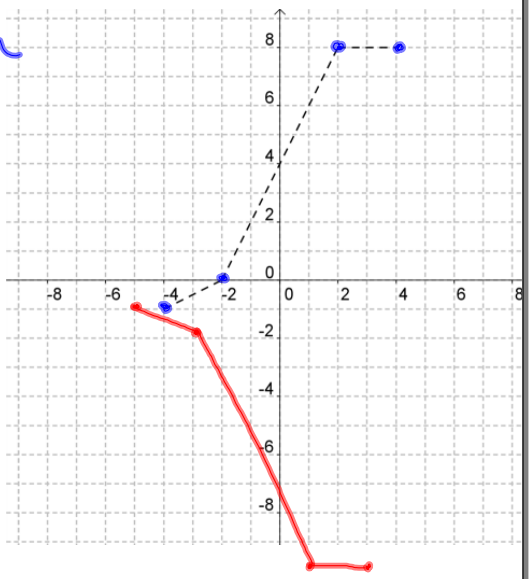
Ex: The graph on the right shows the function .
Given $y = -f(x+1) - 2$. describe the transformations and apply them to the function $y = f(x)$
(Use a table of values with the key points, if you

① vertical reflection
② p = -1
shift left 1
③ q = -2, down 2

$(x, y) \to (x, -y)$
$\to (x-1, -y)$
$\to (x-1, -y-2)$

$(-4, -1) \to (-5, -1)$
$(-2, 0) \to (-3, -2)$
$(2, 8) \to (1, -10)$
$(4, 8) \to (3, -10)$



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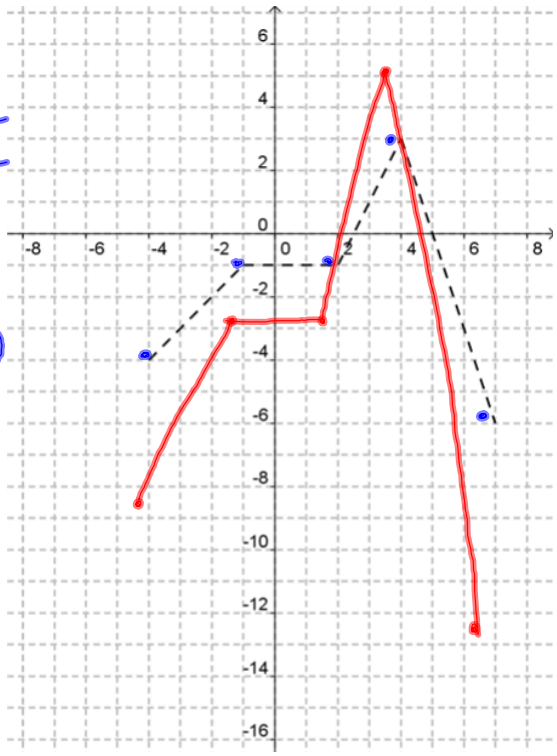
Ex: The graph on the right shows the function $y = f(x)$
Given $y = 2f(x) - 1$, describe the transformations and apply them to the function.
(Use a table of values with the key points, if you want to!)

① a = 2
Vertical scaling by 2
Vertical stretch by 2
$(x, y) \to (x, 2y)$
② q = -1, shift down 1
$(x, 2y) \to (x, 2y-1)$

$(-4, -4) \to (-4, -9)$
$(-1, -1) \to (-1, -3)$
$(2, -1) \to (2, -3)$
$(4, 3) \to (4, 5)$
$(7, -6) \to (7, -13)$



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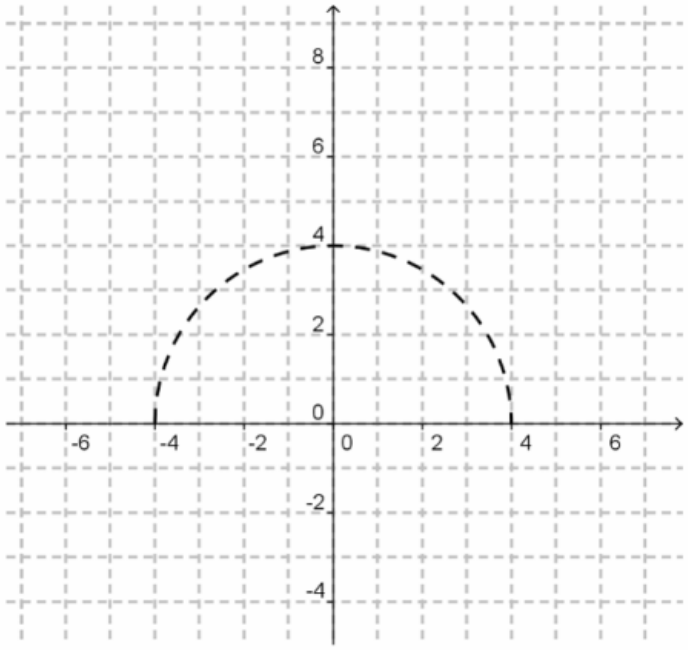
Ex: The graph on the right shows the function $f(x)=\sqrt{16-x^2}$. Given $y=-0.5f(x+2)$, describe the transformations and apply them to the function.

(Use a table of values with the key points, if you want to!)



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HW: Pg. 241 #8b, 9b, 5abd, 4abce

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