

Name: _____ Date: _____ Period: _____

2.5 Transformations a, h, k **NOTES**

All of the different transformations of a function make of the rest of the family of functions. Take any parent function, $f(x)$, the transformations create new functions which have similar structure as the parent but may be flipped, moved, or dilated.

General Function Notation: $f(x) \rightarrow af(x - h) + k$

a	h	k
Vertical reflection: (over the x-axis) a is negative	Shift left: $x+h$	Shift up: $+k$
Vertical stretch: $a > 1$	Shift right: $x-h$	Shift down: $-k$
Vertical shrink: $0 < a < 1$		

Note: $f(-x)$ is a horizontal reflection over the y-axis:

We can talk about transformations using function notation. Describe the transformations of the function, $f(x)$.

Example 1: h k $g(x) = f(x - 1) - 3$ shifts right 1 down 3	Example 2: a k $h(x) = -3f(x) + 2$ reflection over the x-axis vertical stretch by 3 shifts up 2	Example 3: a h $p(x) = \frac{2}{3}f(x + 6)$ vertical shrink by $\frac{2}{3}$ shift left 6
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We can talk about transformations when giving the equation of a function. State what the parent function for the equation and then describe the transformations of the parent function.

Example 4:

$$y = 3\sqrt{x - 7} + 1$$

Parent function: $y = \sqrt{x}$
square root
 Transformation(s):

shift right 7
up 1
v. stretch by 3

Example 5:

$$y = -\frac{1}{2}(x + 3)^3$$

Parent function: $y = x^3$
cubic
 Transformation(s):

reflection over the x-axis
v. shrink by $\frac{1}{2}$
shift left 3

Example 6: **a** **h** **k**

$$y = 3(2)^{x+1} - 5$$

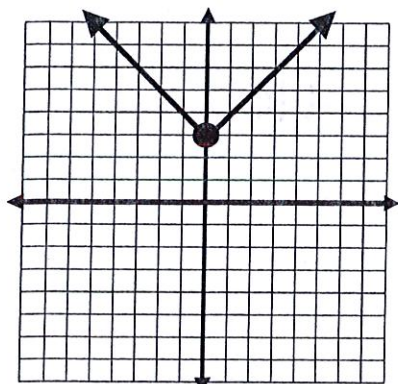
Parent Function: $y = 2^x$
exponential
 Transformation(s):

shift down 5
shift left 1
v. stretch of 3

We can talk about transformations when giving a graph of the function if we compare it to its parent function. Describe the transformations from $f(x)$ to $g(x)$. Remember $f(x)$ is the parent function. Attempt to write the equation based on the transformations.

- Graphs are approximately drawn to scale.
- There are no vertical shrinks or stretches from the parent function.
- Focus on the important point/features of each function based on its parent function.

Example 7:



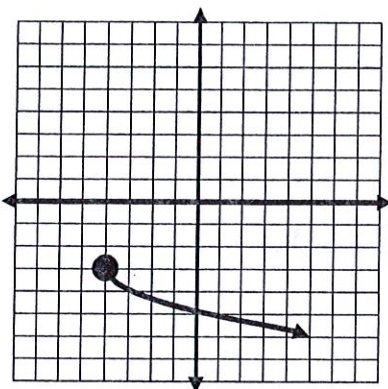
$$y = |x|$$

Transformation(s):

shift up 3 $k: +3$

Equation: $y = |x| + 3$

Example 8:



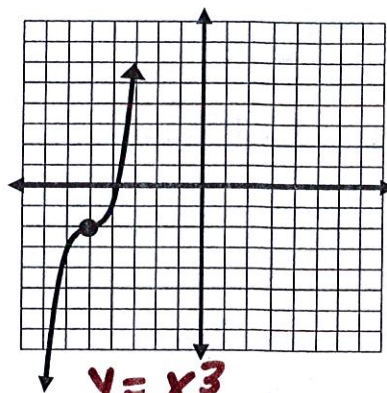
$$y = \sqrt{x}$$

Transformation(s):

shift left 4 $h: +4$
 down 3 $k: -3$
 reflection over $a: -$
 x-axis

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

Example 9:



$$y = x^3$$

Transformation(s):

shift left 5 $h: +5$
 down 2 $k: -2$

Equation: $y = (x+5)^3 - 2$