ALGEBRA RH

Essential Question: What are transformations and how can we apply them to functions? ***Day 1***

Do Now:

The function, $f(x)$, is shown below. Determine the value of $g(4)$, given that $g(x) = 5f(x) + 1$

x	$f(x)$
2	−8
3	−1
4	3
5	7

$x = 4$

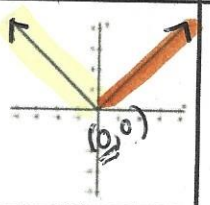
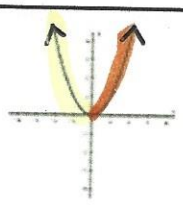
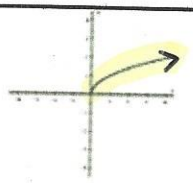
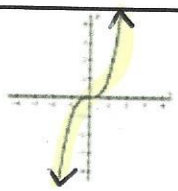
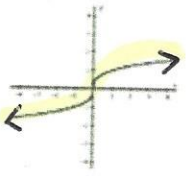
$g(4) = 5f(4) + 1$

$= 5(3) + 1$

$= 16$

$(4, 16)$

Transformation: A mathematical process that applies a change to a ***parent function*** to produce another function with similar characteristics. Here are the parent functions we will be working with.

FUNCTION	$f(x) = \lvert x \rvert$	$f(x) = x^2$	$f(x) = \sqrt{x}$	$f(x) = x^3$	$f(x) = \sqrt[3]{x}$
FUNCTION NAME	absolute value	quadratic	square root	cubic	cube root
GRAPH					
DOMAIN	$(-\infty, \infty)$	$(-\infty, \infty)$	$[0, \infty)$	$(-\infty, \infty)$	$(-\infty, \infty)$
RANGE	$[0, \infty)$	$[0, \infty)$	$[0, \infty)$	$(-\infty, \infty)$	$(-\infty, \infty)$
INCREASING (interval / x value)	$(0, \infty)$	$(0, \infty)$	$(0, \infty)$	$(-\infty, \infty)$	$(-\infty, \infty)$
DECREASING	$(-\infty, 0)$	$(-\infty, 0)$	—	—	—
x-INTERCEPTS	0	0	0	0	0
y-INTERCEPTS	0	0	0	0	0
MAX/MIN	minimum	minimum	minimum	none	none
END BEHAVIOR (y values)	approaches $+\infty$	approaches $+\infty$	approaches $+\infty$	approaches $+\infty$ and $-\infty$	approaches $+\infty$ and $-\infty$

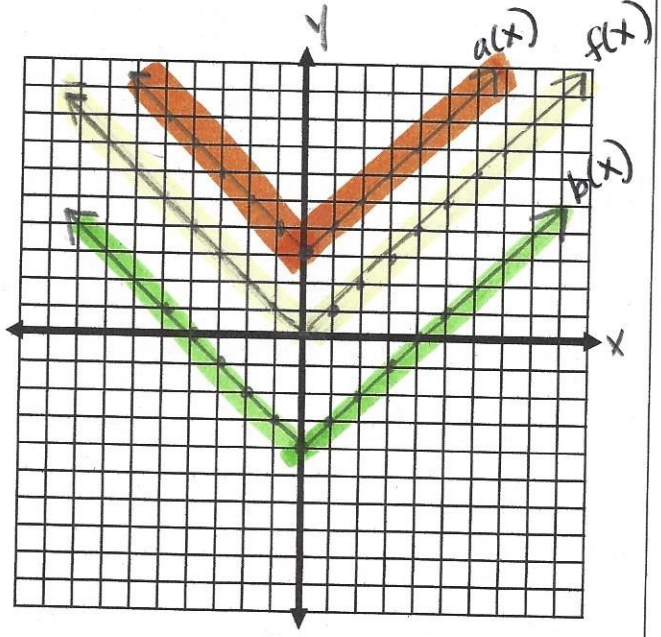
Today we are going to learn how to **TRANSLATE** functions. A translation is a horizontal or vertical shift. This happens when we add/subtract values to our given parent function.

1. In the same coordinate plane, graph the parent function $f(x)$ and the new functions $y = f(x) + k$ for $k = 3$ and $k = -4$.

(a) $f(x) = |x|$

$a(x) = |x| + 3$

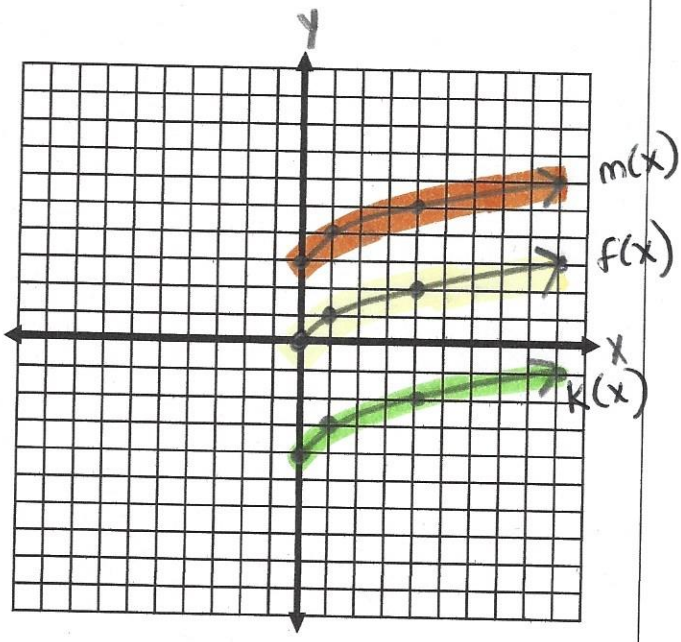
$b(x) = |x| - 4$



(b) $f(x) = \sqrt{x}$

$m(x) = \sqrt{x} + 3$

$k(x) = \sqrt{x} - 4$



Use the results from above to describe the relationship between the graph of $f(x)$ and the two new functions. Discuss some of the key concepts such as domain, range, intercepts, etc...

Domain of translated graphs are the same as the parent function. The range (and y intercept) of the translated graphs are different from the parent function. Adding 3 moved all the points up 3 units subtracting 4 moved all the points down 4 units

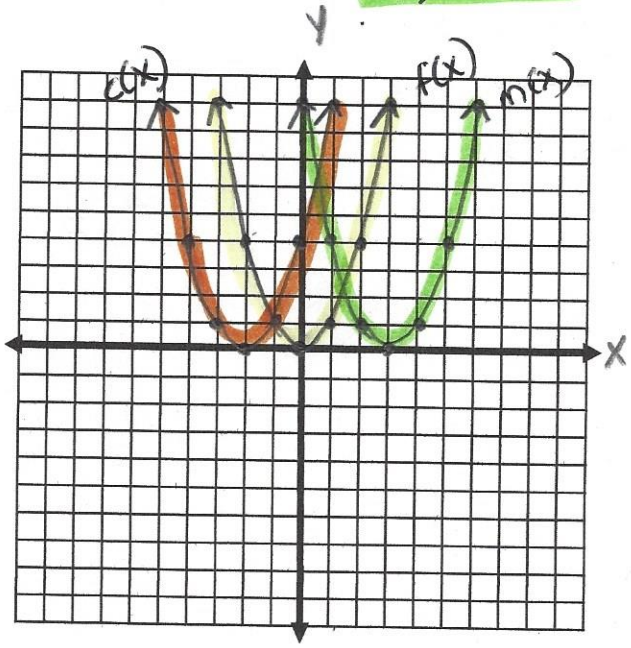
Function Notation	Type of transformation
$f(x) - k$	vertical shift k units down
$f(x) + k$	vertical shift k units up

2. In the same coordinate plane, graph the parent function $f(x)$ and the new functions $y = f(x + h)$ for $h = 2$ and $h = -3$.

(c) $f(x) = x^2$

$c(x) = (x+2)^2$

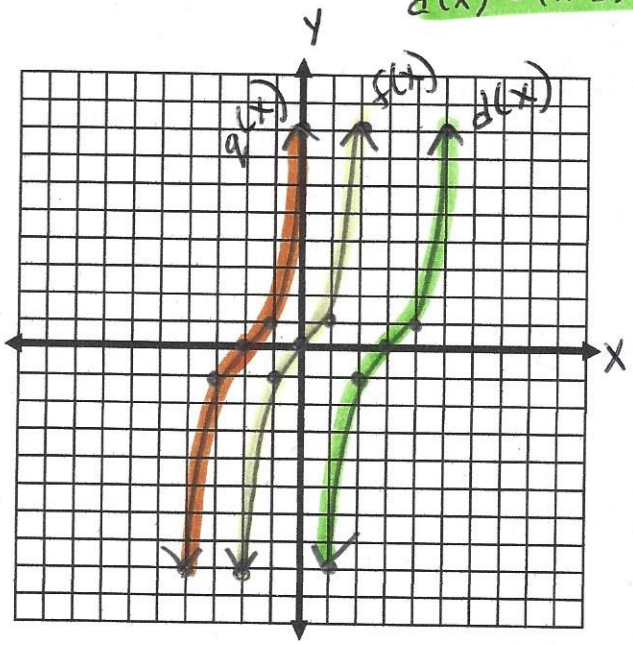
$m(x) = (x-3)^2$



(d) $f(x) = x^3$

$q(x) = (x+2)^3$

$d(x) = (x-3)^3$



Use the results from above to describe the relationship between the graph of $f(x)$ and the two new functions.

Domain and range remain the same
however adding 2 inside the symbol shifted the parent function 2 units to the left
subtracting 3 inside the symbol shifted the parent function 3 units to the right

Function Notation	Type of transformation
$f(x + h)$	horizontal shift h units to the left
$f(x - h)$	horizontal shift h units to the right