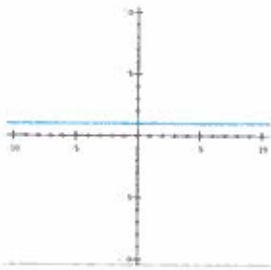
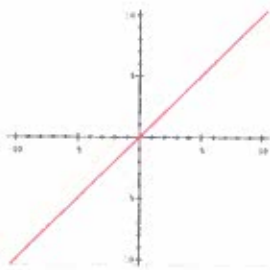
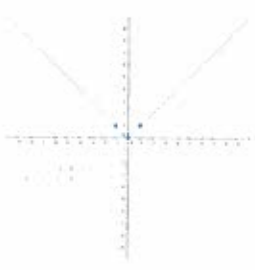
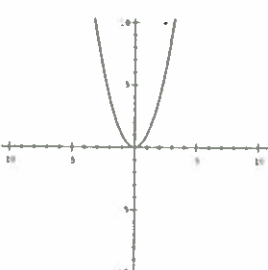


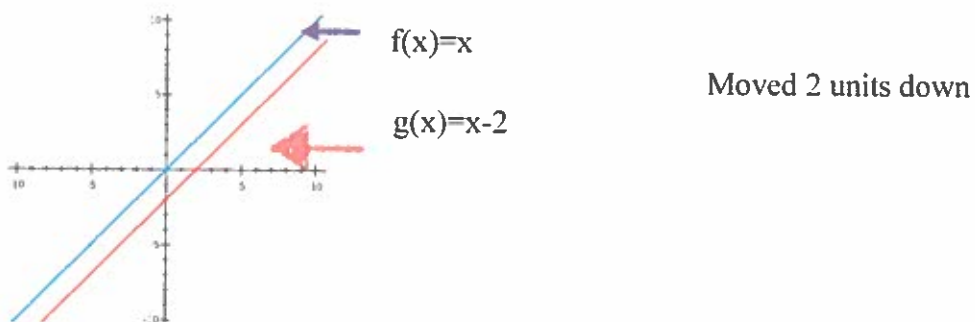
Parent Function and Transformations

Parent Functions - The most basic function of a family

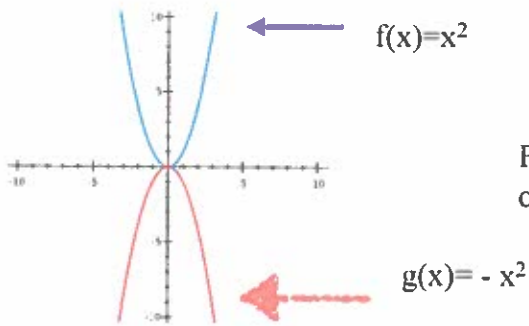
Family:	Constant	Linear	Absolute Value	Quadratic
Rule:	$f(x)=1$	$f(x)=x$	$f(x)= x $	$f(x)=x^2$
Graph:				
Domain:	All real numbers	All real numbers	All real numbers	All real numbers
Range:	$y=1$	All real numbers	$y \geq 0$	$y \geq 0$

Transformations - changes the size, shape, position, or orientation of a graph

Translation - a transformation that shifts a graph horizontally or/and vertically
doesn't change its size, shape or orientation



Reflection - a transformation that flips a graph over the line of reflection does not change the size or shape of the graph



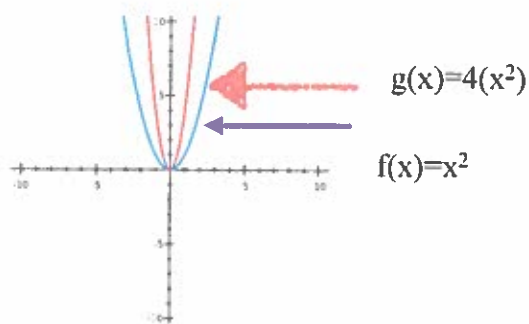
Flip the graph over the x-axis

x	$y=x^2$	$y=-x^2$
-2	2	-2
-1	1	-1
0	0	0
1	1	-1
2	2	-2

^The chart to figure out the point of the reflected graph

Vertical stretch and shrink - multiply all the y-values by the same factor (not 1)

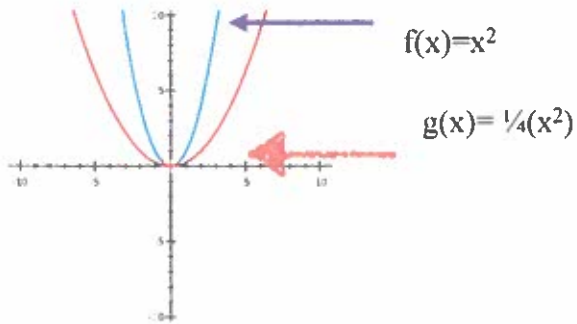
Vertical stretch - when the factor is greater than 1



multiply the y-values by 4

x	$y=x^2$	$y=4(x)^2$
-2	2	16
-1	1	4
0	0	0
1	1	4
2	2	16

Vertical shrink - when the factor is less than 1 and greater than 0

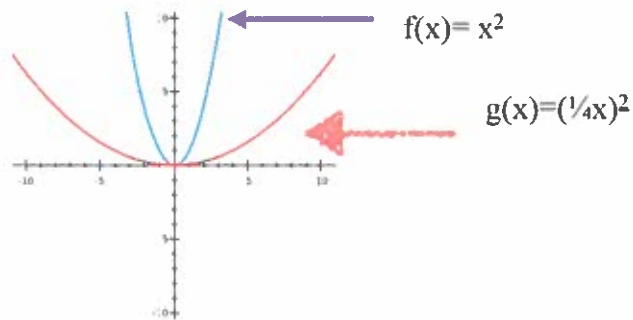


Multiply the y-values by $\frac{1}{4}$

x	$y = x^2$	$y = \frac{1}{4}(x^2)$
-2	2	1
-1	1	$\frac{1}{4}$
0	0	0
1	1	$\frac{1}{4}$
2	2	1

Horizontal stretch and shrink - multiply all the x-values by the same factor (not 1)

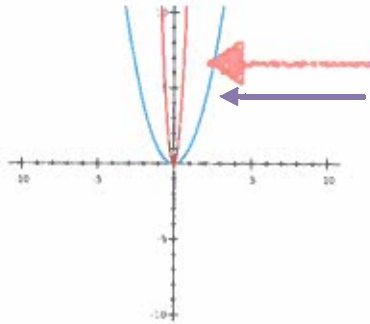
Horizontal stretch - when the factor is less than 1 and greater than 0



Multiply the x-values by $\frac{1}{4}$

x	$y = x^2$	$y = (\frac{1}{4}x)^2$
-2	2	$\frac{1}{4}$
-1	1	$\frac{1}{8}$
0	0	0
1	1	$\frac{1}{8}$
2	2	$\frac{1}{4}$

Horizontal shrink - when the factor is greater than 1



$$g(x) = (4x)^2$$

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

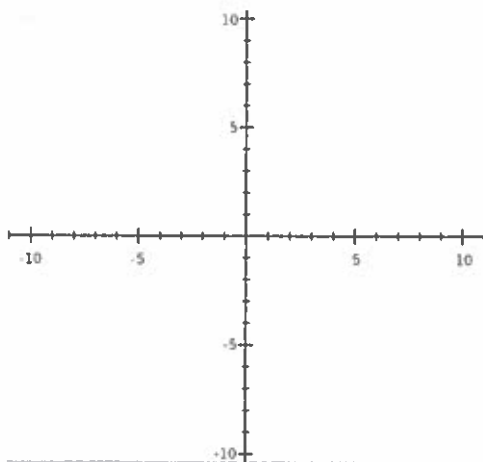
Multiply the x-values by 4

x	$y = x^2$	$y = (4x)^2$
-2	2	64
-1	1	16
0	0	0
1	1	16
2	2	64

]

Example Problem:

Graph $g(x) = -2|x+5| - 3$



Answer:

1. A vertical stretch of 2 \rightarrow multiply the x values by 2
2. A reflection over the x-axis
3. A translation 5 units to the left (*Opposite of the sign*)
4. A translation 3 units down

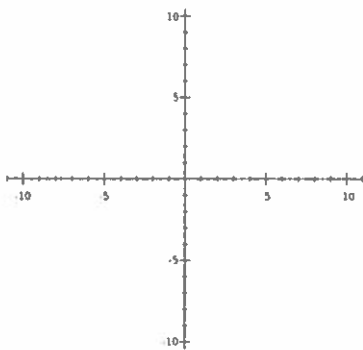
If the parent function is $f(x)=x^2$ what would the equation look like if the following transformations occurred:

1. A vertical shrink of 3
2. A translation 2 units up
3. A translation 4 units to the right

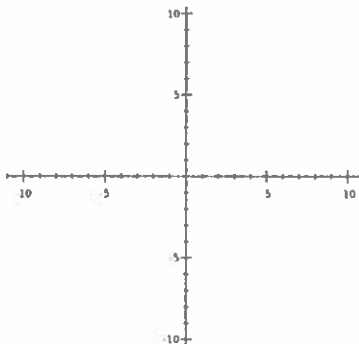
Answer - $f(x) = \frac{1}{3}(x-5)^2+2$

Additional Problems - Describe the transformation and graph (check using your calculator)

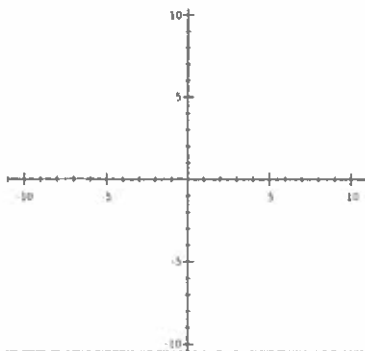
1. $f(x) = \frac{1}{3}x^2$



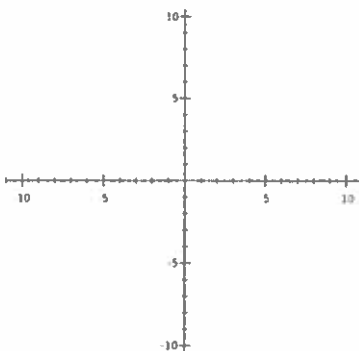
2. $f(x) = |x-5|+2$



3. $g(x) = -|x+1|-1$

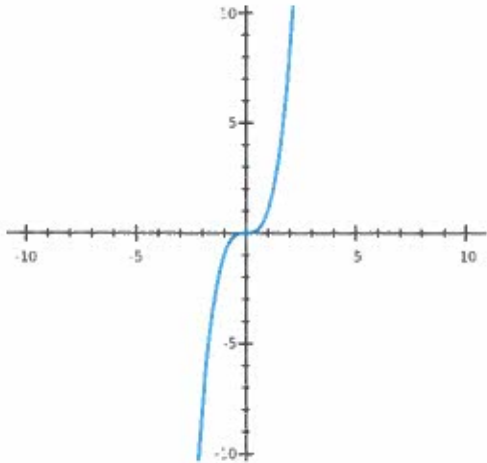


4. $h(x) = -x + 5$

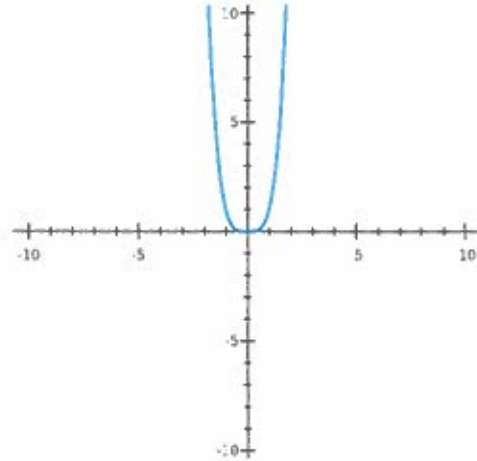


Cubic and Quartic Functions

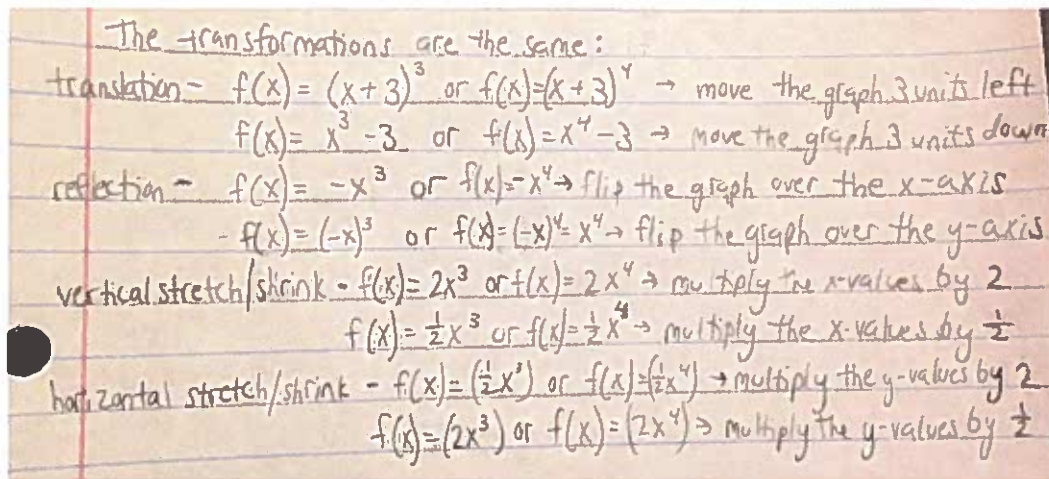
Cubic: $f(x)=x^3$



Quartic: $f(x)=x^4$

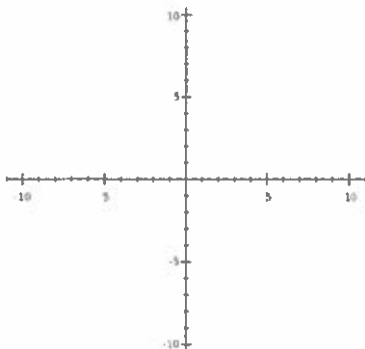


The transformations for these parent functions are exactly the same

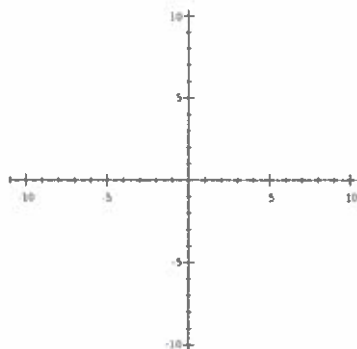


Additional Problems - Describe the transformation and graph (check using your calculator)

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



2. $g(x) = 2(x-3)^4 + 2$



Transformation	$f(x)$ Notation	Examples	
Horizontal Translation Graph shifts left or right.	$f(x - h)$	$g(x) = (x - 5)^4$ $g(x) = (x + 2)^4$	5 units right 2 units left
Vertical Translation Graph shifts up or down.	$f(x) + k$	$g(x) = x^4 + 1$ $g(x) = x^4 - 4$	1 unit up 4 units down
Reflection Graph flips over x - or y -axis.	$f(-x)$ $-f(x)$	$g(x) = (-x)^4 = x^4$ $g(x) = -x^4$	over y -axis over x -axis
Horizontal Stretch or Shrink Graph stretches away from or shrinks toward y -axis.	$f(ax)$	$g(x) = (2x)^4$ $g(x) = \left(\frac{1}{2}x\right)^4$	shrink by a factor of $\frac{1}{2}$ stretch by a factor of 2
Vertical Stretch or Shrink Graph stretches away from or shrinks toward x -axis.	$a \cdot f(x)$	$g(x) = 8x^4$ $g(x) = \frac{1}{4}x^4$	stretch by a factor of 8 shrink by a factor of $\frac{1}{4}$