

# Vertical Transformations

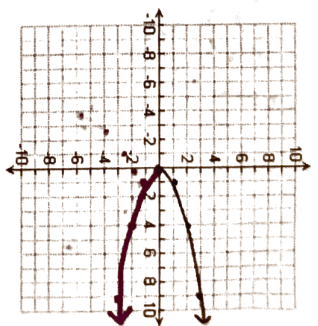
Equation	Equivalent Notation	Table	Graph												
$f(x) = x^3 - 3$	$f(x) = x^3$ Graph $\boxed{f(x)} - 3$ $x^3 - 3$	<table border="1"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>-8</td> </tr> <tr> <td>-1</td> <td>-1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>8</td> </tr> </tbody> </table>	x	f(x)	-2	-8	-1	-1	0	0	1	1	2	8	
x	f(x)														
-2	-8														
-1	-1														
0	0														
1	1														
2	8														
$f(x) =  x  + 4$	$f(x) =  x $ Graph $f(x) + 4$	<table border="1"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>2</td> </tr> <tr> <td>-1</td> <td>1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>2</td> </tr> </tbody> </table>	x	f(x)	-2	2	-1	1	0	0	1	1	2	2	
x	f(x)														
-2	2														
-1	1														
0	0														
1	1														
2	2														
$f(x) = 3x^2$	$f(x) = x^2$ Graph $3 \cdot f(x)$	<table border="1"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>4</td> </tr> <tr> <td>-1</td> <td>1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>4</td> </tr> </tbody> </table>	x	f(x)	-2	4	-1	1	0	0	1	1	2	4	
x	f(x)														
-2	4														
-1	1														
0	0														
1	1														
2	4														
$f(x) = \frac{1}{4}x^2$	$f(x) = x^2$ Graph $\frac{1}{4} \cdot f(x)$	<table border="1"> <thead> <tr> <th>x</th> <th>f(x)</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>1</td> </tr> <tr> <td>-1</td> <td>1/4</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1/4</td> </tr> <tr> <td>2</td> <td>1</td> </tr> </tbody> </table>	x	f(x)	-2	1	-1	1/4	0	0	1	1/4	2	1	
x	f(x)														
-2	1														
-1	1/4														
0	0														
1	1/4														
2	1														

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

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

Graph  $-f(x)$

x	f(x)
0	0
1	-1
4	-2
9	-3



Summarize your findings about vertical transformations:

addition or subtraction makes the function translate up or down  
 a coefficient makes the function stretch or compress  
 a negative coefficient makes the function reflect over x axis

Predict how each of these is different from the parent function:

a)  $f(x) = \sqrt{x} - 100$

Shift down 100

b)  $g(x) = x^3$

Graph  $g(x) + 8$

Shift up 8

c)  $h(x) = -2|x|$

reflect across x axis +  
 vertical stretch by a factor of 2

d)  $j(x) = x^2$

Graph:  $-\frac{1}{5}j(x)$   
 reflect across x axis  
 vertical compression by a factor of  $\frac{1}{5}$

2) Write an equation for a quadratic function shifted 5 units up.

$$f(x) = x^2 + 5$$

3) Write an equation for a cubic function vertically stretched by a factor of 5.

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

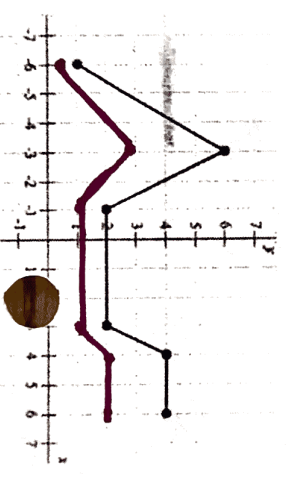
4) Write an equation for a square root function reflected across the x axis.

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

5) Write an equation for a cube root function vertically compressed by a factor of 1/5.

$$f(x) = \frac{1}{5}\sqrt[3]{x}$$

6)  $f(x)$  is graphed to the right. Graph  $\frac{1}{2} \cdot f(x)$



# Functions and Transformations HW 1

For 1-6, If the parent function is  $f(x) = \sqrt{x}$ ,

describe in Words the Effect on the Parent Function

1.  $f(x) + 10$
2.  $f(x) - 10$
3.  $-f(x)$
4.  $2f(x)$
5.  $f(x) - 2$
6.  $-f(x) + 3$

- 7a. Graph  $f(x) = x^2$
- b. Graph  $f(x) + 2$  in a different color.
- c. Graph  $f(x) - 3$  in a different color.
- d. Graph  $2f(x)$  in a different color.

