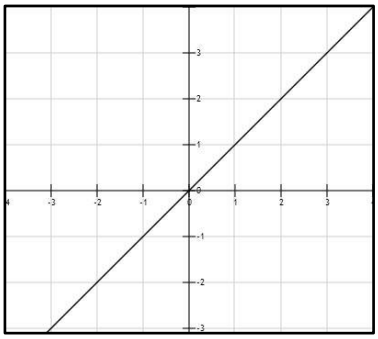
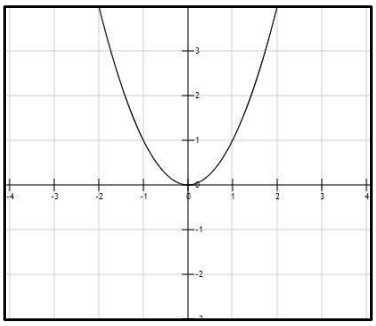
Graphing Standard Function & Transformations

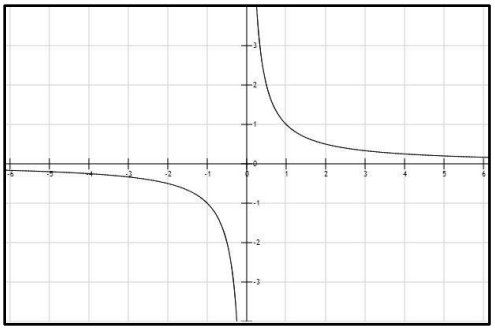
A few standard graphs



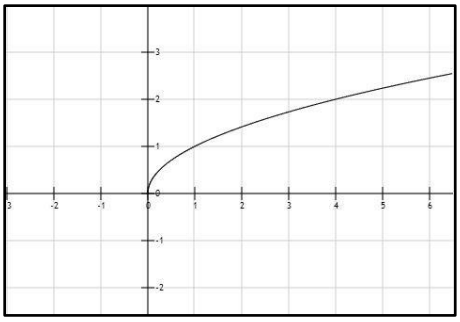
$f(x) = x$



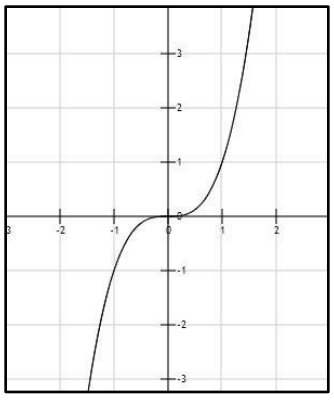
$f(x) = x^2$



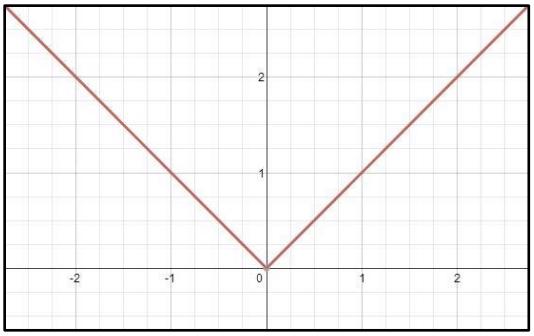
$f(x) = \frac{1}{x}$



$f(x) = x^{1/2}$



$f(x) = x^3$



$f(x) = |x|$

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Graphing Standard Function & Transformations

The rules below take these standard plots and shift them horizontally/ vertically

Vertical Shifts

Let f be the function and *c* a positive real number.

- The graph of y = f(x) + c is the graph of y = f(x) shifted c units vertically upwards.
- The graph of y = f(x) - c is the graph of y = f(x) shifted c units vertically downwards.
-

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

The graph of

Shifts the graph of *f* up **2** units

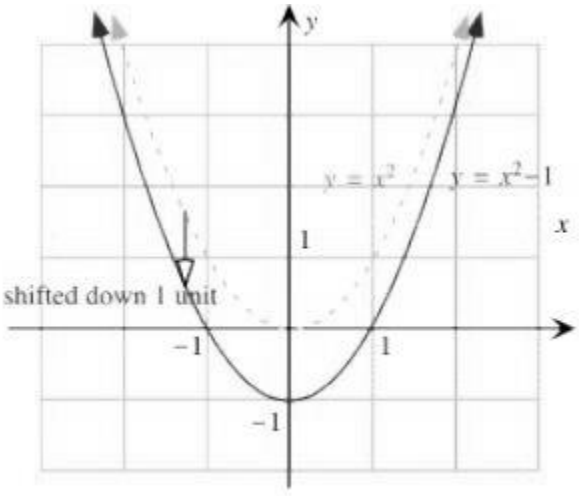
$h(x) = x^2 - 3 = f(x) - 3$

The graph

Shifts the graph of ***f*** down **3** units

Look for the **positive** and **negative** sign. **Positive** sign makes the graph move upwards and the **negative** sign makes it move *downwards*

Here is a picture of the graph of g(x) = x2 1. It is obtained from the graph of f(x) = x^2 by shifting it down 1 unit.



Graphing Standard Function & Transformations

Horizontal Shifts

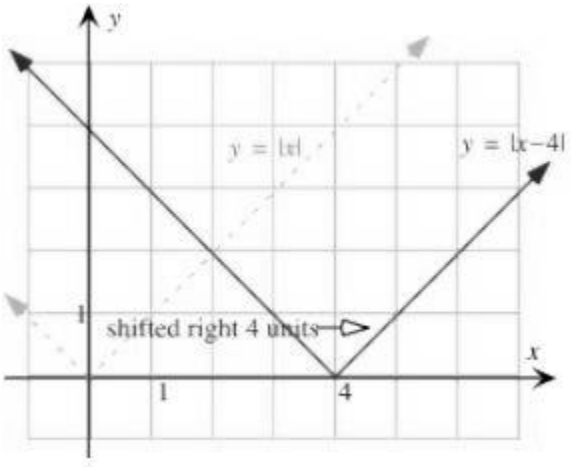
Let f be a function and c a positive real number.

- The graph of y = f (x + c) is the graph of y = f (x) shifted to the left *c* units.
- The graph of y = f (x + c) is the graph of y = f (x) shifted to the right *c* units.

$g(x) = (x-3)^2 = f(x-3)$

h (x) = (x + 2)2 = f (x+2)

Here is a picture of the graph of g(x) = |x4|. It is obtained from the graph of f(x) = |x| by shifting it to the right 4 units.



Horizontal/ Vertical Scaling

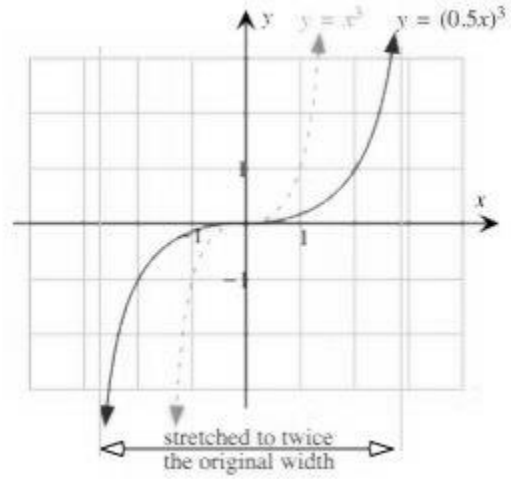
Horizontal Scaling

Let g(x) = f(cx) where c is a positive real number.

Graphing Standard Function & Transformations

• If c > 1, the graph of g is the graph of f, compressed in the x-direction by a factor of c.

• If 0 < c < 1, then the graph is stretched in the x-direction by a factor of 1/c



Here is a picture of the graph of g(x) = (0.5x)3. Since c = 0.5 < 1, the graph is obtained from that of f(x) = x3 by stretching it in the x-direction by a factor of 1/c = 2.

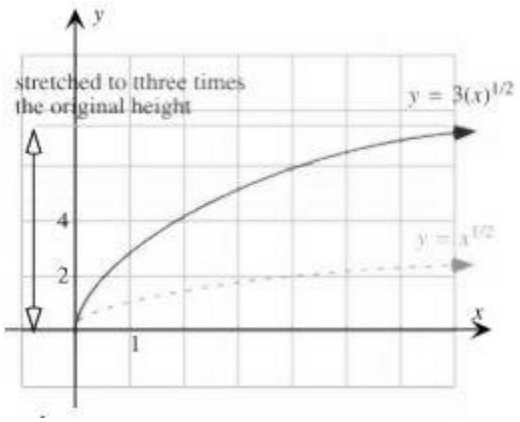
Vertical Scaling

Let g(x) = cf(x) here c is a positive real number.

• If c > 1, the graph of g is the graph of f, stretched in the y-direction by a factor of c.

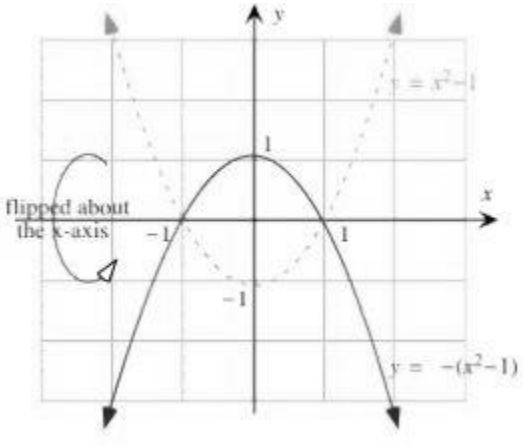
• If 0 < c < 1, then the graph is compressed in the y-direction by a factor of 1/c.

Here is a picture of the graph of g(x) = 3(x)1/2. Since c = 3 > 1, the graph is obtained from that of f(x) = x1/2 by stretching it in the y-direction by a factor of c = 3.



Reflection about the x axis

The graph of y = - f (x) is the graph of y = f (x) reflected about the x- axis.
Here is a picture of the graph of g(x) = (x 2 1). It is obtained from the graph of f(x) = x 2 1 by reflecting it in the x-axis.



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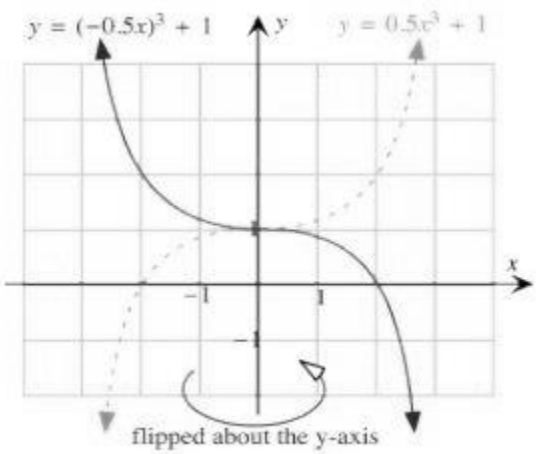
Reflection about the y axis

The graph of y = f (-x) is the graph of y = f (x) reflected about the y-axis.
Here is a picture of the graph of g(x) =(0.5x)3+1. It is obtained from the graph of f(x) = 0.5x3+1 by reflecting it in the y-axis.



Summary of Transformations

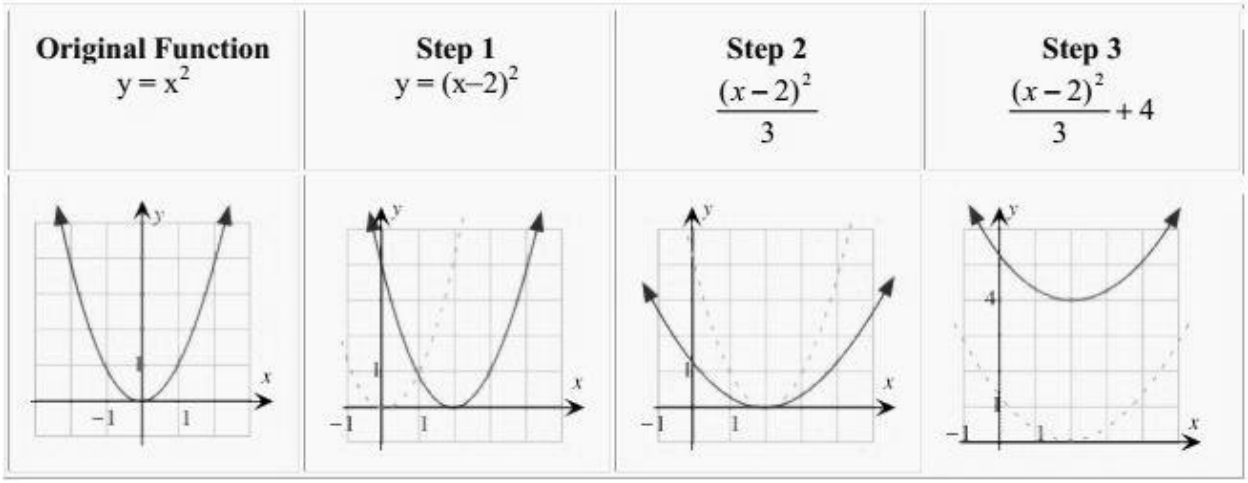
To graph	Draw the graph of f and:	Changes in the equation of y = f(x)
Vertical Shifts y = f (x) + c y = f (x) – c	Raise the graph of f by c units Lower the graph of f by c units	C is added to f (x) C is subtracted from f (x)

Graphing Standard Function & Transformations

Horizontal Shifts $y = f(x + c)$ $y = f(x – c)$	Shift the graph of f to the left c units Shift the graph of f to the right c units	x is replaced with x + c x is replaced with x – c
Reflection about the x axis $y = - f(x)$	Reflects the graph of f about the x axis	f (x) is multiplied by –1
Reflection about the y axis $y = f(-x)$	Reflect the graph of f about the y axis	X is replaced with –x

Sample Question:

Sketch the curve for g(x) = $\frac{(x-2)^2}{3} + 4$



Solve for yourself:

Graphing Standard Function & Transformations

1. $f(x) = \sqrt{(x-5)^3}$
2. $g(t) = \frac{1}{5}|3t|$
3. $r(a) = \frac{2}{(3a+4)}$

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