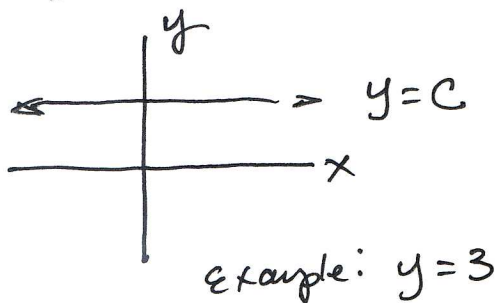


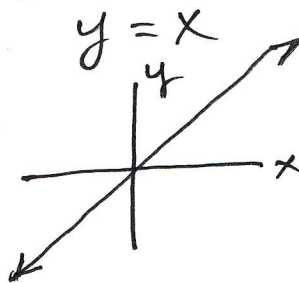
Section 3.2 Families of Graphs

many different types of graphs that are functions. These types are called parent functions. This means that numbers can be added to the function that will alter the location and shape of the graph.

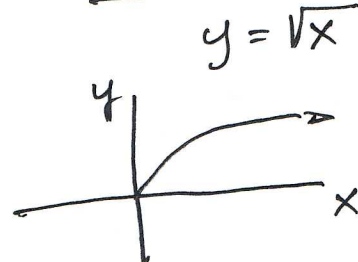
Constant function



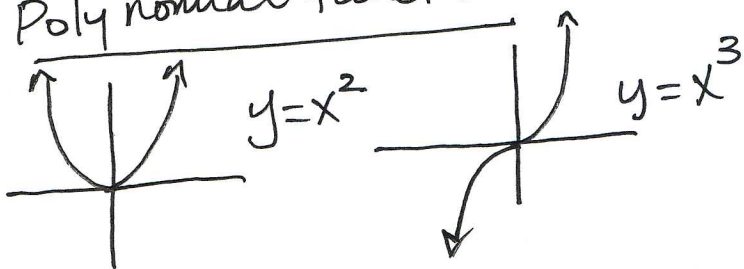
Identity function



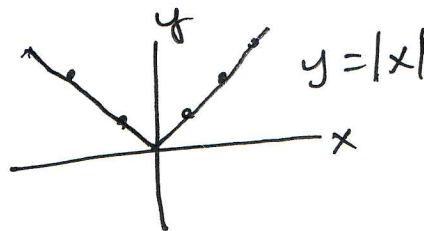
Square root



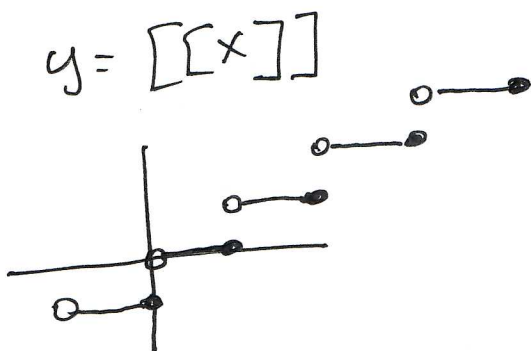
Polynomial functions



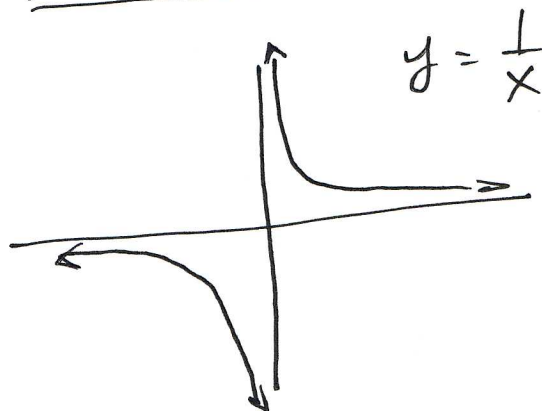
Absolute value



Greatest integer function



Rational function



When we add numbers to the function, we can cause changes in the location and shape of the function. Two types of changes can occur. These changes are called Transformations. The first transformation is called a translation. A translation means the graph is relocating either vertically, horizontally, or both.

$f(x+c)$ or $f(x-c)$ causes a horizontal translation.

moves left

moves right

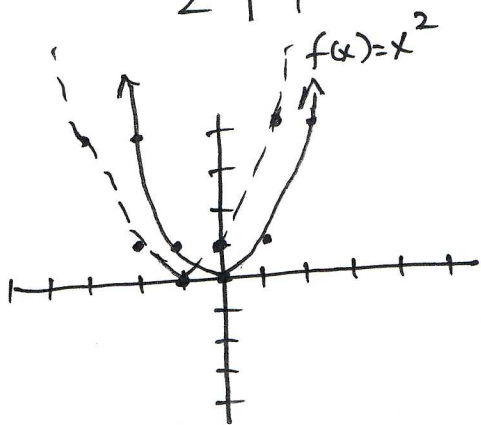
ex. $f(x) = x^2$

x	y
0	0
-1	1
-2	4
1	1
2	4

$$f(x+1) = (x+1)^2$$

x	y
0	1
-1	0
-2	1
-3	4
1	4
2	9

$$f(x+1) = (x+1)^2$$



Note that dotted graph is shifted 1 to the left

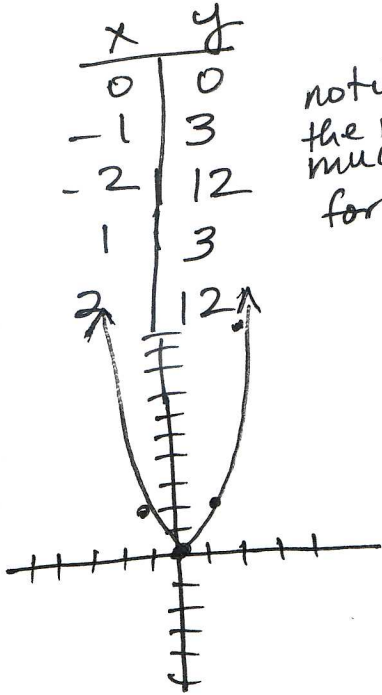
Dilation - The width of the graph is altered by either narrowing or widening the graph using a coefficient on the function.

If $a > 1$, then the graph narrows.

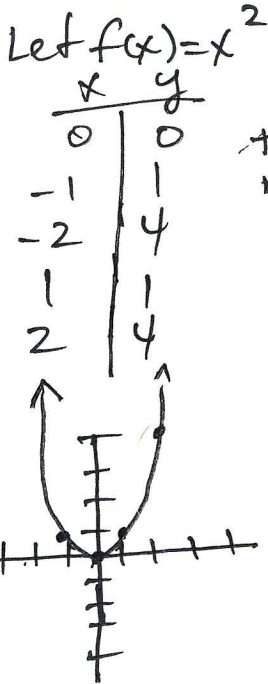
If $0 < a < 1$, then the graph widens.

Let $f(x) = 3x^2$

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

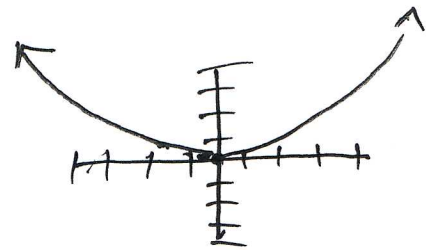


notice that the range is much larger for $f(x) = 3x^2$.



notice that the range is much smaller for $f(x) = \frac{1}{3}x^2$. This makes the graph wider.

x	y
0	0
-1	1/3
-2	4/3
1	1/3
2	4/3



Determining a picture:

the change in a graph without seeing

$$f(x) = 2(x-1)^2 + 1$$

↑ translation (up 1)
 ↑ Translation (1 right)
 ↑ Dilation (Twice as narrow as original parent graph of $f(x) = x^2 + 1$)

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

$g(x) = \frac{3}{4} x^2$

$g(x)$ is a dilation that is compressed vertically (wider) by a factor of $\frac{3}{4}$

16. $f(x) = x^3$

$g(x) = (x-5)^3$

$g(x)$ is a translation of 5 to the right of $f(x)$.

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

a) $y = -(1.5x)^2$

\rightarrow reflected (-1) vertically, translation expanded by a factor of 1.5.

b) $y = 4(x-3)^2$

\rightarrow translated 3 to the right and expanded vertically by a factor of 4.

c) $y = \frac{1}{2}x^2 - 5$

\rightarrow translated 5 downward and compressed vertically by a factor of $\frac{1}{2}$.

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

a) $y = \frac{1}{0.5x}$

\rightarrow expanded horizontally by a factor of:

b) $y = \frac{1}{6x} + 8$

\rightarrow compressed horizontally by a factor of $\frac{1}{6}$ and translated up by 8.

c) $y = \frac{1}{|x|}$

\rightarrow The left half of the parent graph is replaced by a reflection of the right half of the parent graph.

Real-Life Application for 3.2

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40 Taxi fare \$1.50 + \$.25 per 0.2 mile
+ \$.25 per 15 second wait time

If speed ≥ 9.6 mph, meter measures distance.

If speed < 9.6 mph, meter measures wait time

Traveling 0.1 mile and then waiting at a stop light for 37.5 seconds equals \$1.50 + \$.25 (distance) + \$.25 wait time

Rounding up to the nearest unit, write out a function for calculating cab fare and then graph the function

a) $f(x) = 0.25((x-1)) + 1.50$ if $[[x]] = x$

or $f(x) = 0.25[[x]] + 1.50$ if $[[x]] < x$

b)

x	f(x)
$0 < x \leq 1$	1.50
$1 < x \leq 2$	1.75
$2 < x \leq 3$	2.00
$3 < x \leq 4$	2.25
$4 < x \leq 5$	2.50

