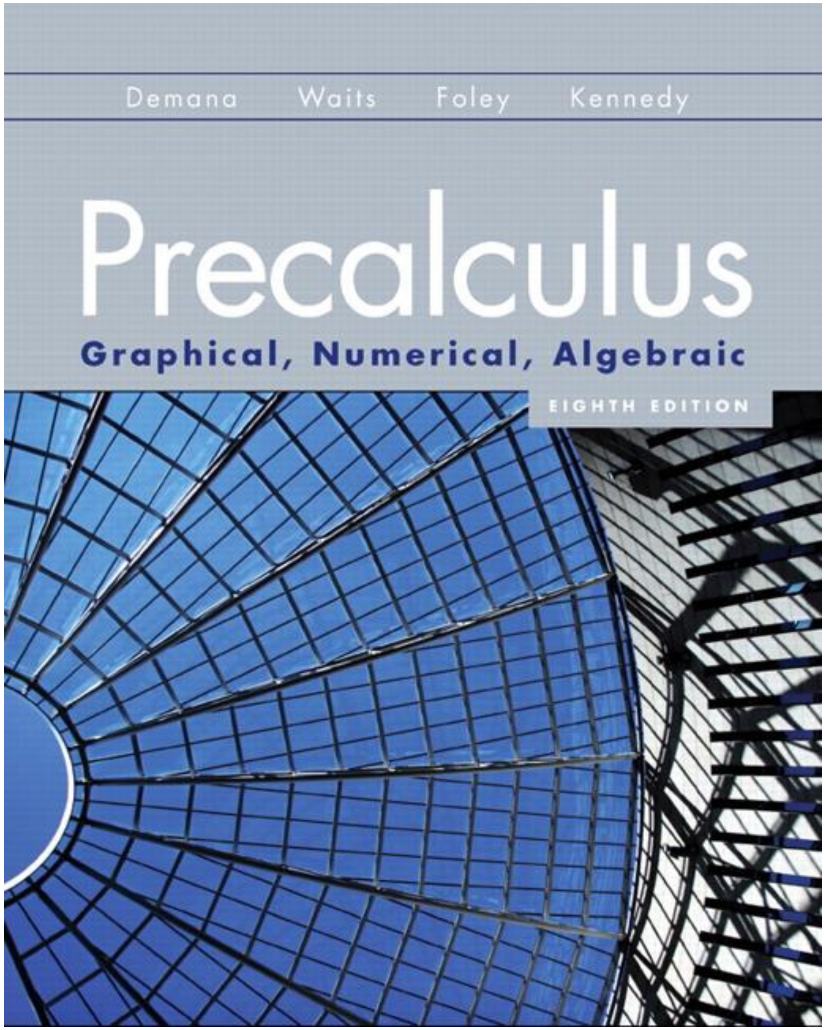
1.3

Twelve Basic Functions



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Bell Ringer

- Write questions from any of the home learning assignments on the board.

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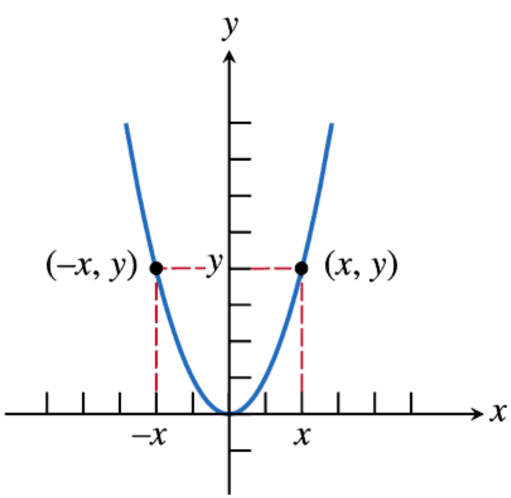
Even Functions

Even functions are symmetrical around the y-axis.

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

Graphically



Numerically

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

Algebraically

For all x in the domain of f,

$$f(-x) = f(x)$$

Functions with this property (for example, x^n, n even) are **even** functions.

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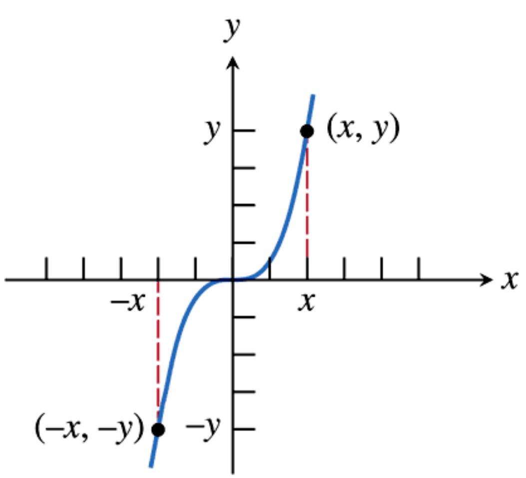
Odd Functions

Odd functions are the same if you rotate them 180 degrees.

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

Graphically



Numerically

x	y
−3	−27
−2	−8
−1	−1
1	1
2	8
3	27

Algebraically

For all x in the domain of f,

$$f(-x) = -f(x).$$

Functions with this property (for example, x^n, n odd) are **odd** functions.

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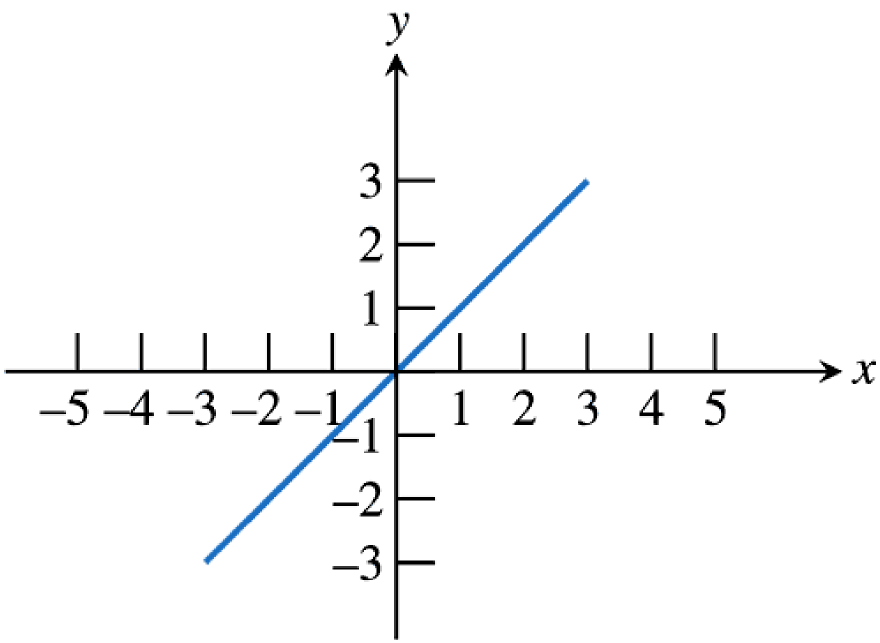
The Identity Function



$$f(x) = x$$

Interesting fact: This is the only function that acts on every real number by leaving it alone.

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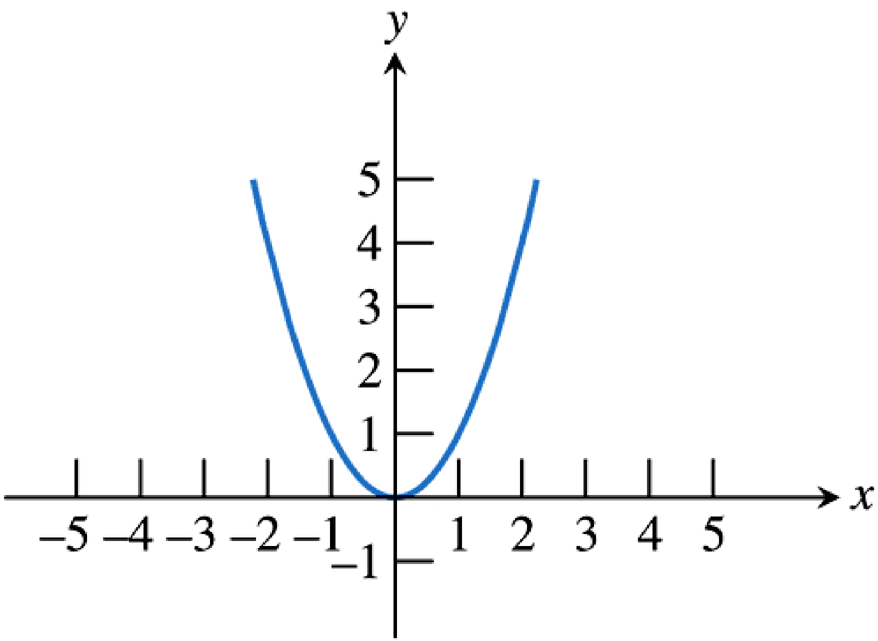
The Squaring Function



$f(x) = x^2$

Interesting fact: The graph of this function, called a parabola, has a reflection property that is useful in making flashlights and satellite dishes.

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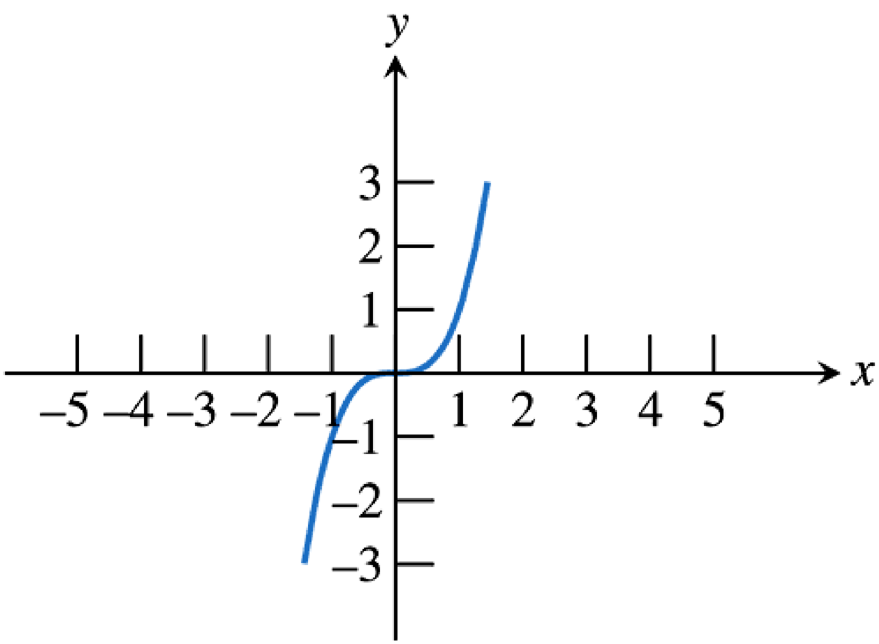
The Cubing Function



$f(x) = x^3$

Interesting fact: The origin is called a "point of inflection" for this curve because the graph changes curvature at that point.

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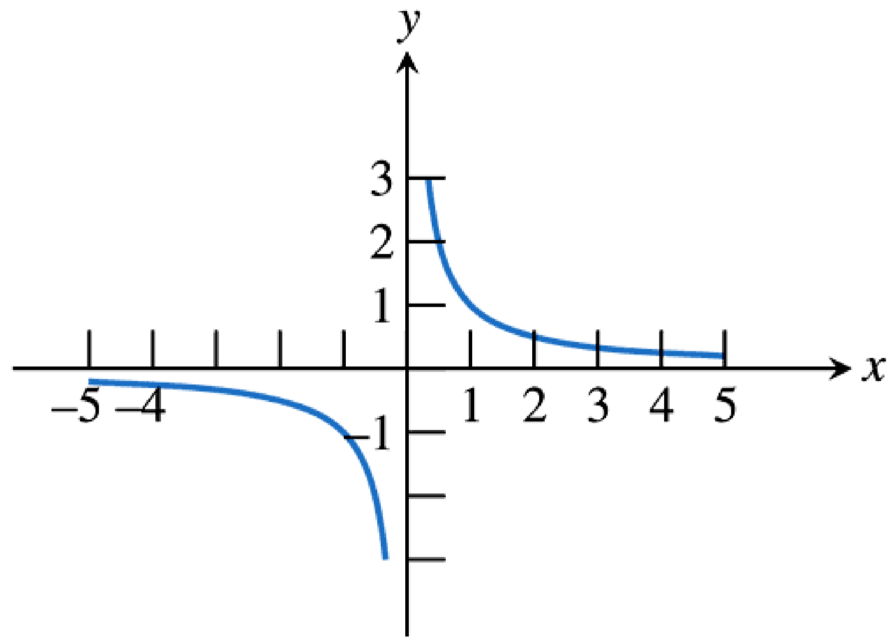
The Reciprocal Function



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

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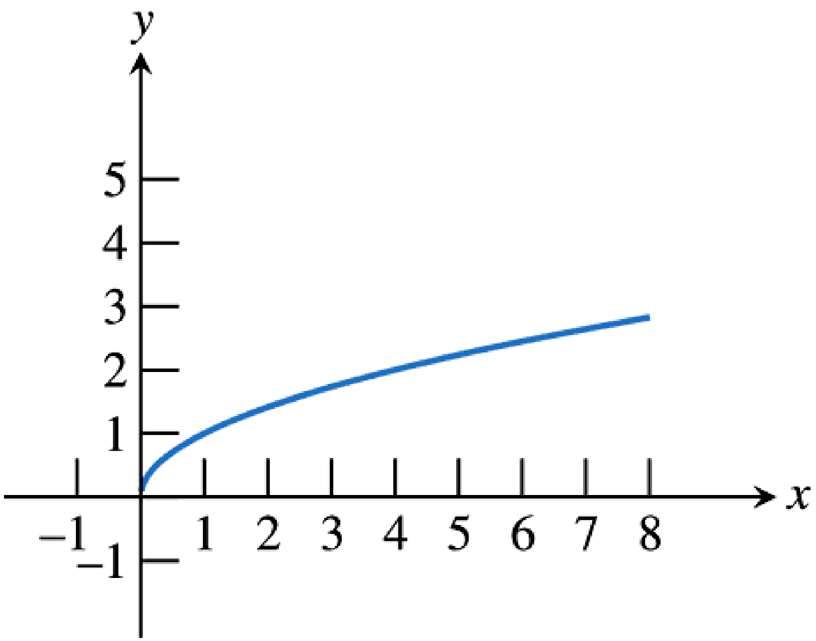
The Square Root Function



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

Interesting fact: Put any positive number into your calculator. Take the square root. Then take the square root again. Then take the square root again, and so on. Eventually you will always get 1.

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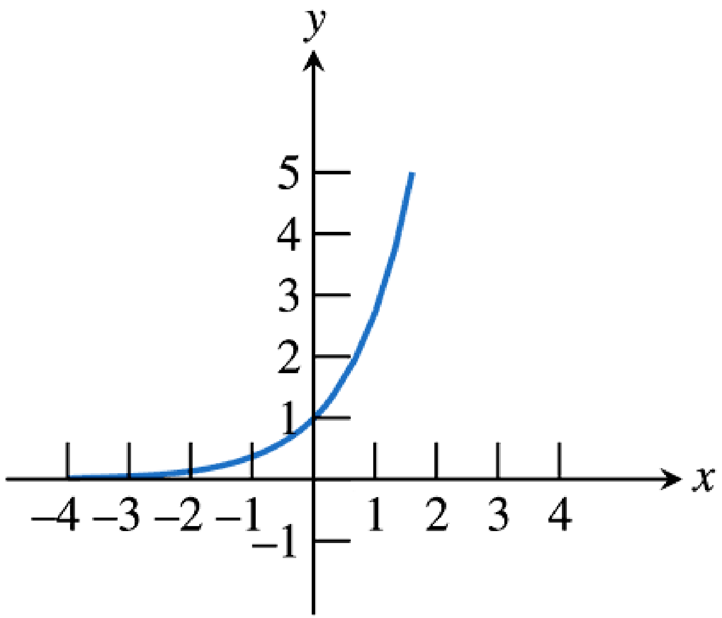

$f(x) = e^x$

Interesting fact: The number e is an irrational number (like π) that shows up in a variety of applications. The symbols e and π were both brought into popular use by the great Swiss mathematician Leonhard Euler (1707–1783).

The Exponential Function

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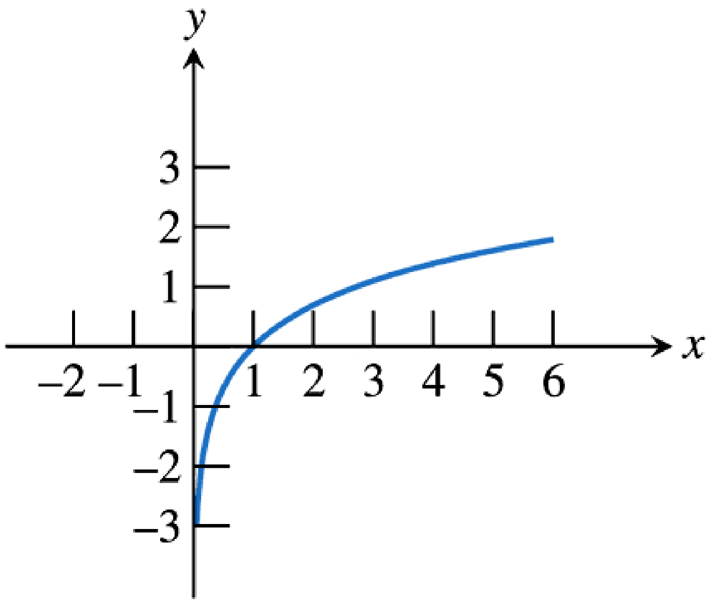

$f(x) = \ln x$

Interesting fact: This function increases very slowly. If the x-axis and y-axis were both scaled with unit lengths of one inch, you would have to travel more than two and a half miles along the curve just to get a foot above the x-axis.

The Natural Logarithm Function

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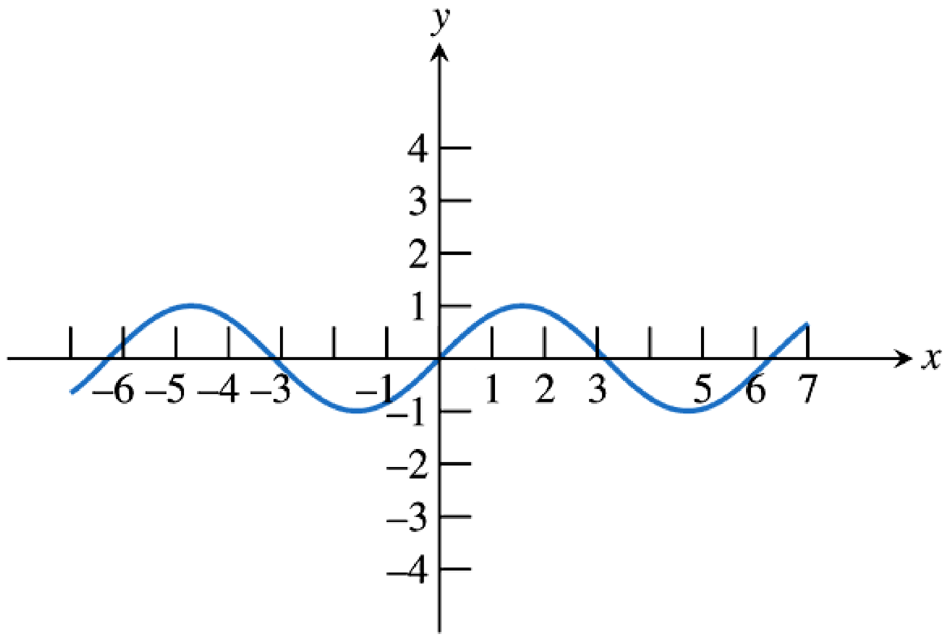

$f(x) = \sin x$

Interesting fact: This function and the sinus cavities in your head derive their names from a common root: the Latin word for "bay." This is due to a 12th-century mistake made by Robert of Chester, who translated a word incorrectly from an Arabic manuscript.

The Sine Function

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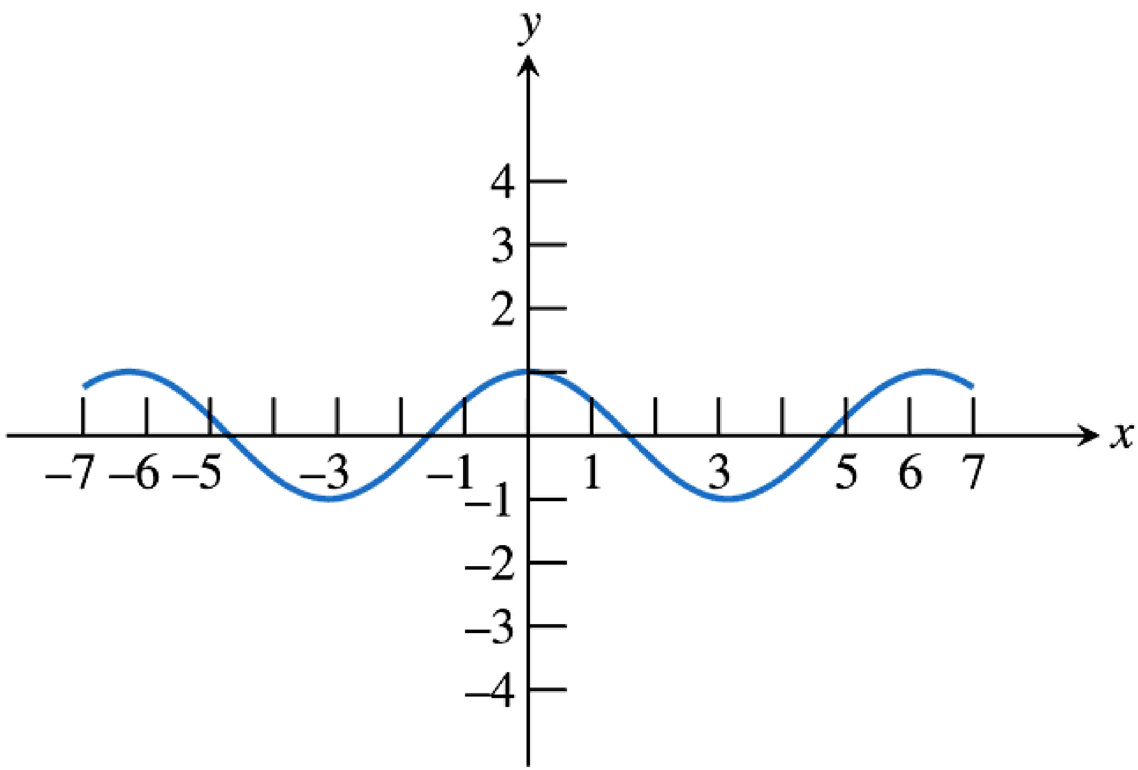

$f(x) = \cos x$

Interesting fact: The local extrema of the cosine function occur exactly at the zeros of the sine function, and vice versa.

The Cosine Function

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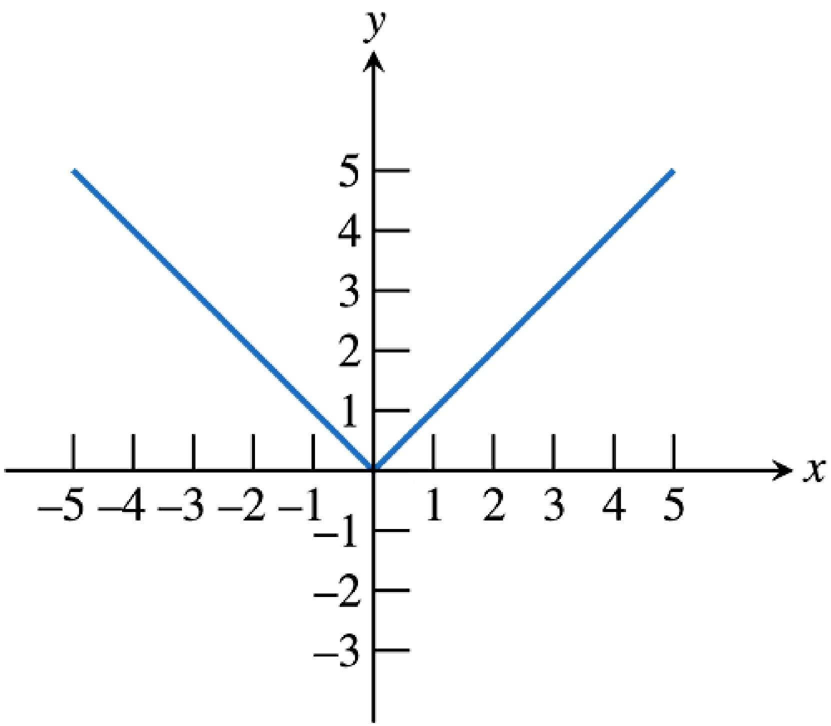

$$f(x) = |x| = \text{abs}\,(x)$$

Interesting fact: This function has an abrupt change of direction (a "corner") at the origin, while our other functions are all "smooth" on their domains.

The Absolute Value Function

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Example **Looking for Domains**

One of the functions has domain the set of all reals except 0.

Which function is it?

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Solution

One of the functions has domain the set of all reals except 0.

Which function is it?

The function $y = 1/x$ has a vertical asymptote at $x = 0$.

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Example **Analyzing a Function Graphically**

Graph the function $y = -x^2 - 1$

On what interval is the function

- Increasing?

- Decreasing?

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Example **Analyzing a Function Graphically**

Graph the function $y = -x^2 - 1$

Does the function have any extrema?

How does this graph relate to $y = x^2$

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Identify Doman, Range, Continuity and Symmetry

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

Domain:

Range:

Continuous?

Symmetric?

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Identify Doman, Range, Continuity and Symmetry

$y = x^3 + 1$

Domain:

Range:

Continuous?

Symmetric?

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Identify Doman, Range, Continuity and Symmetry

$$y = \frac{-1}{x}$$

Domain:

Range:

Continuous?

Symmetric?

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Identify Doman, Range, Continuity and Symmetry

$y = -x$

Domain:

Range:

Continuous?

Symmetric?

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Identify Doman, Range, Continuity and Symmetry

$$y = -\sqrt{x}$$

Domain:

Range:

Continuous?

Symmetric?

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