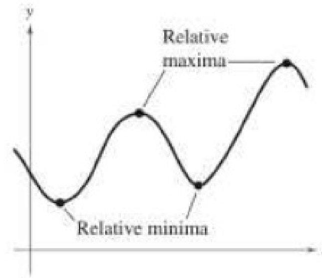
### Definitions of Relative Minimum and Relative Maximum



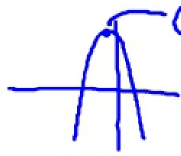

A function value $f(a)$ is called a **relative minimum** of $f$ when there exists an interval $(x_1, x_2)$ that contains $a$ such that

$$x_1 < x < x_2 \quad \text{implies} \quad f(a) \le f(x).$$

A function value $f(a)$ is called a **relative maximum** of $f$ when there exists an interval $(x_1, x_2)$ that contains $a$ such that

$$x_1 < x < x_2 \quad \text{implies} \quad f(a) \ge f(x).$$

$f(x) = -4x^2 - 7x + 3$



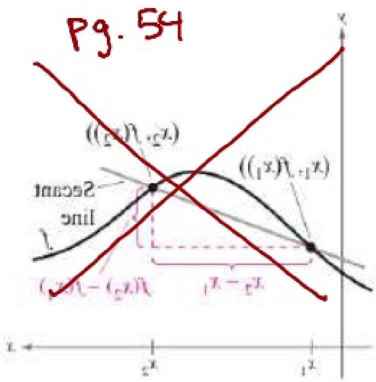

increasing $(-\infty, -.875)$

decreasing $(-.875, \infty)$

never constant

### Average Rate of Change of a Function

Pg. 54



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

$$\frac{\overset{y_2 - y_1}{f(x_2) - f(x_1)}}{x_2 - x_1}$$

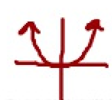
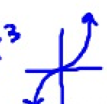
a) $x_1 = 3$ to $x_2 = -2$

$f(x_1) = (3)^2 + 2(3) = 9 + 6 = 15$

$f(x_2) = (-2)^2 + 2(-2) = 4 + -4 = 0$

$\frac{0 - 15}{-2 - 3} = \frac{-15}{-5} = \boxed{3}$

### Even and Odd Functions

$y = x^2$  $y = x^3$ 

A function is said to be even when its graph is symmetric with respect to the $y$-axis and odd when its graph is symmetric with respect to the origin. They symmetry tests from Section 1.2 yield the following tests for even and odd functions.

#### Tests for Even and Odd Functions

A function $y = f(x)$ is **even** when, for each $x$ in the domain of $f$, $f(-x) = f(x)$. $(-2,3)$ $(2,3)$

A function $y = f(x)$ is **odd** when, for each $x$ in the domain of $f$, $f(-x) = -f(x)$. $(-2,3)$ $(2,-3)$

Section 1.6 A Library of Parent Functions

Constant Function

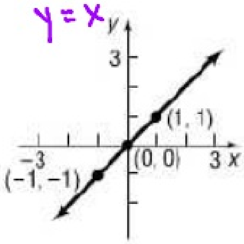
$y = a$

- Domain: $\mathbb{R}$
- Range: $a$
- horizontal line through $a$.

**Identity Function** (linear)

$f(x) = x$

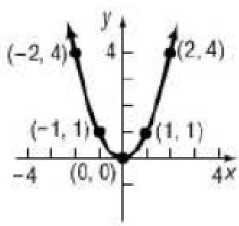
$y = x$




- Domain: $\mathbb{R}$
- Range: $\mathbb{R}$
- Line with slope of $m = 1$
- Intercept: $(0,0)$
- Odd Function
- Increasing on $(-\infty,\infty)$
- Bisects Quadrants I and III
- Key Points: $(-2,-2)$, $(-1,-1)$, $(0,0)$, $(1,1)$, $(2,2)$

**Square Function** (Quadratic)

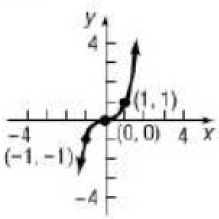
$f(x) = x^2$




- Domain: $\mathbb{R}$
- Range: $[0,\infty)$
- Parabola
- Intercept: $(0,0)$
- Even Function
- Decreasing on $(-\infty,0)$ and increasing on $(0,\infty)$
- Key Points: $(-2,4)$, $(-1,1)$, $(0,0)$, $(1,1)$, $(2,4)$

**Cube Function** (cubic)

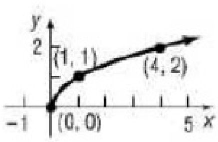
$f(x) = x^3$




- Domain: $\mathbb{R}$
- Range: $\mathbb{R}$
- Intercept: $(0,0)$
- Odd Function
- Increasing on $(-\infty,\infty)$
- Key Points: $(-2,-8)$, $(-1,-1)$, $(0,0)$, $(1,1)$, $(2,8)$

**Square Root Function**

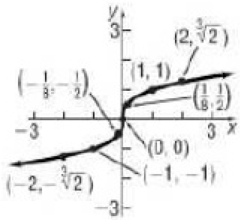
$f(x) = \sqrt{x}$




- Domain: $[0,\infty)$
- Range: $[0,\infty)$
- Intercept: $(0,0)$
- Neither even nor odd
- Increasing on $[0,\infty)$
- Minimum value of 0 at $x = 0$
- Key Points: $(0,0)$, $(1,1)$, $(4,2)$, $(9,3)$

**Cube Root Function**

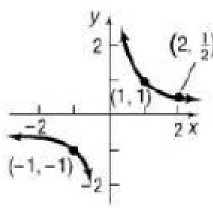
$f(x) = \sqrt[3]{x}$




- Domain: $\mathbb{R}$
- Range: $\mathbb{R}$
- Intercept: $(0,0)$
- Odd Function
- Increasing on $(-\infty,\infty)$
- Key Points: $(-8,-2)$, $(-1,-1)$, $(0,0)$, $(1,1)$, $(8,2)$

**Reciprocal Function** (Rational)

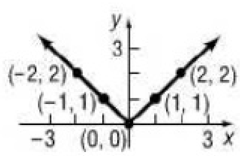
$f(x) = \frac{1}{x}$



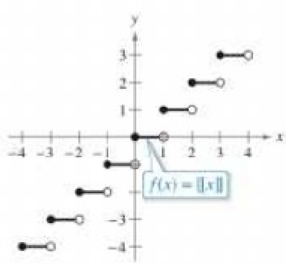

- Domain: $(-\infty,0)\cup(0,\infty)$
- Range: $(-\infty,0)\cup(0,\infty)$
- No Intercepts
- Odd Function
- Decreasing on $(-\infty,0)$ and $(0,\infty)$
- Key Points: $(-2,-\frac{1}{2})$, $(-1,-1)$, $(-\frac{1}{2},-2)$, $(\frac{1}{2},2)$, $(1,1)$, $(2,\frac{1}{2})$

**Absolute Value Function**

$f(x) = |x|$




- Domain: $\mathbb{R}$
- Range: $[0,\infty)$
- Intercept: $(0,0)$
- Even Function
- Decreasing on $(-\infty,0)$ and increasing on $(0,\infty)$
- Minimum value of 0 at $x=0$
- Key Points: $(-2,2)$, $(-1,1)$, $(0,0)$, $(1,1)$, $(2,2)$




**Step Function** (greatest integer)

- The domain of the function is the set of all real numbers. $\mathbb{R}$
- The range of the function is the set of all integers.
- The graph has a $y$-intercept at $(0, 0)$ and $x$-intercepts in the interval $[0, 1)$.
- The graph is constant between each pair of consecutive integer values of $x$.
- The graph jumps vertically one unit at each integer value of $x$.

[[ ]]

$\|2.3\| = 2$

$[[4]] = 4$

$[[13.7]] = 13$

$[[-1.2]] = -2$