

1.4 Library of Functions; Piecewise-defined Functions

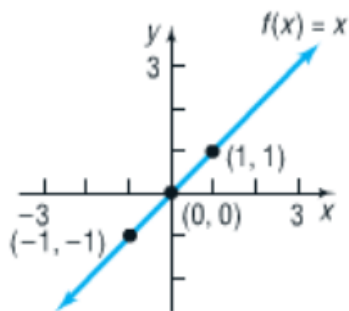
PREPARING FOR THIS SECTION

- Intercepts (Foundations, Section F.2, pp. 10–11)
- Graphs of Key Equations (Foundations, Section F.2: Example 3, p. 9; Example 10, p. 13; Example 11, p. 14; Example 12, p. 14)

Objectives:

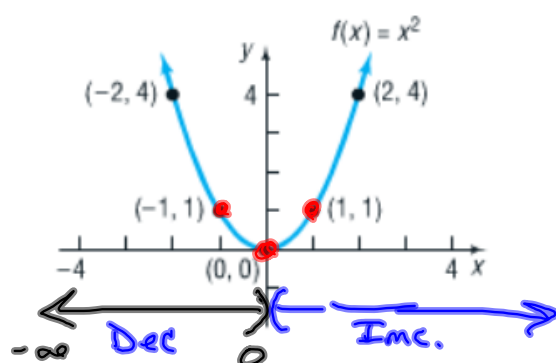
- 1 Graph the Functions Listed in the Library of Functions
- 2 Graph Piecewise-defined Functions

Identity Function



$$\begin{aligned} \mathbb{D} &= \mathbb{R} \\ \mathbb{R} &= \mathbb{R} \end{aligned}$$

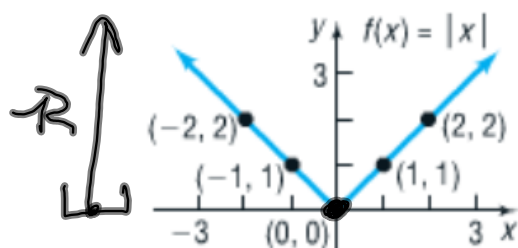
Square Function



Decreasing:
 $(-\infty, 0)$
 $\mathcal{D} = \mathbb{R}$
 $\mathcal{R} = [0, \infty)$ Increasing
 $(0, \infty)$

x	$y = f(x) = x $	(x, y)
0	0	(0, 0)
1	1	(1, 1)
2	2	(2, 2)
3	3	(3, 3)

Absolute Value Function



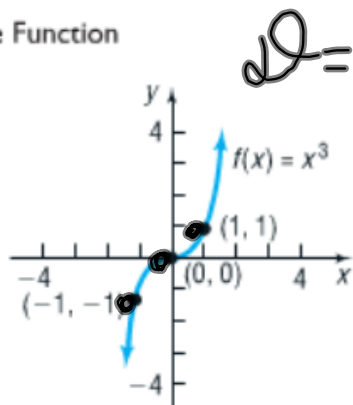
Piece wise Definition
 $x = -5 \Rightarrow |x| = |-5| = 5 = -x$
 $|x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$

Properties of $f(x) = |x|$

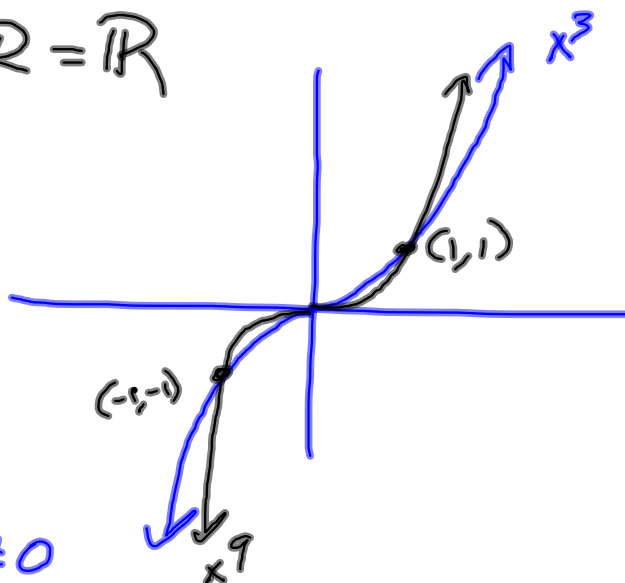
1. The x -intercept of the graph of $f(x) = |x|$ is 0. The y -intercept of the graph of $f(x) = |x|$ is also 0.
2. The function is even.
3. It is decreasing on the interval $(-\infty, 0)$.
It is increasing on the interval $(0, \infty)$.
4. It has a local minimum of 0 at $x = 0$.

$\mathcal{D} = \mathbb{R}$
 $\mathcal{R} = [0, \infty)$

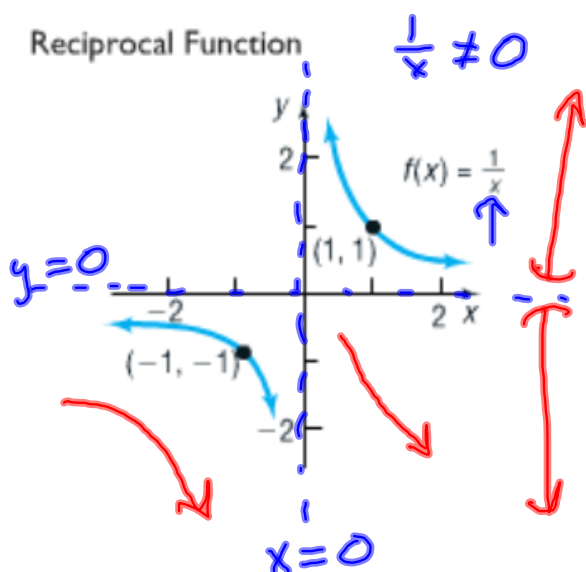
Cube Function



$$\mathcal{D} = \mathcal{R} = \mathbb{R}$$



Reciprocal Function



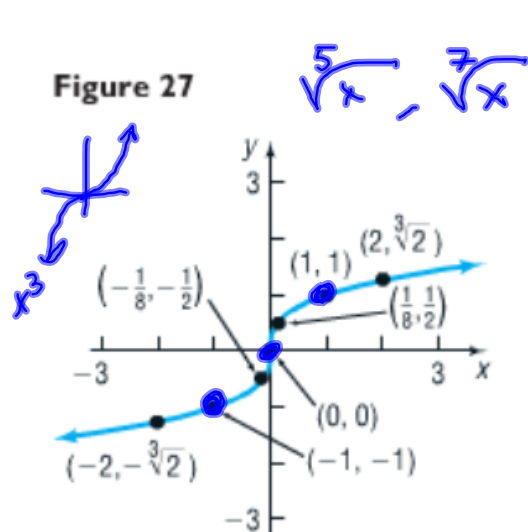
$$\frac{1}{x} \neq 0$$

$$\mathcal{D} = (-\infty, 0) \cup (0, \infty)$$

$$\mathcal{R} = (-\infty, 0) \cup (0, \infty)$$

Decreasing on its domain.

Figure 27



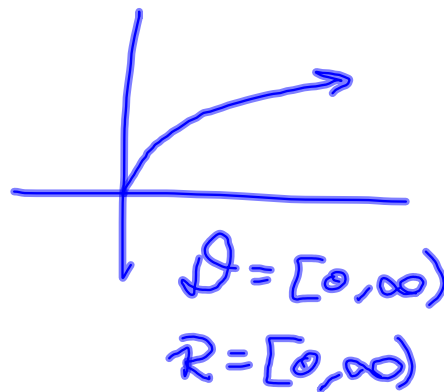
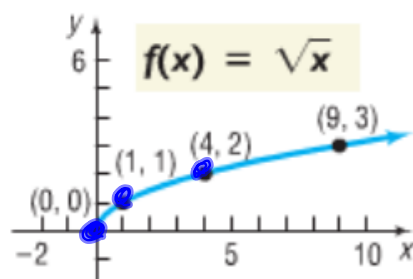
x	$y = f(x) = \sqrt[3]{x}$	(x, y)
0	0	$(0, 0)$
$\frac{1}{8}$	$\frac{1}{2}$	$(\frac{1}{8}, \frac{1}{2})$
1	1	$(1, 1)$
2	$\sqrt[3]{2} \approx 1.26$	$(2, \sqrt[3]{2})$
8	2	$(8, 2)$

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

1. The x -intercept of the graph of $f(x) = \sqrt[3]{x}$ is 0. The y -intercept of the graph of $f(x) = \sqrt[3]{x}$ is also 0.
2. The function is odd.
3. It is increasing on the interval $(-\infty, \infty)$.
4. It does not have a local minimum or a local maximum.

Graphing Calculator Warning!

Figure 26

**Properties of $f(x) = \sqrt{x}$**

1. The x -intercept of the graph of $f(x) = \sqrt{x}$ is 0. The y -intercept of the graph of $f(x) = \sqrt{x}$ is also 0.
2. The function is neither even nor odd.
3. It is increasing on the interval $(0, \infty)$.
4. It has a minimum value of 0 at $x = 0$.