1-5 Parent Functions and Transformations

Describe the following characteristics of the graph of each parent function: domain, range, intercepts, symmetry, continuity, end behavior, and intervals on which the graph is increasing/decreasing.

1. $f(x) = [[x]]$

ANSWER:

D = $\{x \mid x \in \mathbb{R}\}$, R = $\{y \mid y \in \mathbb{Z}\}$. The graph has a y-intercept at (0, 0) and x-intercepts for $\{x \mid 0 \le x < 1, x \in \mathbb{R}\}$. The graph has no symmetry. The graph has a jump discontinuity for $\{x \mid x \in \mathbb{Z}\}$. $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = \infty$. The graph is constant for $\{x \mid x \notin \mathbb{Z}\}$. The graph increases for $\{x \mid x \in \mathbb{Z}\}$.

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

ANSWER:

D = $\{x \mid x \neq 0,\ x \in \mathbb{R}\}$, R = $\{y \mid y \neq 0,\ y \in \mathbb{R}\}$. The graph has no intercepts. The graph is symmetric with respect to the origin. The graph has an infinite discontinuity at $x = 0$. $\lim_{x \to -\infty} f(x) = 0$ and $\lim_{x \to \infty} f(x) = 0$. The graph is decreasing on $(-\infty, 0)$ and $(0, \infty)$.

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

ANSWER:

D = $\{x \mid x \in \mathbb{R}\}$, R = $\{y \mid y \in \mathbb{R}\}$. The graph has an intercept at (0, 0). The graph is symmetric with respect to the origin. The graph is continuous. $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = \infty$. The graph is increasing on $(-\infty, \infty)$.

4. $f(x) = x^4$

ANSWER:

D = $\{x \mid x \in \mathbb{R}\}$, R = $\{y \mid y \ge 0, y \in \mathbb{R}\}$. The graph has an intercept at (0, 0). The graph is symmetric with respect to the y-axis. The graph is continuous. $\lim_{x \to -\infty} f(x) = \infty$ and $\lim_{x \to \infty} f(x) = \infty$. The graph is decreasing on $(-\infty, 0)$ and increasing on $(0, \infty)$.

5. $f(x) = c$

ANSWER:

D = $\{x \mid x \in \mathbb{R}\}$, R = $\{y \mid y = c, c \in \mathbb{R}\}$. If $c = 0$, all real numbers are x-intercepts. If $c \neq 0$, there are no x-intercepts. The graph has a y-intercept at $(0, c)$. If $c \neq 0$, the graph is symmetric with respect to the y-axis. If $c = 0$, the graph is symmetric with respect to the x-axis, y-axis, and origin. The graph is continuous. $\lim_{x \to -\infty} f(x) = c$ and $\lim_{x \to \infty} f(x) = c$. The graph is constant on $(-\infty, \infty)$.

6. $f(x) = x$

ANSWER:

D = $\{x \mid x \in \mathbb{R}\}$, R = $\{y \mid y \in \mathbb{R}\}$. The graph has an intercept at (0, 0). The graph is symmetric with respect to the origin. The graph is continuous. $\lim_{x \to -\infty} f(x) = -\infty$ and $\lim_{x \to \infty} f(x) = \infty$. The graph is increasing on $(-\infty, \infty)$.