Chapter 2 Functions and Their Graphs

Section 2.1
Linear equation in two variables - An equation relating two variables, x and y, whose graph is a line
Slope – The number of units the line rises (or falls) vertically for each unit of horizontal change from left to right
Slope-intercept form – A linear equation written in the form $y = mx + b$
Ratio – If the x-axis and the y-axis have the same unit of measure, then the slope has no units and is called a ratio
Rate of change – If the x-axis and the y-axis have different units of measure, then the slope is called a rate of change
Point-slope form – The equation of the line with slope m passing through the point (x_1, y_1) is $y - y_1 = m(x - x_1)$
Two-point form – The equation of the line passing through points (x_1, y_1) and (x_2, y_2) is

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

General form – An equation of the form $Ax + By + C = 0$ where A and B are not both zero
Parallel – Two distinct nonvertical lines are parallel if and only if their slopes are equal. That is $m_1 = m_2$.
Perpendicular – Two distinct nonvertical lines are perpendicular if and only if their slopes are negative reciprocals of each other. That is, $m_1 = -1/m_2$.

Section 2.2
Function – A function f from a set A to a set B is a relation that assigns to each element x in the set A exactly one element y in the set B.
Domain – The set of inputs of the function f
Range – The set of all outputs for the given set of inputs of the function f
Independent variable – A variable in an equation that represents a function that can take on any value for which the function is defined
Dependent variable – A variable in an equation that represents a function whose value depends on the value of the independent variable
Function notation – The symbol, $f(x)$, read as the value of f at x or f of x, used to describe y as a function of x, where f is the name of the function and $f(x)$ is the value of the function at x
Piecewise-defined function – A function defined by two or more equations over a specified domain
Implied domain – The set of all real values for which the function is defined

Section 2.3
Graph of a function – The collection of ordered pairs $(x, f(x))$ such that x is in the domain of f
Vertical Line Test – A set of points in the coordinate plane is the graph of y as a function of x if and only if no vertical line intersects the graph at more than one point
Zeros of a function – The x-values for which f(x) = 0
Increasing function – A function f is increasing on an interval if, for any x_1 and x_2 in the interval, $x_1 < x_2$ implies $f(x_1) < f(x_2)$.
Decreasing function – A function f is decreasing on an interval if, for any x_1 and x_2 in the interval, $x_1 < x_2$ implies $f(x_1) > f(x_2)$
Constant function – A function f is constant on an interval if, for any x_1 and x_2 in the interval, $f(x_1) = f(x_2)$
Relative minimum – A function value $f(a)$ is called a relative minimum of f if there exists and interval (x_1, x_2) that contains a such that $x_1 < x < x_2$ implies $f(a) \leq f(x)$.
Relative maximum- A function value $f(a)$ is called a relative maximum of f if there exists and interval (x_1, x_2) that contains a such that $x_1 < x < x_2$ implies $f(a) \geq f(x)$
Linear function – A function of the form $f(x) = mx + b$
Greatest integer function – The greatest integer function is denoted by $[|x|]$ and is defined as the greatest integer less than or equal to x
Step function – A function whose graph resembles a set of stair steps
Even function – A function $y = f(x)$ is even if, for each x in the domain of f, $f(-x) = f(x)$

Odd function – A function $y = f(x)$ is odd if, for each x in the domain of f, $f(-x) = -f(x)$

Section 2.4

Vertical shift – A transformation of the graph of $y = f(x)$, represented by $h(x) = f(x) \pm c$, in which the graph is shifted upward or downward c units respectively (c is a positive real number)

Horizontal shift – A transformation of the graph of $y = f(x)$, represented by $h(x) = f(x \pm c)$, in which the graph is shifted to the left or to the right c units respectively (c is a positive real number)

Reflection – A transformation of the graph of $y = f(x)$ in which $h(x) = -f(x)$ represents a reflection in the x-axis and $h(x) = f(-x)$ represents a reflection in the y-axis

Vertical stretch – A nonrigid transformation of the graph of $y = f(x)$ represented by $y = cf(x)$ for $c > 1$. The graph appears to have been stretched vertically.

Vertical shrink- A nonrigid transformation of a graph $y = f(x)$ represented by $y = cf(x)$ for $0 < c < 1$. The graph appears to have been shrunk vertically.

Section 2.5

Arithmetic combination of functions – Two or more functions combined by the operations of addition, subtraction, multiplication, or division

Composition of functions – The composition of the function f with the function g is $(f \circ g)(x) = f(g(x))$

Section 2.6

Inverse – Let f and g be two functions. If $f(g(x)) = x$ for every x in the domain of g and $g(f(x)) = x$ for every x in the domain of f , then g is the inverse of the function f. The function g is denoted by f^{-1}.

Horizontal Line Test – A function f has an inverse if and only if no horizontal line intersects the graph of f at more that one point