# Chapter 1 Functions and Their Graphs

**Section 1.1**
**Solution point** – For an equation in $x$ and $y$, a point $(a, b)$ is a solution point if the substitution of $x = a$ and $y = b$ is satisfies the equation
**Graph of an equation** – The set of all solution points of an equation
**Intercepts** – The points at which the graph touches or crosses an axis

**Section 1.2**
**Slope** – The number of units the line rises or falls vertically for each unit of horizontal change from left to right
**Point-slope form** – The equation of the line that passes through the point $(x_1, y_1)$ and has slope $m$ is $y - y_1 = m(x - x_1)$
**Slope-intercept form** – A linear equation written in the form $y = mx + b$
**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.
**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 1.3**
**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 $x$
**Implied domain** – The set of all real values for which the function is defined

**Section 1.4**
**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
**Increasing** – 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** – 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** – 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 $f(a) \geq f(x)$
**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 1.5**
**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
**Rigid transformation** – Transformations in which the basic shape of the graph is unchanged
**Nonrigid transformation** – Transformations that cause a distortion (a change in the original shape of the graph

**Section 1.6**
**Arithmetic combination** – Two or more functions combined by the operations of addition, subtraction, multiplication, or division
**Composition** – The composition of the function $f$ with the function $g$ is $(f \circ g)(x) = f(g(x))$

**Section 1.7**
**Inverse function** – 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 $f^{-1}$.
**One-to-one** – A function $f$ is one-to-one if, for $a$ and $b$ in its domain, $f(a) = f(b)$ implies $a = b$
**Horizontal Line Test** – A function is one-to-one if every horizontal line intersects the graph of the function at most once