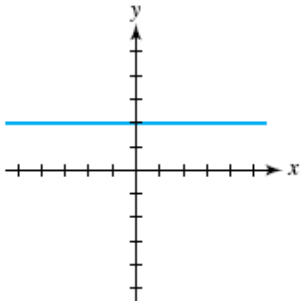
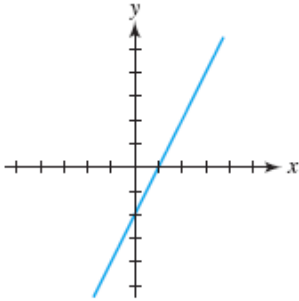
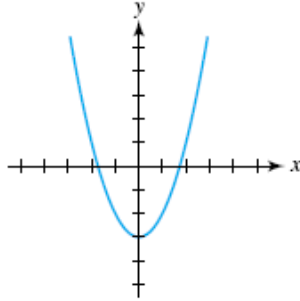
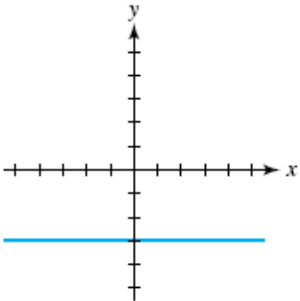
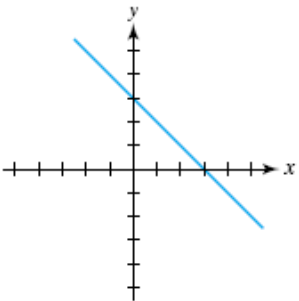
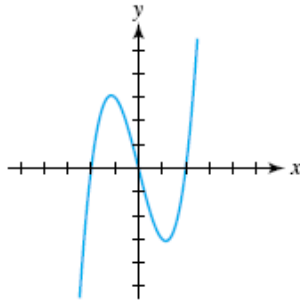


Terminology for Section 1.4

Concept	Formula	Examples
Slope of a line passing through (x_1, y_1) and (x_2, y_2)	$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$ $\Delta y = y_2 - y_1 \text{ denotes the change in } y.$ $\Delta x = x_2 - x_1 \text{ denotes the change in } x.$	<p>A line passing through $(-1, 3)$ and $(1, 7)$ has slope $m = \frac{7 - 3}{1 - (-1)} = \frac{4}{2} = 2$.</p> <p>This slope indicates that the line rises 2 units for each unit increase in x.</p>
Average rate of change of f from x_1 to x_2	<p>If (x_1, y_1) and (x_2, y_2) lie on the graph of f, then the average rate of change from x_1 to x_2 equals</p> $\frac{y_2 - y_1}{x_2 - x_1}$	<p>If $f(x) = 3x^2$, then the average rate of change from $x = 1$ to $x = 3$ is given by</p> $\frac{27 - 3}{3 - 1} = 12$ <p>because $f(3) = 27$ and $f(1) = 3$. This means that, on average, $f(x)$ increases by 12 units for each unit increase in x when $1 \leq x \leq 3$.</p>
Difference quotient	<p>Calculates average rate of change of f from x to $x + h$.</p> $\frac{f(x + h) - f(x)}{h}, h \neq 0$	<p>If $f(x) = 2x$, then the difference quotient equals</p> $\frac{2(x + h) - 2x}{h} = \frac{2h}{h} = 2.$
Constant function	$f(x) = b$, where b is a fixed number.	$f(x) = 12$, $g(x) = -2.5$, and $h(x) = 0$. Every constant function is a linear function.
Linear function	$f(x) = ax + b$, where a and b are fixed numbers or constants. The graph of f has slope a .	$f(x) = 3x - 1$, $g(x) = -5$, and $h(x) = \frac{1}{2} - \frac{3}{4}x$. Their graphs have slopes 3, 0, and $-\frac{3}{4}$, respectively.
Nonlinear function	A nonlinear function cannot be expressed in the form $f(x) = ax + b$.	$f(x) = \sqrt{x + 1}$, $g(x) = 4x^3$, and $h(x) = x^{1.01} + 2$

The following table summarizes important concepts related to constant, linear, and nonlinear functions.

Concept	Constant Function	Linear Function	Nonlinear Function
Slope of graph	Always zero	Always constant	No notion of one slope
Average rate of change	Always zero	Always constant	Can vary
Graph	Horizontal line	Nonvertical line	Not a line
Examples	 $f(x) = 2$	 $f(x) = 2x - 2$	 $f(x) = x^2 - 3$
Examples	 $f(x) = -3$	 $f(x) = -x + 3$	 $f(x) = x^3 - 4x$