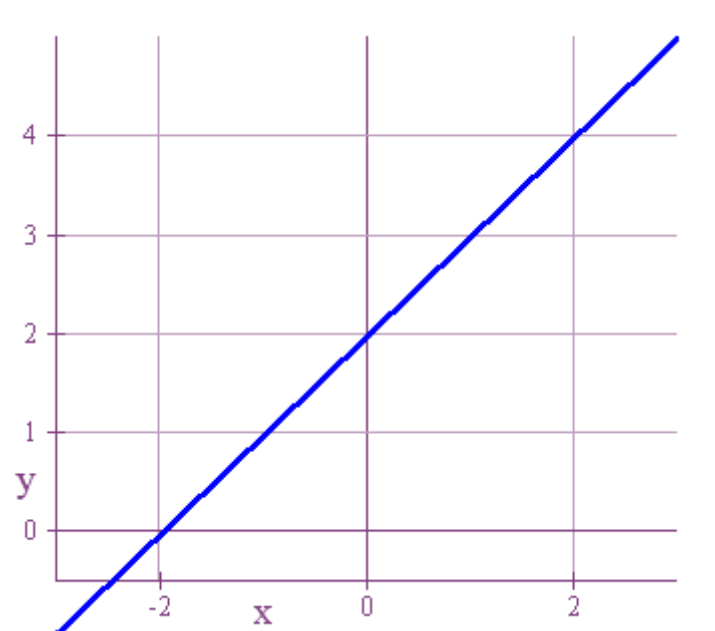# LINEAR FUNCTIONS

A linear equation can be written in the form $Ax + By = C$ where not both A and B equal zero.

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A linear function can be written in the form $y = f(x) = mx + b.$

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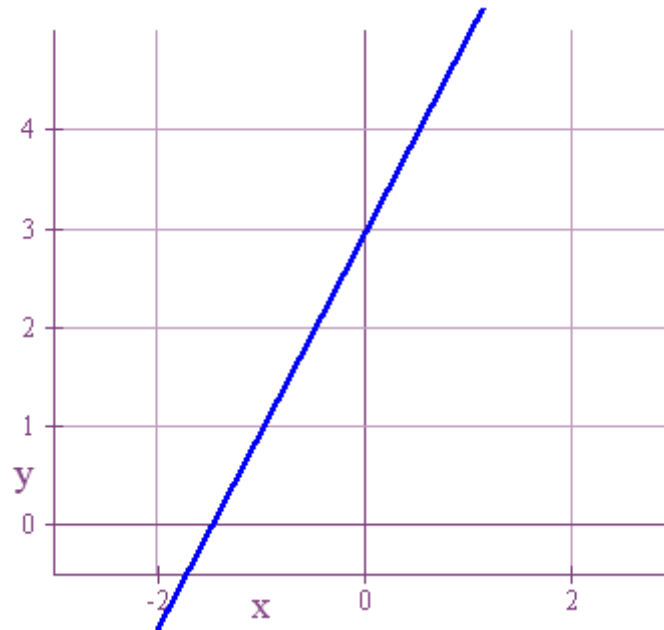The graph of a linear equation or function is a straight line.

The slope of the line that passes through the points (x_1, y_1) and (x_2, y_2)

is $slope = m = \dfrac{rise}{run} = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{\Delta y}{\Delta x} = \dfrac{\text{change in } y}{\text{change in } x}$

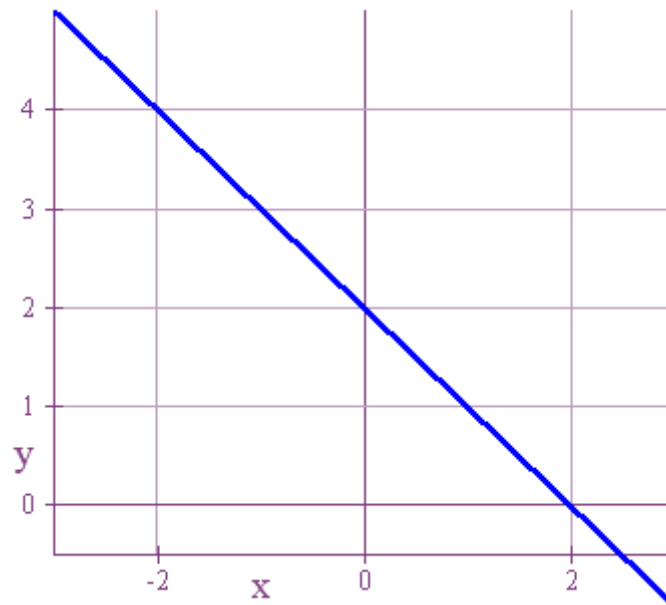$= $ the rate at which y changes with respect to a change in x

If a linear function increases as we go from left to right, then it has positive slope.
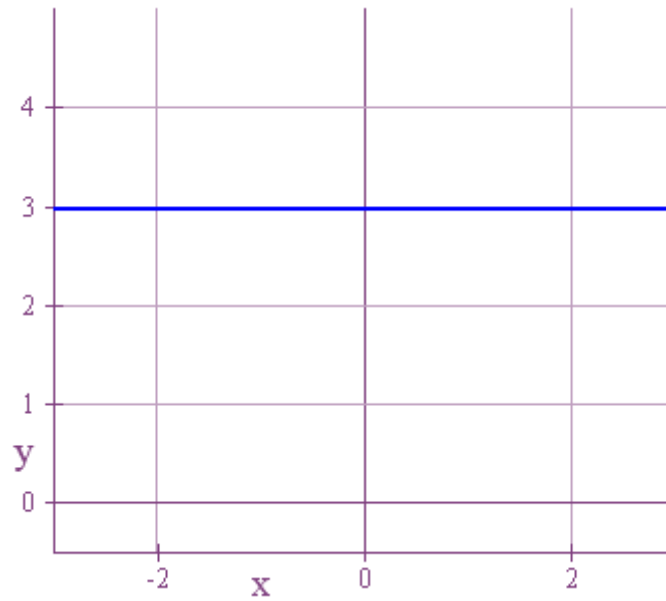
$y = 2x + 3$

If a linear function decreases as we go from left to right, then it has negative slope.
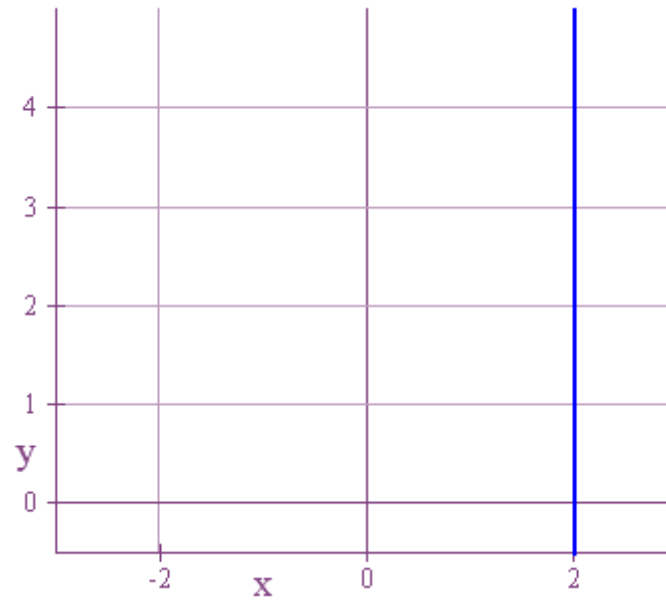
$y = -x + 2$

A horizontal line has zero slope .

$y = 3$

A vertical line has undefined or no slope .

$x = 2$

Forms for equations for lines.

Slope-intercept form

$$y = mx + b$$

Point-slope form

$$y - b = m(x - a)$$

Benton's point-slope form

$$y = m(x - a) + b$$

Horizontal lines

$$y = b$$

Vertical lines

$$x = a$$

EXAMPLE:

$P = (1,3)$

$Q = (3,7)$

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$$\text{slope} = m = \frac{7-3}{3-1} = \frac{4}{2} = 2$$

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$P = (1,3)$

$m = 2$

$y = mx + b$

$3 = 2(1) + b \Rightarrow b = 1$

$y = 2x + 1$

OR:

$$P = (1,3)$$
$$Q = (3,7)$$

OR:

$P = (1, 3)$

$Q = (3, 7)$

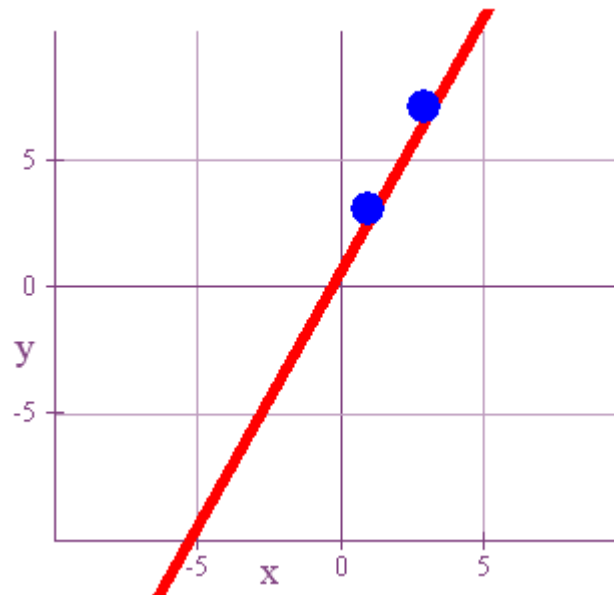$$\text{slope} = m = \frac{7 - 3}{3 - 1} = \frac{4}{2} = 2$$

OR:

$P = (1,3)$

$Q = (3,7)$

$$\text{slope} = m = \frac{7-3}{3-1} = \frac{4}{2} = 2$$

$y = 2(x-1)+3$

$y = 2x+1$

EXAMPLE:

$P = (1, 4)$

$Q = (3, 4)$

EXAMPLE:

$P = (1, 4)$

$Q = (3, 4)$

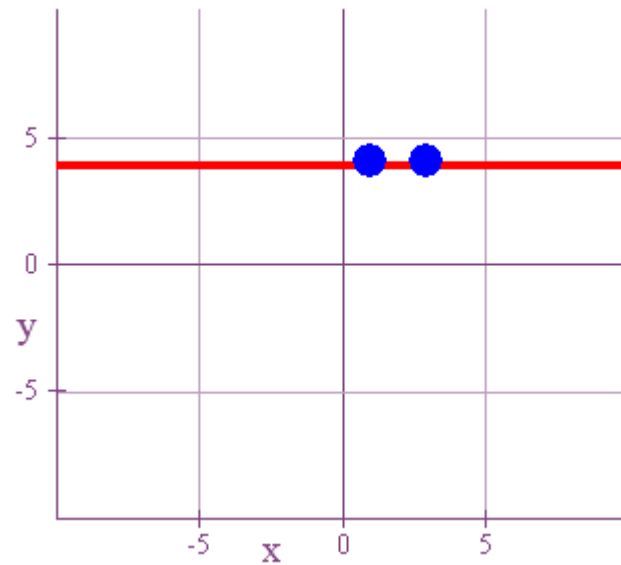$$\text{slope} = m = \frac{4 - 4}{3 - 1} = \frac{0}{2} = 0$$

EXAMPLE:

$P = (1,4)$

$Q = (3,4)$

$\text{slope} = m = \dfrac{4-4}{3-1} = \dfrac{0}{2} = 0$

$y = 4$

EXAMPLE:

$P = (3,1)$

$Q = (3,4)$

EXAMPLE:

$$P = (3,1)$$

$$Q = (3,4)$$

$$\text{slope} = m = \frac{4-1}{3-3} = \frac{3}{0} = \text{undefined}$$

EXAMPLE:

$$P = (3,1)$$
$$Q = (3,4)$$

$$\text{slope} = m = \frac{4-1}{3-3} = \frac{3}{0} = \text{undefined}$$

$$x = 3$$