The Slope of a Line

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Department of Mathematics

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The Slope of a Line

Learning Objectives:

- Find the slope of a line from its graph.

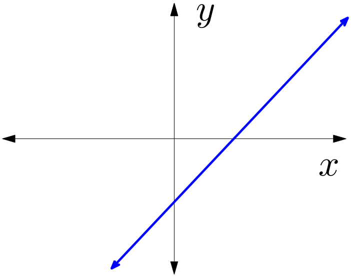
Learning Objectives:

- Find the slope of a line from its graph.
- Find the slope of a line given two points on the line.

Definition

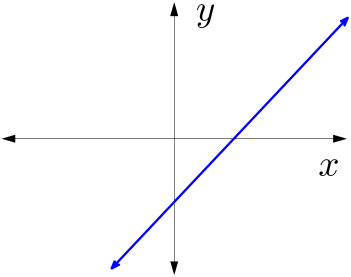
The slope of a line is a measure of the steepness of the line.

A line that rises from left to right has positive slope.

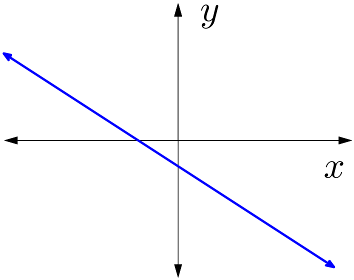


Positive Slope

A line that <u>falls</u> from left to right has <u>negative</u> slope.

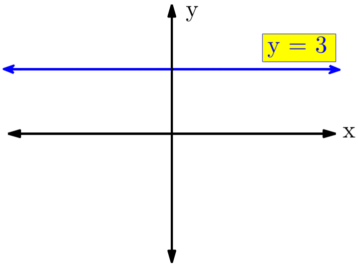


Positive Slope



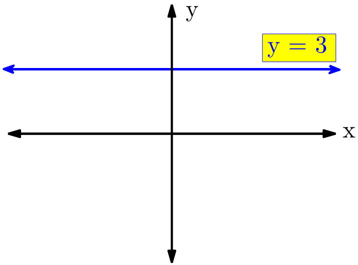
Negative Slope

Horizontal lines have zero slope



graph of $x = 3$

Horizontal lines have zero slope, and vertical lines have no slope.



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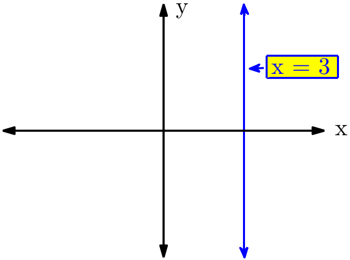
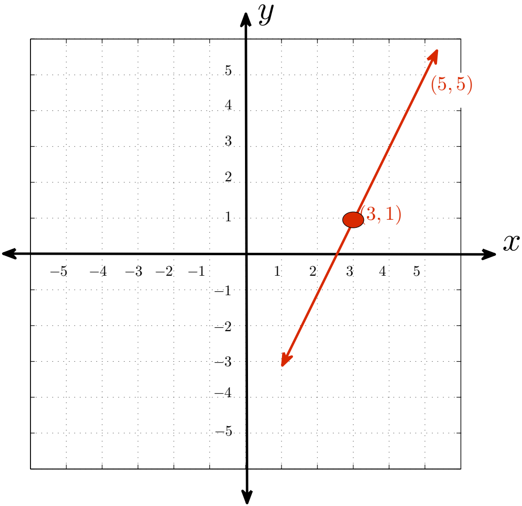


graph of $y = 3$

We can define the slope of a line as the ratio of the vertical change to the horizontal change when moving from one point to another on the line.



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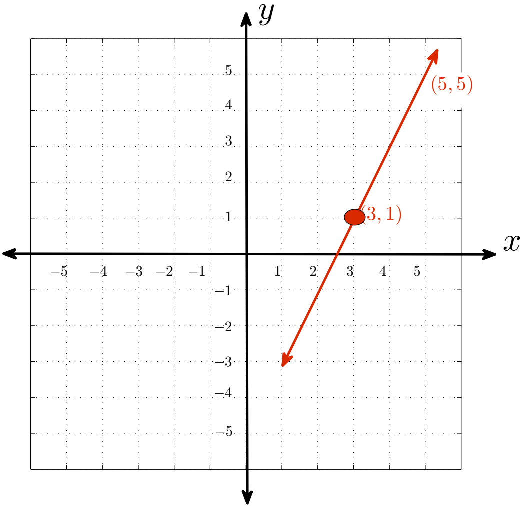

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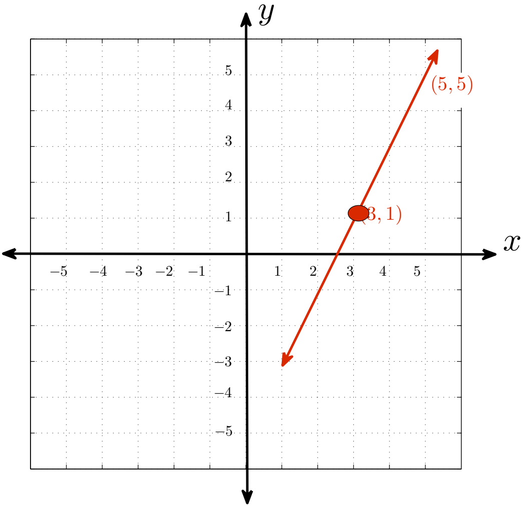

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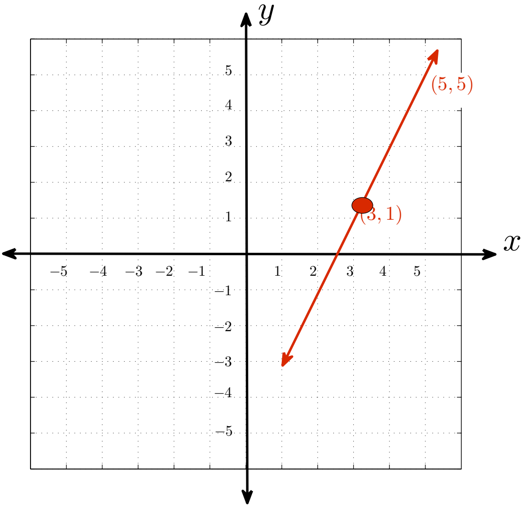

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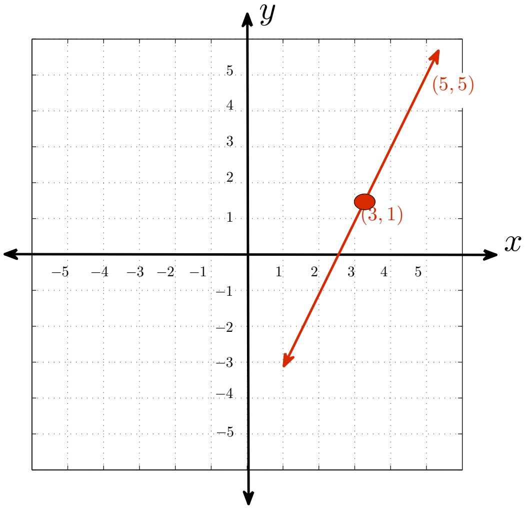

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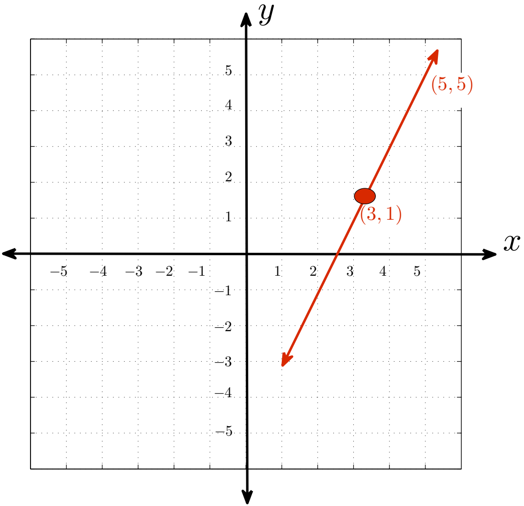

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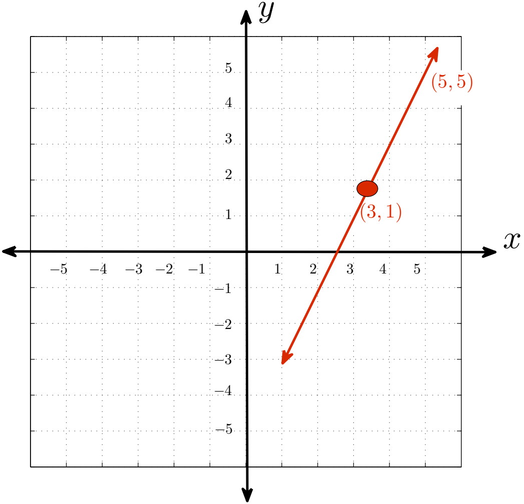

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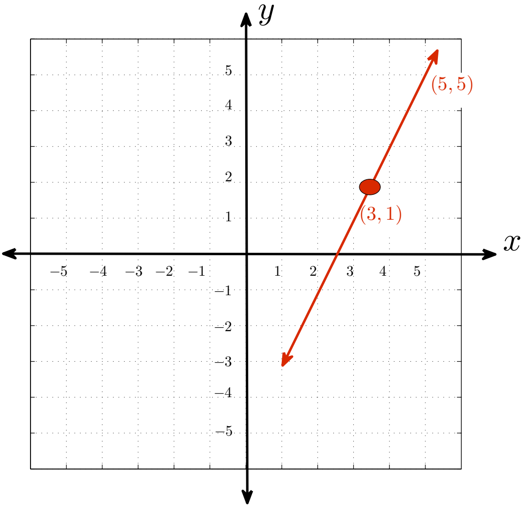

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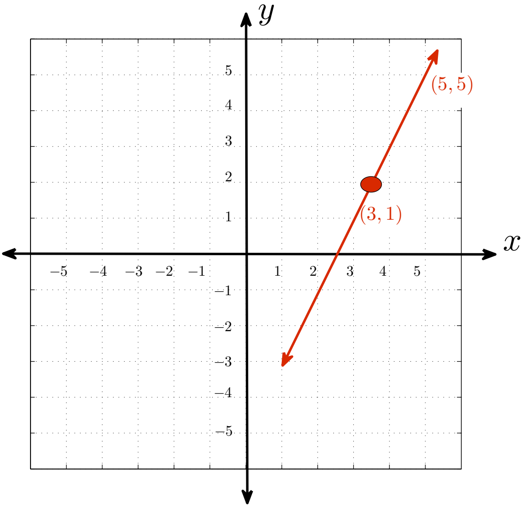

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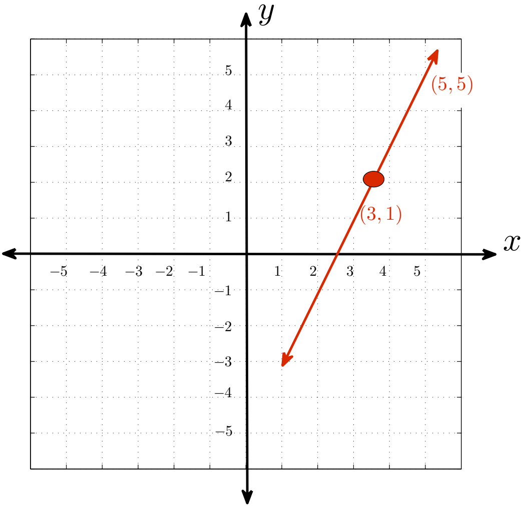

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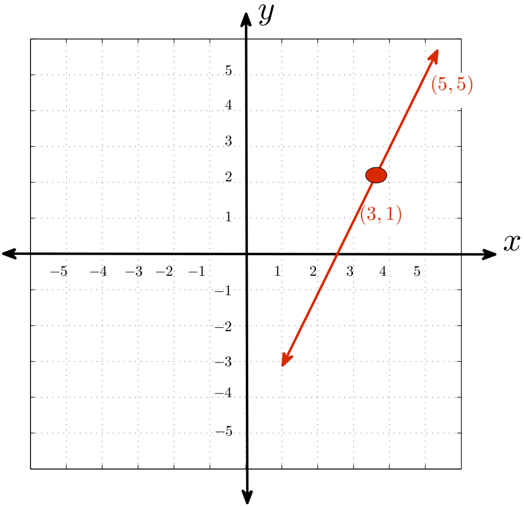

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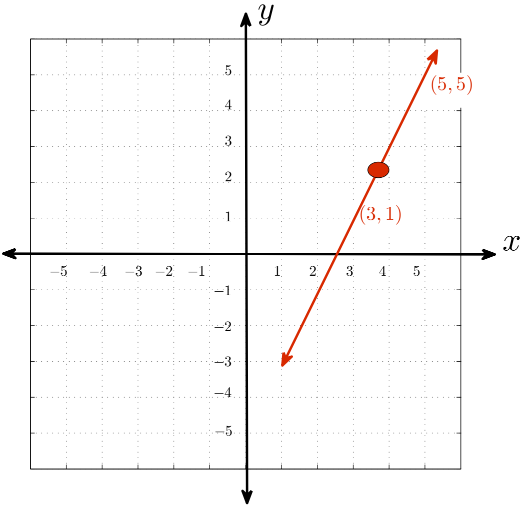

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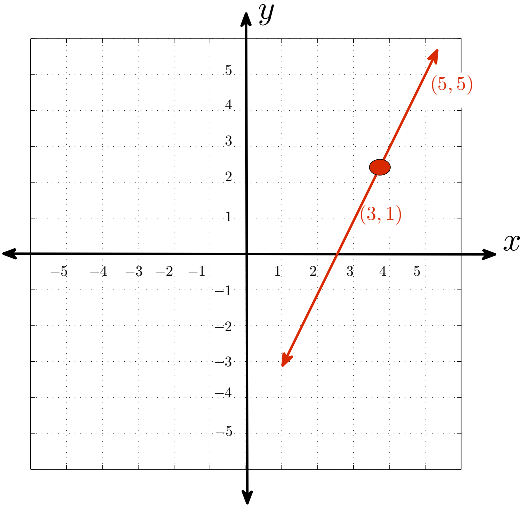

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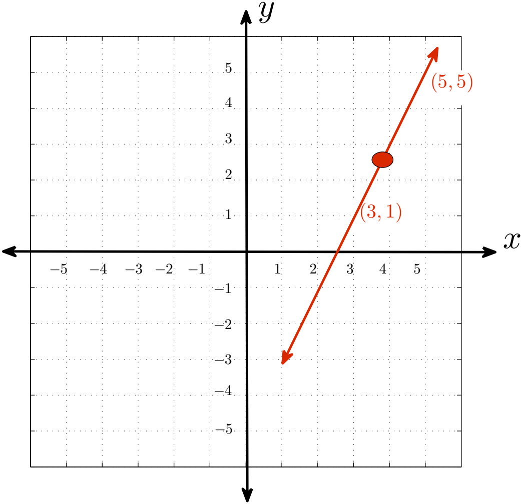

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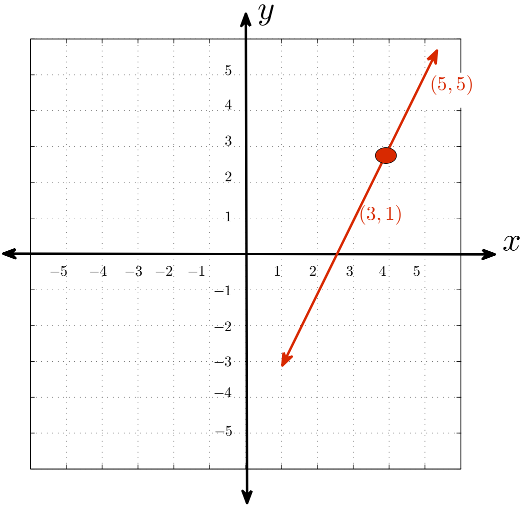

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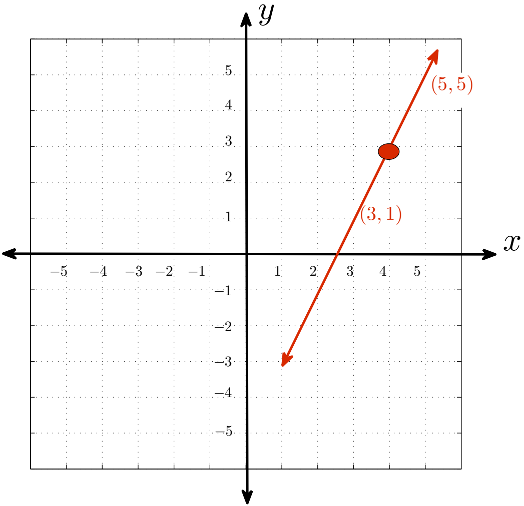

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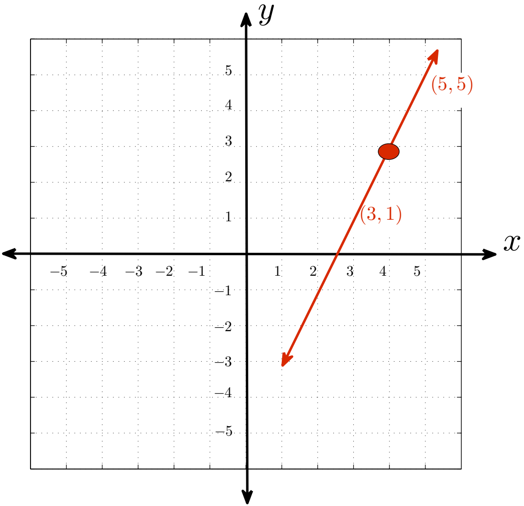

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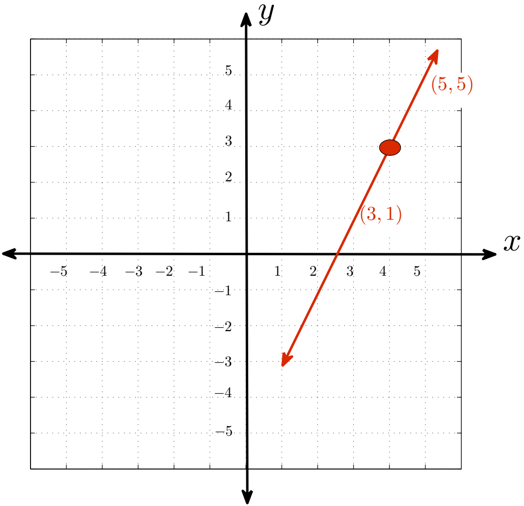

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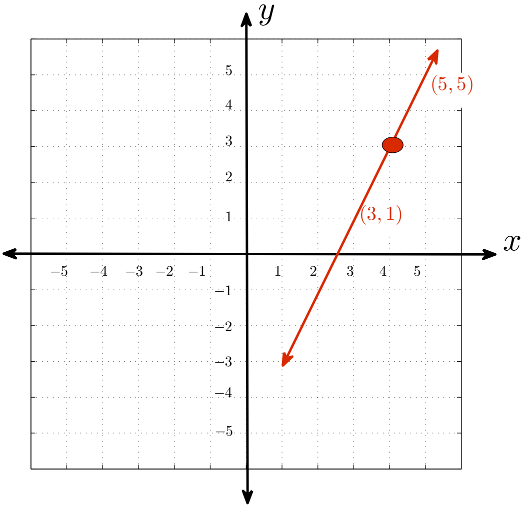

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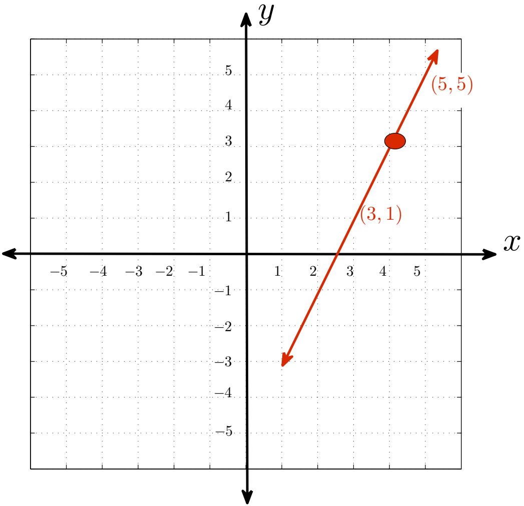

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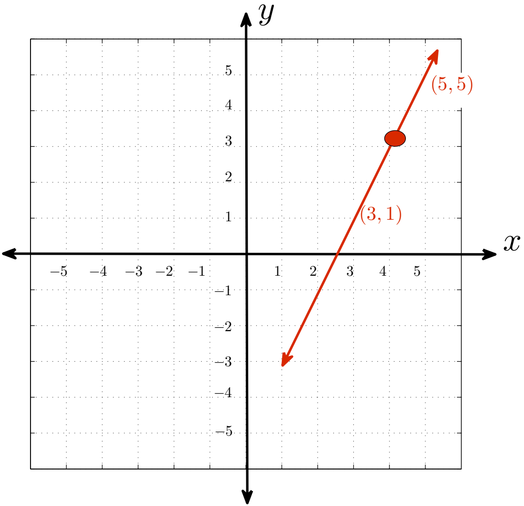

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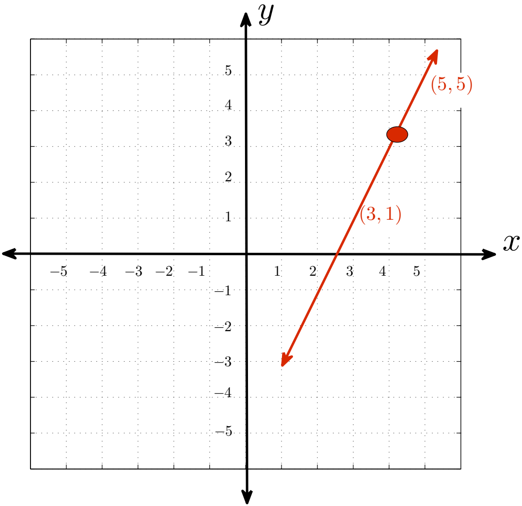

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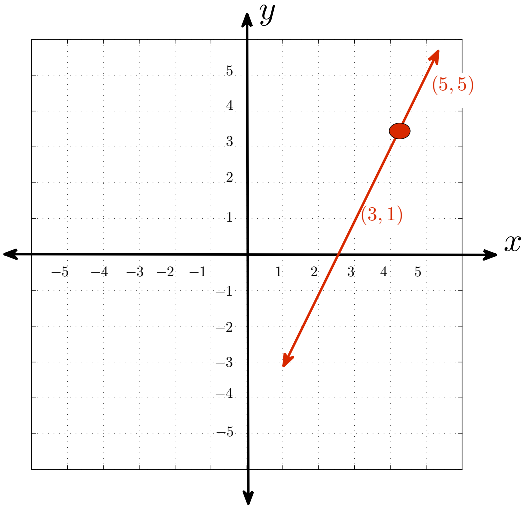

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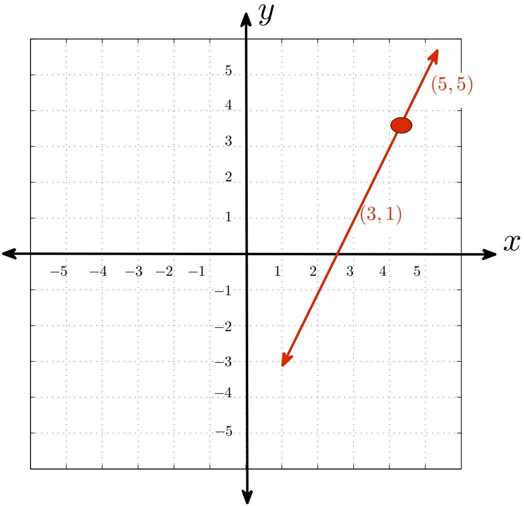

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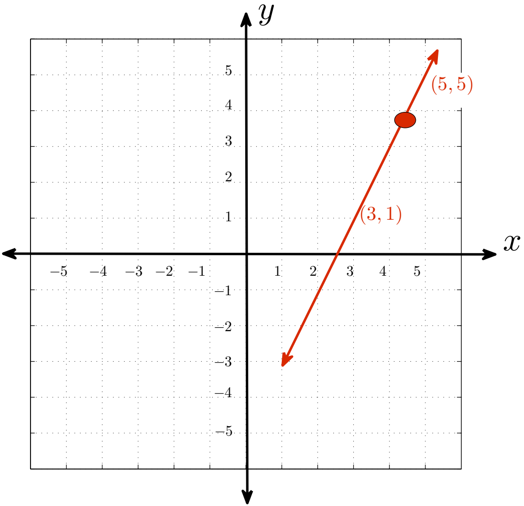

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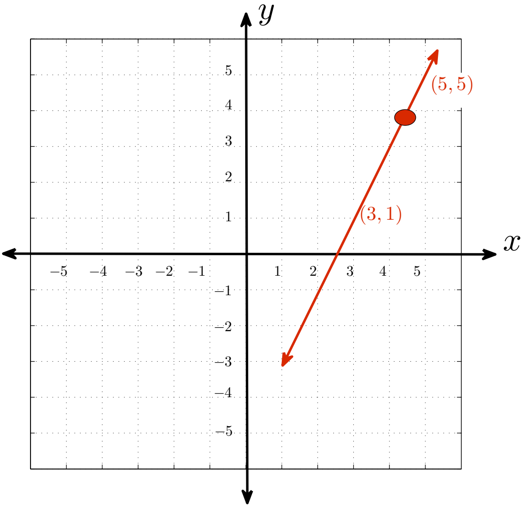

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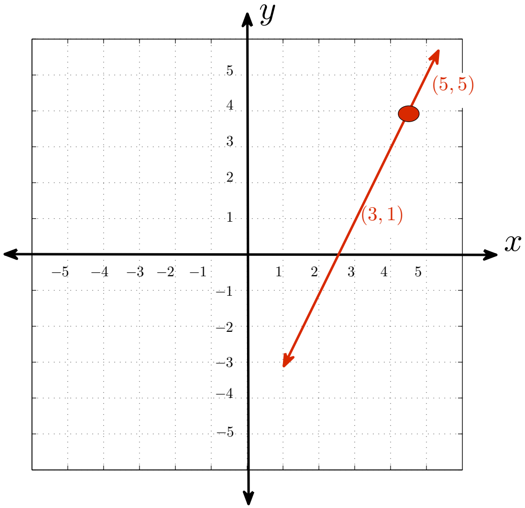

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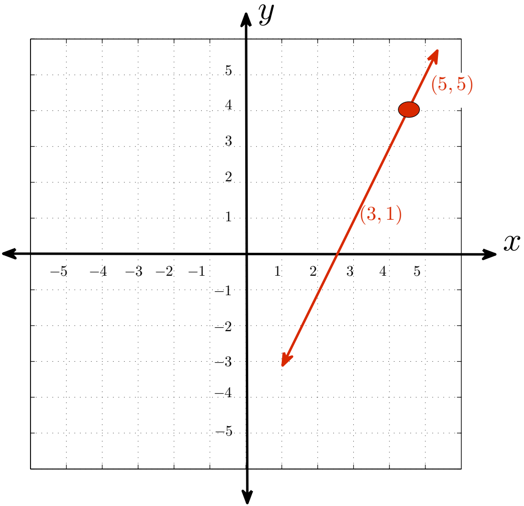

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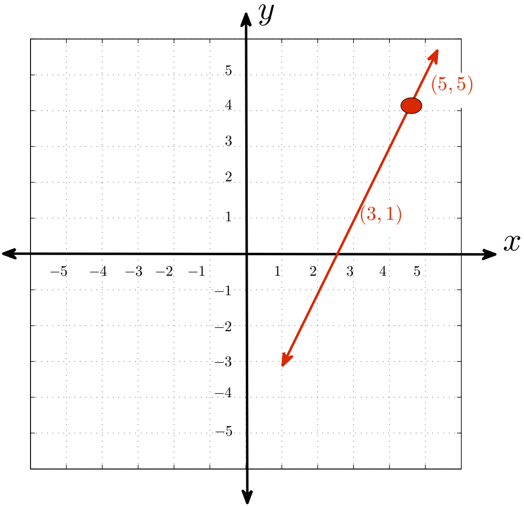

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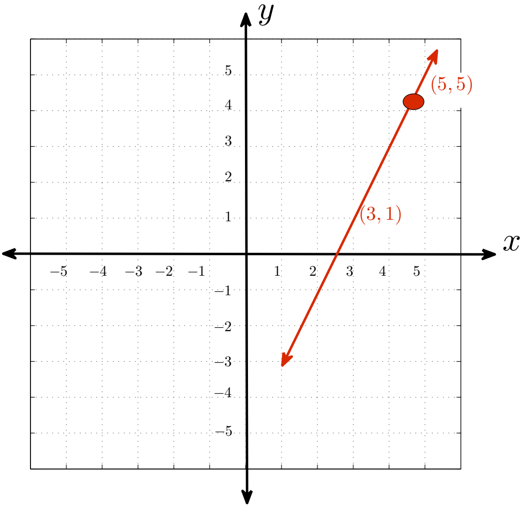

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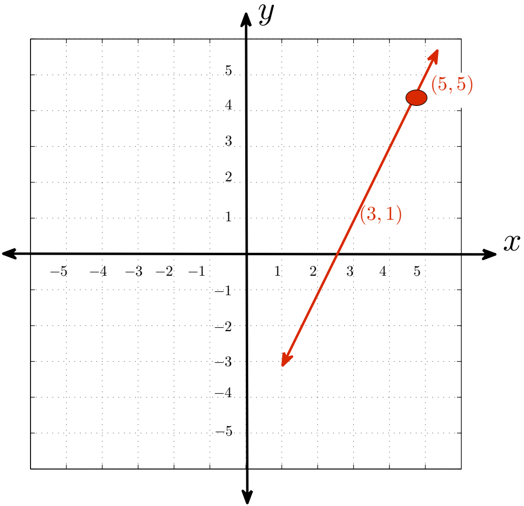

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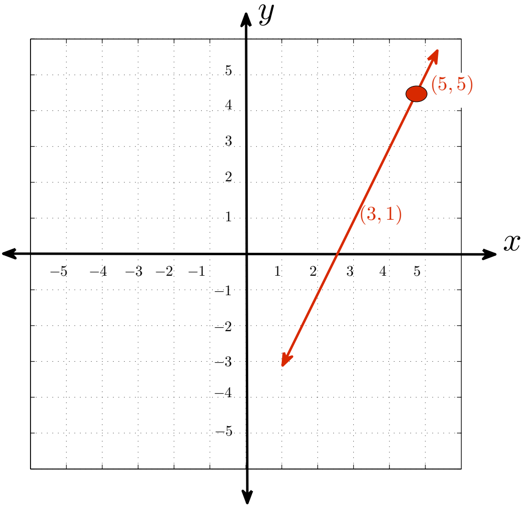

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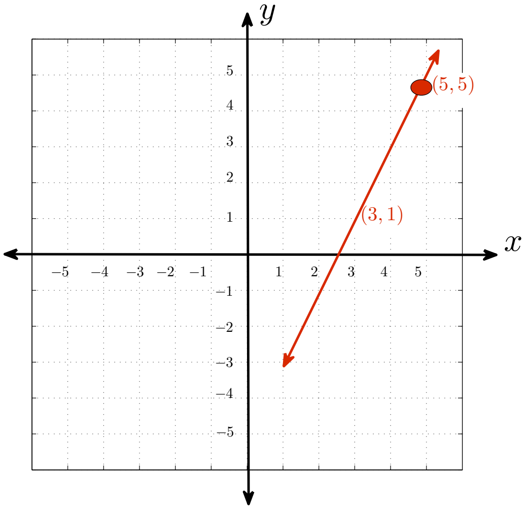

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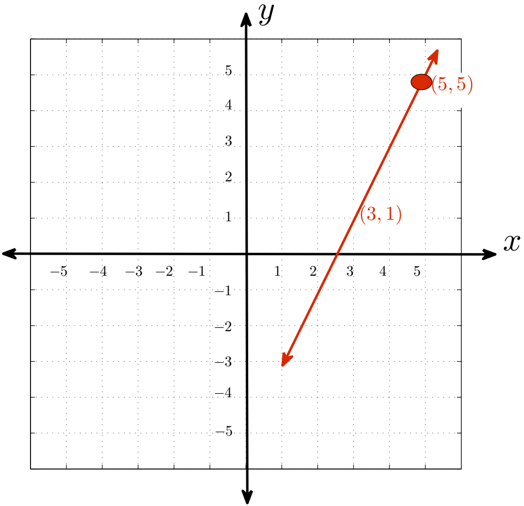

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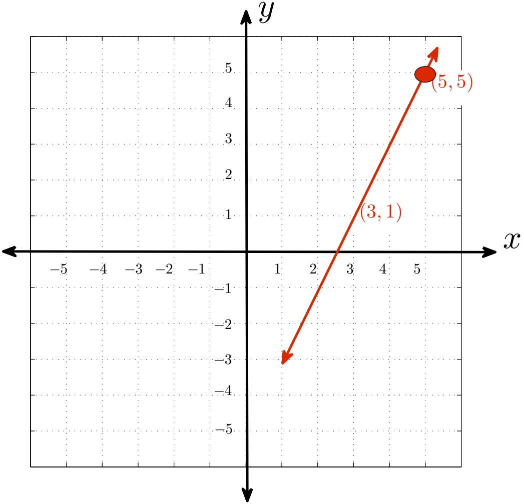

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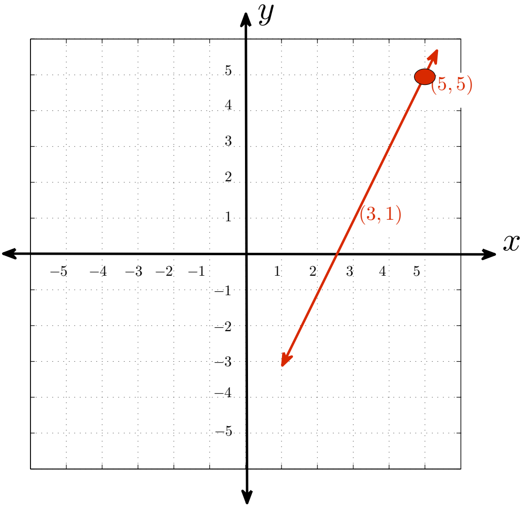

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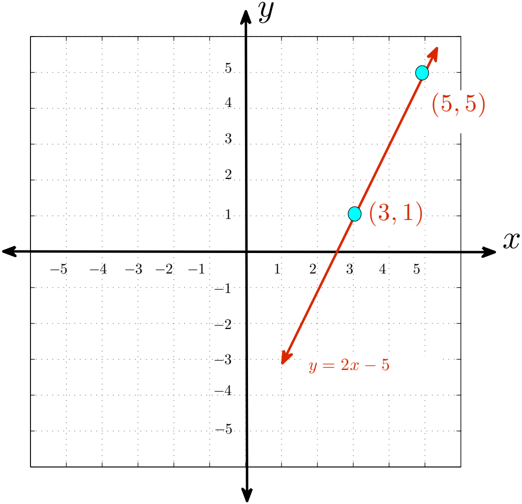

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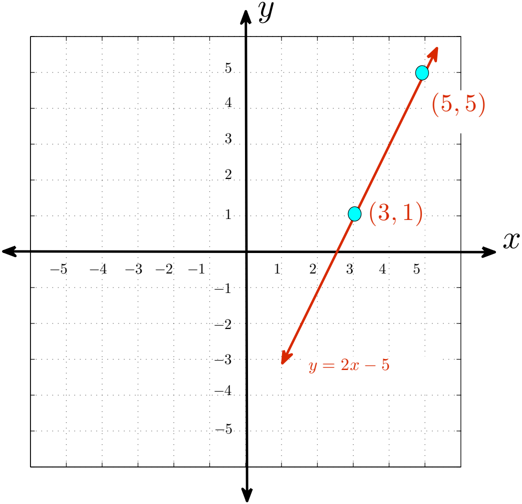

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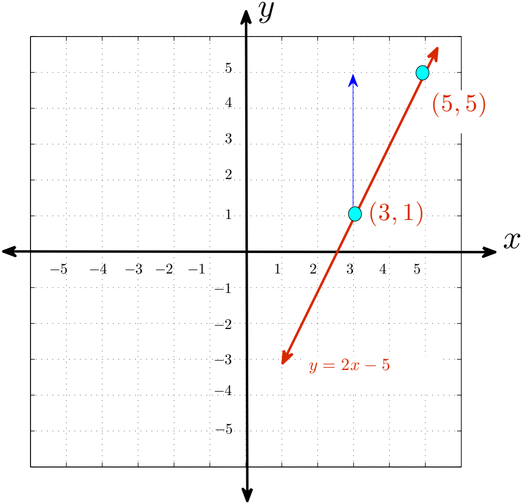

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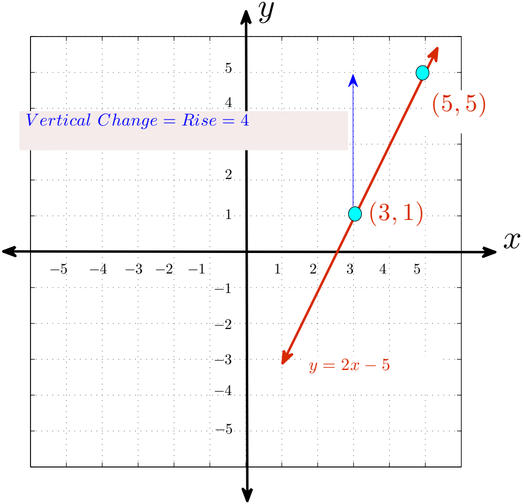

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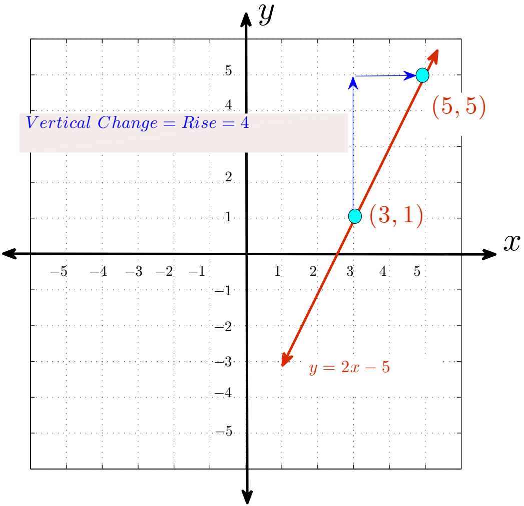

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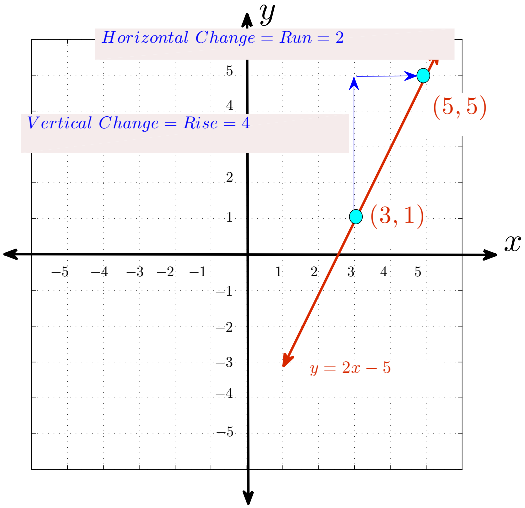
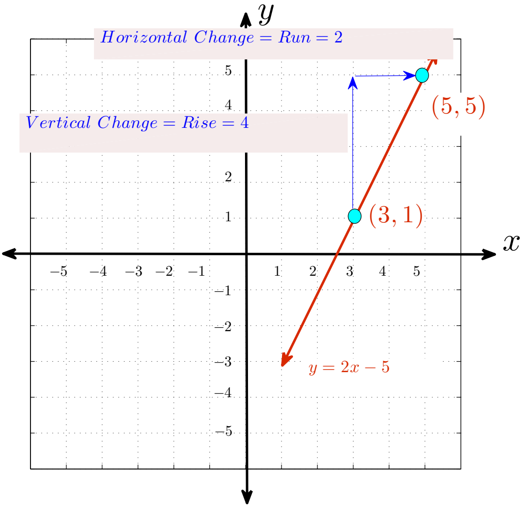
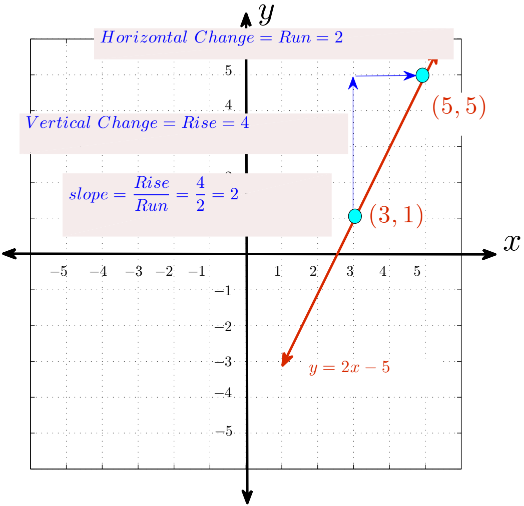


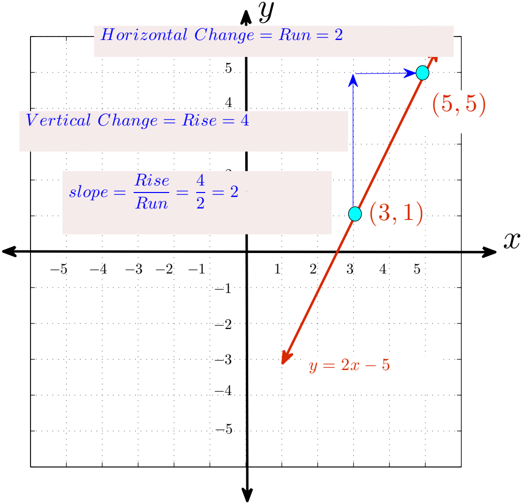
$$slope = \frac{Rise}{Run} = \frac{4}{2} = 2$$



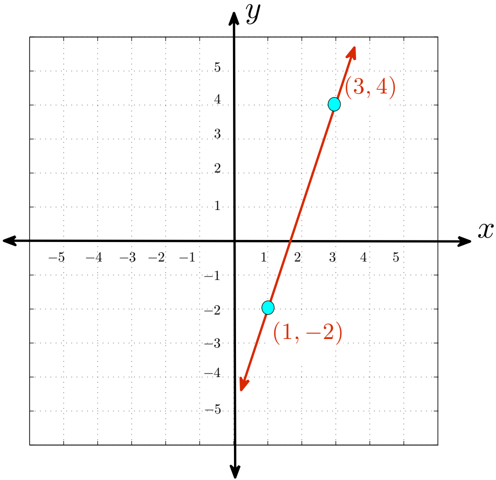
Notice that the vertical change is measured by subtracting the y-coordinates of the two points, 5 – 1 $=$ 4.



Notice that the vertical change is measured by subtracting the *y*-coordinates of the two points, 5 – 1 $=$ 4. The horizontal change is the difference between the *x*-coordinates, 5 – 3 $=$ 2.

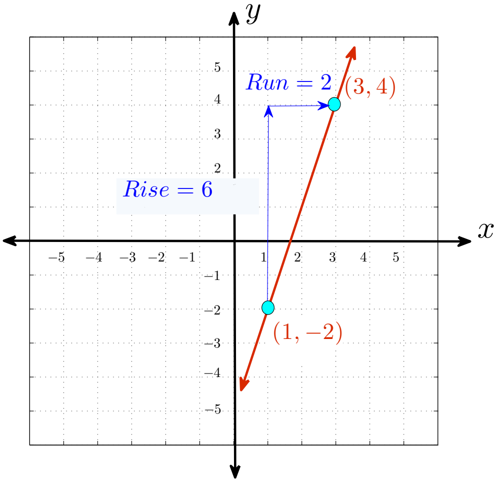


Ex. Find the slope of a line through $(3, 4)$ and $(1, -2)$.



Ex. Find the slope of a line through (3, 4) and (1, –2).

$$slope = \frac{Rise}{Run} = \frac{6}{2} = 3$$



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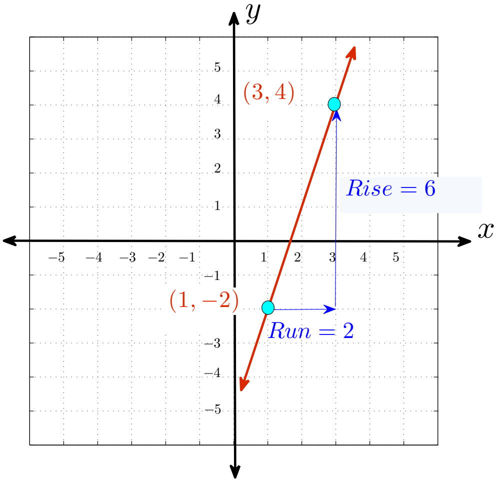
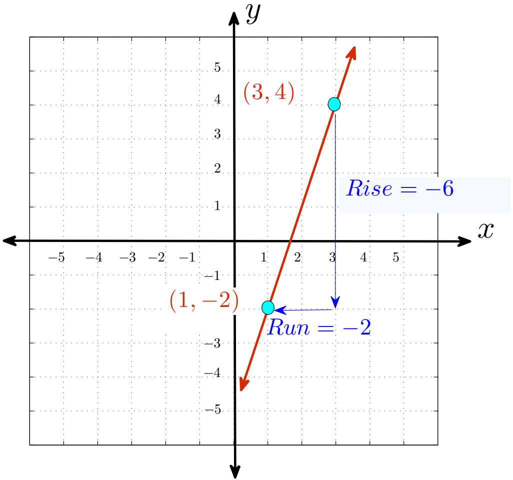


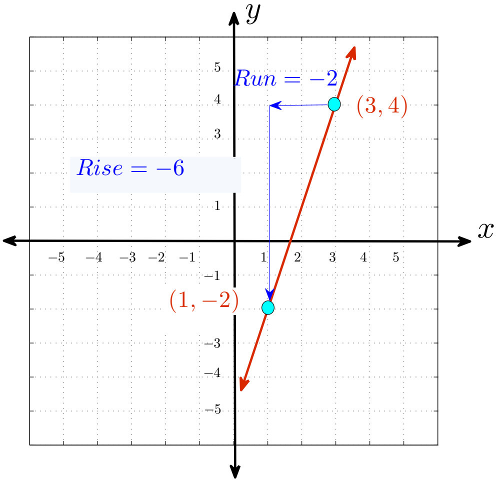
Ex. Find the slope of a line through (3, 4) and (1, –2).

$$slope = \frac{Rise}{Run} = \frac{-6}{-2} = 3$$

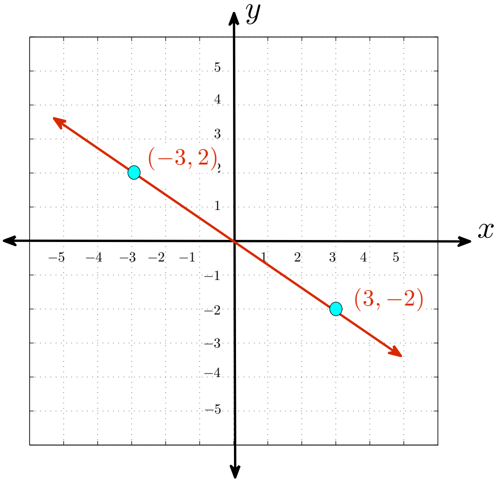


Ex. Find the slope of a line through (3, 4) and (1, –2).

$$slope = \frac{Rise}{Run} = \frac{-6}{-2} = 3$$

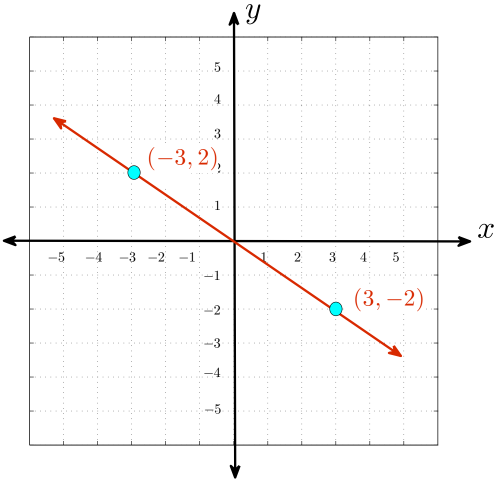


Ex. Find the slope of a line through $(-3, 2)$ and $(3, -2)$.



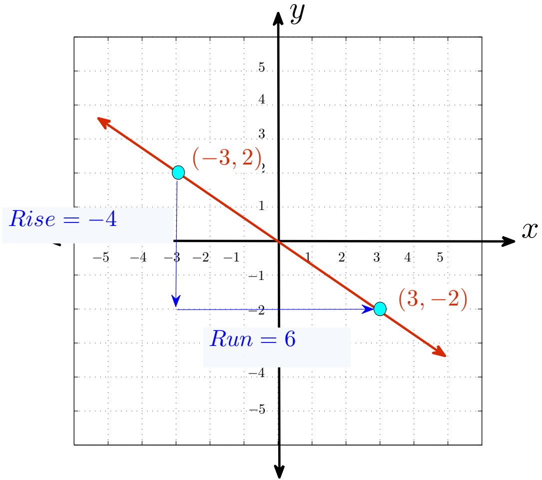
Ex. Find the slope of a line through (–3, 2) and (3, –2).

We expect a negative slope for the solution because the graph of the line falls from left to right.



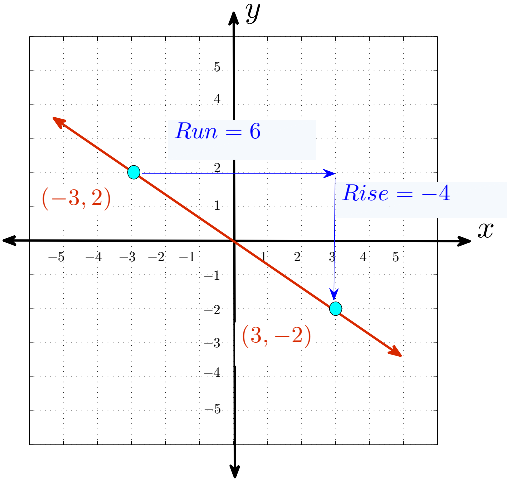
Ex. Find the slope of a line through (–3, 2) and (3, –2).

$$\textit{slope} = \frac{\textit{Rise}}{\textit{Run}} = \frac{-4}{6} = \frac{2\cdot(-2)}{2\cdot\ \ 3} = \frac{\not{2}\cdot(-2)}{\not{2}\cdot\ \ 3} = -\frac{2}{3}$$



Ex. Find the slope of a line through (–3, 2) and (3, –2).

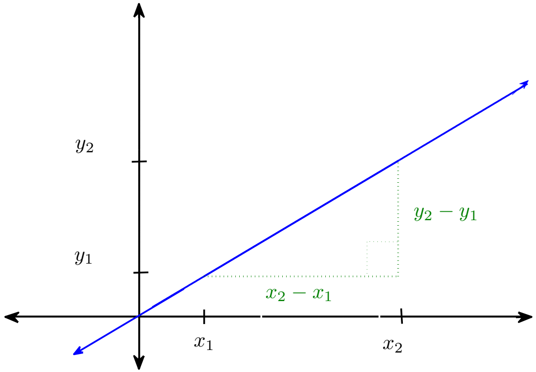
$$slope = \frac{Rise}{Run} = \frac{-4}{6} = \frac{2\cdot(-2)}{2\cdot\ \ 3} = \frac{\not{2}\cdot(-2)}{\not{2}\cdot\ \ 3} = -\frac{2}{3}$$



Definition

Let (x_1, y_1) and (x_2, y_2) be any two points on the rectangular coordinate plane. The **SLOPE** of a line which passes through the points (x_1, y_1) and (x_2, y_2) is m, where m is given by the formula:

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



Classroom Examples: Take the next three minutes to work these 2 problems.

Use the slope formula, $m = \dfrac{(y_2 - y_1)}{(x_2 - x_1)}$, to find the slope of a line containing the given points.

- $(7, -4)$ and $(4, 2)$
- $(2, -3)$ and $(-1, -3)$

Theorem

If line L_1 *has slope* m_1 *and line* L_2 *has slope* m_2, *then*

$$L_1 \text{ is parallel to } L_2 \text{ if and only if } m_1 = m_2$$

Theorem

If line L_1 *has slope* m_1 *and line* L_2 *has slope* m_2*, then*

L_1 *is perpendicular to* L_2 *if and only if* $m_1 \cdot m_2 = 1 \left(\text{or } m_1 = -\dfrac{1}{m_2} \right)$

Theorem

If line L_1 *has slope* m_1 *and line* L_2 *has slope* m_2*, then*

L_1 *is perpendicular to* L_2 *if and only if* $m_1 \cdot m_2 = 1$ $\left(\text{or } m_1 = -\frac{1}{m_2}\right)$