

# Cartesian Plane: Point-Slope Formula for Lines

Video companion

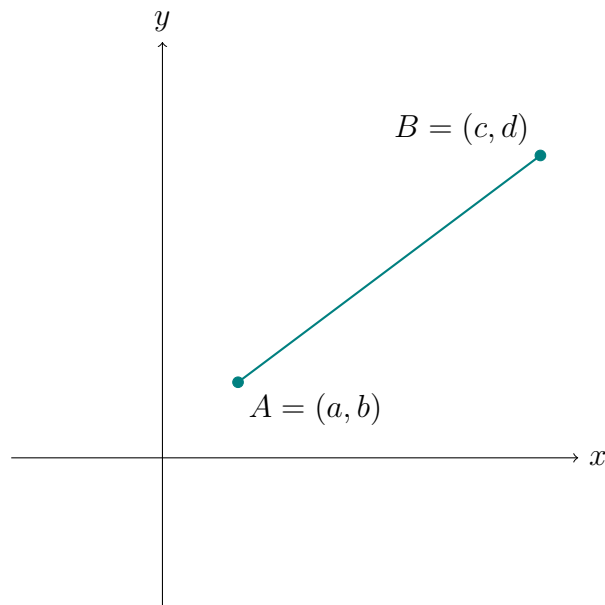
## 1 Introduction

In this video: Demystify formulas for equations of lines

$$y - y_0 = m(x - x_0) \quad \text{Point-slope form}$$

$$y = mx + b \quad \text{Slope-intercept form}$$

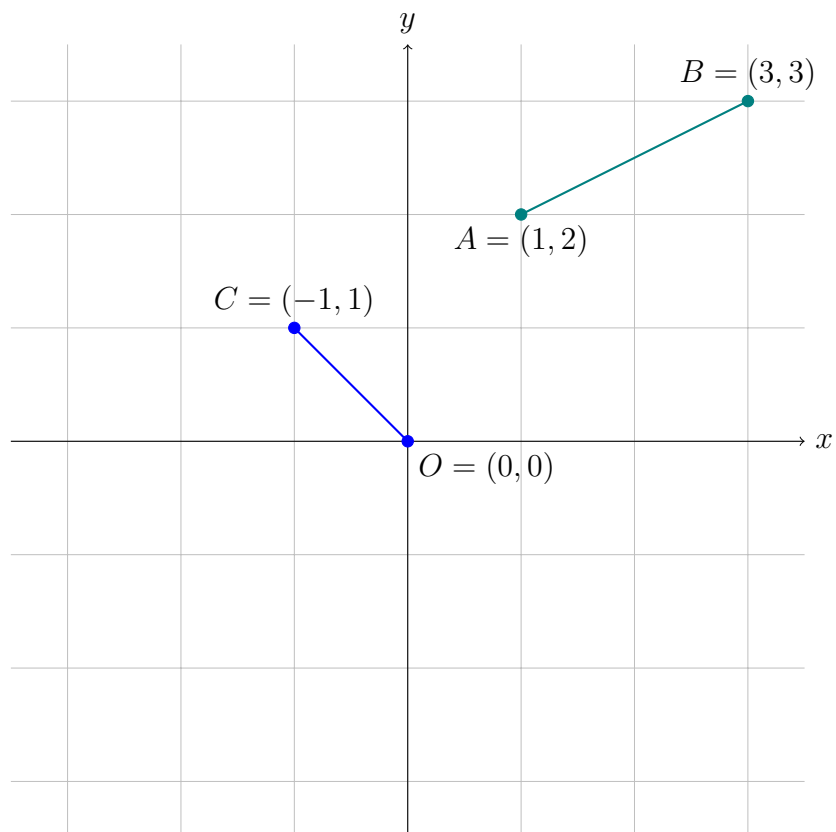
## 2 Slope of a line segment



Slope of  $\overrightarrow{AB}$ :

$$m = \frac{d - b}{c - a} = \frac{\text{“rise”}}{\text{“run”}}$$

### 3 Examples



Slope of  $\overrightarrow{AB}$ :

$$m = \frac{3 - 2}{3 - 1} = \frac{1}{2}$$

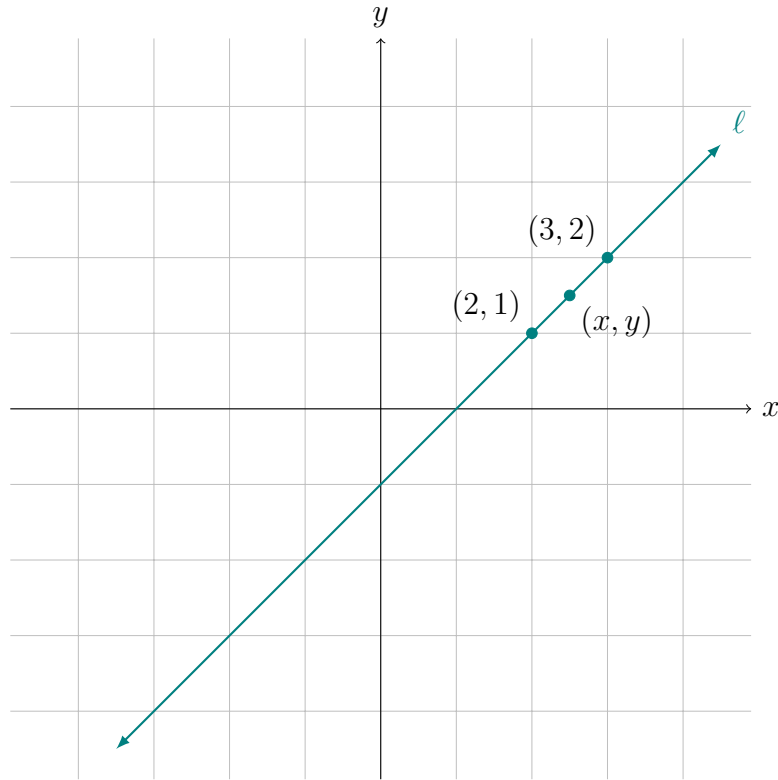
$m = \frac{1}{2}$  is a positive slope.

Slope of  $\overrightarrow{CO}$ :

$$m = \frac{0 - 1}{0 - (-1)} = -1$$

$m = -1$  is a negative slope.

## 4 Equation of a line



For a point  $(x, y)$  to be on the line, the line segment from  $(2, 1)$  to  $(x, y)$  need to have a slope of 1.

$$1 = \frac{y - 1}{x - 2}$$
$$y - 1 = 1(x - 2)$$

The line is defined by this formula:

$$\ell = \{(x, y) \in \mathbb{R}^2 : y - 1 = 1(x - 2)\}$$

Check that  $(3, 2)$  is on the line:

$$(3, 2) \in \ell?$$
$$2 - 1 \stackrel{?}{=} 1(3 - 2)$$
$$1 \stackrel{?}{=} 1 \quad \checkmark$$

Check if  $(5, 1)$  is on the line:

$$(5, 1) \in \ell ?$$

$$1 - 1 \stackrel{?}{=} 1(5 - 2)$$

$$0 \stackrel{?}{=} 3 \quad \times$$

## 5 Point-slope formula

If a line  $\ell$  has slope  $m$ , *and* if  $(x_0, y_0)$  is *any* point on  $\ell$ , then  $\ell$  has the equation

$$\boxed{y - y_0 = m(x - x_0).}$$