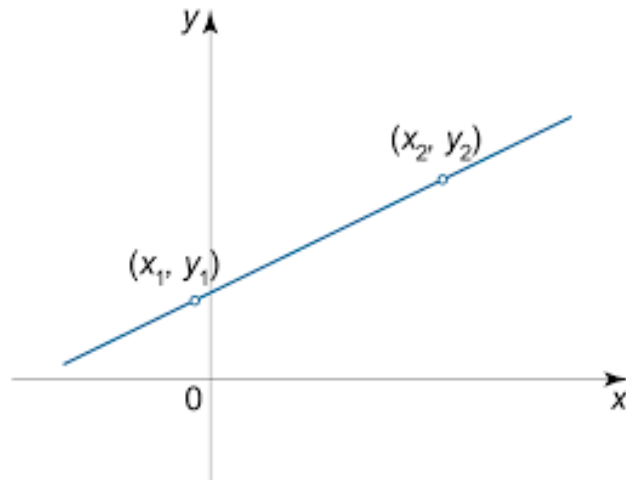


Key Formulas for the Equation of a Line



The most important feature of a line is the rate at which it increases or decreases, which we call **slope**.

To find the slope m of any straight line, all we need is two points (x_1, y_1) and (x_2, y_2) which the line runs through, such as the ones shown above.

$$\text{Slope: } m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope Intercept Form

$$y = mx + b$$

- good for when we are given the slope and y-intercept of the line
- b is the y-value of the y-intercept of the line

Point Slope Form

$$y - y_1 = m(x - x_1)$$

- good for when we are given the slope of the line and a point that the line runs through
- x_1 and y_1 are the x- and y-values of any point the line runs through

Standard Form

$$Ax + By = C$$

- good for when we want to find the x- and y- intercepts of the line
- A, B, and C are uncharacteristic constants

Examples

- 1) A straight line runs through the points $(-1,4)$ and $(0,1)$. Write the equation of this line in **slope intercept form**.

First, we always want to find the slope: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 4}{0 - (-1)} = \frac{-3}{1} = -3$

Notice that one of the points given is our y-intercept $(0,1)$ – so we have everything we need.

$$m = -3, b = 1$$

So our slope intercept equation is given by $y = -3x + 1$

- 2) A line is described by the equation (in **standard form**): $6x + 8y = 24$
Find the x- and y- intercepts of this line.

This is quite simple. To find the y-intercept, we set $x = 0$, and to find the x-intercept, we set $y = 0$.

When $x = 0$:

$$0 + 8y = 24 \rightarrow 8y = 24 \rightarrow y = 3$$

So our y-intercept is $(0, 3)$

When $y = 0$:

$$6x + 0 = 24 \rightarrow 6x = 24 \rightarrow x = 4$$

So our x-intercept is $(4, 0)$

- 3) A straight line runs through the points $(-2,7)$ and $(2,-5)$. Write the equation of this line in **slope intercept form**.

First, the slope: $m = \frac{-5 - 7}{2 - (-2)} = \frac{-12}{4} = -3$

Sometimes it is useful to write our equation in one form and then transform it into the one we want. Initially, let's write it in **point slope form since we have a point and (we found) a slope. We could use either point - let's choose $(2,-5)$, but it is good practice to try it with both.

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - (-5) &= -3(x - 2) \end{aligned}$$

Now to put our equation into **slope intercept form**, we just solve for y and simplify.

$$\begin{aligned} y + 5 &= -3(x - 2) \\ y + 5 - 5 &= -3x + 6 - 5 \end{aligned}$$

$$y = -3x + 1$$