Different ways to write the equation of a line

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Ways to write an equation of line

There are different ways to write the equation of a line. If we consider the line above through the points $P_1(0, 6)$ and $P_2(3, 2)$ we can write the equation as,

$$y = mx + b$$

where,

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 6}{3 - 0} = \frac{-4}{3}$$

and $b = 6$, or

$$l : y = -\frac{4}{3}x + 6$$

Another way to write the equation of the line is to use one of the points in the formula below,

$$m(y - y_0) = (x_1 - x_0)$$

say the point $P_1(0, 6)$ which gives,

$$-\frac{4}{3}(y - 6) = x - 0$$

giving,

$$l : -\frac{4}{3}(y - 6) = x$$

The last way to write the equation of the line is in the form

$$Ax + By + C = 0$$

Using the fist form,

$$y = mx + b$$

let's try and rewrite this form into this third and final form of the equation of a line, $Ax + By + C = 0$.

$$y = -\frac{4}{3}x + 6 \qquad \textit{multiply both sides by 3}$$

$$3y = -4x + 18 \qquad \textit{bring all terms to one side of the = sign}$$

$$4x + 3y - 18 = 0$$

Now we have our third way to write the equation of a line.

$$l : 4x + 3y - 18 = 0.$$

Exercises

1. Find the equation of the line that goes through the points $P_1 = (2, -3)$ and $P_2 = (-1, 0)$.

2. Write the equation of the line found in #1 in the following three forms:

   a) $y = mx + b$

   b) $m(y_1 - y_0) = x_1 - x_0$

   c) $Ax + By + C = 0$.

