Finding a Linear Equation

The standard form for a linear equation is $y = mx + c$

If we are given two points (x_1, y_1) and (x_2, y_2)

Then the gradient is given by $m = (y_2 - y_1) / (x_2 - x_1)$ ①

Point (x_2, y_2) is arbitrary. We can replace with the general term (x, y) so

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

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

or $(y - y_1) = m(x - x_1)$ ②

But we can now replace m with ①. Hence by rearrangement

$$(y - y_1)/(y_2 - y_1) = (x - x_1)/(x_2 - x_1)$$ ③

Which looks a bit heavy but is quite logical.

Suppose we have the points (2, 3) and (6, 11)

First construct a simple table

x_1	y_1	x_2	y_2
2	3	6	11

And the substitute the values into $(y - y_1)/(y_2 - y_1) = (x - x_1)/(x_2 - x_1)$

$$(y - 3) / (11 - 3) = (x - 2) / (6 - 2)$$
$$(y - 3) / 8 = (x - 2) / 4$$
$$y = 2(x - 2) + 3$$
$$y = 2x - 1$$

Summary

If we're given a point and a gradient use ②. If we're given 2 points use ③

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