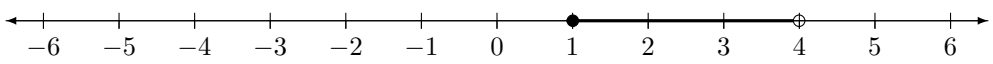
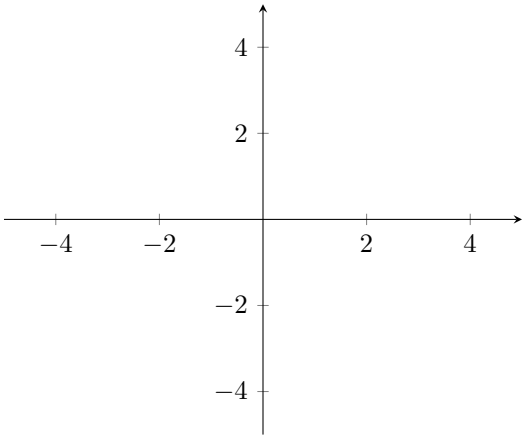
1 Graphing and solving linear equations through rearrangement, substitution and subtraction

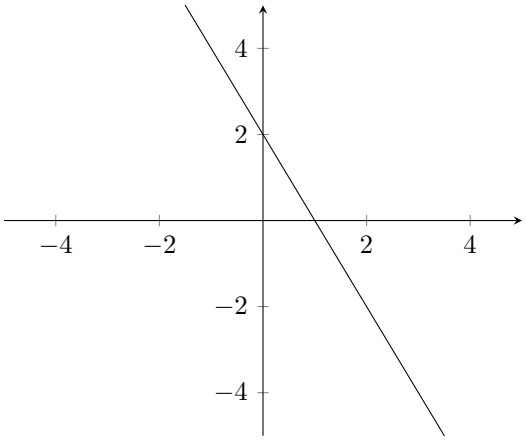
We begin our study of algebra by remembering the number line. If you haven't seen one in a while, it looks like this:



Here I used the number line to show adding $1 + 3$. But often we want to draw on two number lines at the same time, to see where our graphs intersect:



This is good because we can now plot not just one number, but two at the same time... and these relations can be expressed in line equations where each point on the line is a co-value for x and y that is true in the line equation:



These lines are expressed with equations like $y = mx + b$ where:

$$y = \underbrace{m}_{\text{the ratio of x and y}} x + \underbrace{b}_{\text{a constant value}}$$

It can be helpful to think about where m comes from:

$$\frac{y}{x} = \frac{y}{x} \rightarrow y = (\underbrace{\frac{y}{x}}_{\text{m}})x \tag{1}$$

We know slope is a ratio of $\frac{\Delta x}{\Delta y}$ and for any x and y this can be expressed:

$$\frac{y_2 - y_1}{x_2 - x_1} \tag{2}$$

1.1 Graphing line and finding the equation of a line with any two points that lie on it

We can draw the graph for a line equation $y = mx + b$ by:

- identifying the b-value on the y-axis... (hint: this is found by imagining x to be 0)
- drawing from that point the line slope given by m

We can also find a line equation from any two points on the graph $(x_2, y_2)$and (x_1, y_1) by reversing the process:

- finding m, or the slope with $\frac{y_2 - y_2}{x_2 - x_1}$
- substituting one of our points for x and y and the value we just found for m to solve for b