What is integral and why would I know that?

Imagine that we have some kind of function of depending on something.

For example, you can visualize the speed of my work depending on the time of day on a graph like this:

I measure my speed in code lines per minute, in real life I am a programmer.

The amount of work is the speed of my work multiplied by time. That is, if I write 3 lines per minute, I get 180 per hour. If we have such a graph, we can find out how much work I have done in a day: this is the area under the graph. But how do I calculate it?

Let's divide the chart into bars of equal width with the value per hour. And the height of these bars will be equal to the speed of work in the middle of this hour.

The area of each bar is easy to calculate separately, we need to multiply its width by the height. It turns out that the area of each column is about how much work I did in each hour. And if you sum up all the columns, you get an approximate amount of my work for the day.

The problem is that the result is approximate, and we need an exact number. We'll break the chart into columns for half an hour:

You can see in the picture that it is much closer to what we are looking for.

In this way we can reduce the intervals on the chart to infinity, and each time we will get closer and closer to the area under the chart. And when the width of the bars will tend to zero, then the sum of their areas will tend to the area under the chart. This is called an integral and is denoted like this:

In this formula, f(x) means a function that depends on the value of x, and the letters a and b are the segment on which we want to find the integral.

Why do we want to find it?
Scientists try to express all physical phenomena as a mathematical formula. Once we have a formula, we can use it to calculate anything further. And the integral is one of the main tools for working with functions.

For example, if we have a formula for a circle, we can use the integral to calculate its area. If we have a formula for the sphere, we can calculate its volume. With the help of integration we find energy, work, pressure, mass, electric charge and many other values.

No, why would I do that?
No, just out of curiosity. In fact, integrals are even in the school curriculum, but not many people around remember what it is.