A Primer in the Math Needed for Econ 101

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Abstract

The math needed for an introductory economics class is not difficult. In case you need some reminders, here's a brief summary.

1 Absolute Values

The absolute value of a number is how far away it is from zero. So the absolute value of 3.14 is 3.14 and the absolute value of -5 is 5. The mathematical symbol for absolute value is two vertical lines around the number, e.g. $|x|$.

2 Functions

A function is a little like a factory: it takes an input and changes it into an output. For example if you had 7 as your input into a function that squared whatever you fed it, the output would be 49. If you input 12 into a function that trebled everything, the output would be 36.

This is what we mean when we say $y = f(x)$. Here, y is the output, x is the input, and f is the function. When economists talk about 'demand functions', we mean that the input is the price of a good (P), the demand function (D) is how the market reacts to that, and the output (Q) is how much is demanded. In mathematical notation, we would say $Q = D(P)$. For example, if 100 units are demanded at a price of 2, we could express this as $100 = D(2)$. Of course just like converting $x = 10y$ into $y = \frac{1}{10}x$, we could flip the demand function into the "inverse demand function", expressing the price as a function of the quantity provided.

These are all examples where there is only one input, but we can generalize this to as many inputs as we like. If we wanted to express y (e.g. inflation) as a function of a, b, and c (e.g. oil prices, interest rates, and unemployment) we could write $y = f(a, b, c)$.

2.1 An example

The above section was to help you understand the mathematical notation of functions. This subsection provides you with an example of using functions. Suppose the hourly wage (y) your job pays you depends on a base rate (a) and some fraction (b) of your sales (x). In general, we could write this as $y = f(a, b, x)$. If you think about this for a little while, you

should be able to convince yourself that the relationship can be expressed as $y = a + bx$.[1]

Let's say your base rate is 3 dollars and you get 50% of all sales. In this case, we can write your wages as $y = 3 + 0.5x$.

3 Slopes

A slope measures how responsive one variable is to another. If the slope of a line is 100, it's a lot more sensitive than if the slope were 3.

***Key Point*:** Slope of a Line $= \dfrac{\Delta Y}{\Delta X}$

When I was in high school, the formula I remembered to calculate the slope was "the rise over the run". By that I mean you look at how much it goes up (the 'rise', or ΔY) and divide by how much it changes horizontally (the 'run', or ΔX).[2]

3.1 An Example

Consider the wage example from above, where you earn one-half of your sales as a bonus. Remember that the slope measures how responsive one variable is to another. Apply that logic here and you should automatically see that the slope of the wage line must be one-half. As your sales go up by 50, your wage goes up by 25. The rise over the run is 25 divided by 50 which equals $\frac{1}{2}$.

4 Areas

The area of a triangle is half the base by the perpendicular height. The area of a rectangle is the base by the height.

5 Expected Value

The expected value is a *weighted average* of the possible values a variable can take. In general, you write out (the probability of an event) $\times$ (the outcome) for each event, and then add them up.

For example, if I offer you three hidden doors behind which are \$1, \$5, and \$10 (but you don't know which is behind which) the expected value of this is $(\frac{1}{3} \times 1) + (\frac{1}{3} \times 5) + (\frac{1}{3} \times 10) = 5.33$. It does not matter that the expected value is not one of the options; that's not what we mean by 'expected value'. Rather the expected value is the average amount that would be earned if this game were played by many different people.

[1] This is important. Do convince yourself of it.

[2] If you're familiar with calculus, you can think of the slope as the same thing as the derivative. Relating back to our talk of functions, if $y = f(x)$, then the slope is $f'(x)$ or $\frac{dy}{dx}$. If you're not taking calculus and this confuses you, don't worry about it and just ignore it.