

Learning Algebra: How and Why

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If you ever learn to play the harp, you will spend a lot of time with pages of music that look something like this:



Maybe you know how to read music, or maybe you don't. But look at this: the same few notes, over and over again, just moved up or down the scale a little. Not very interesting music. Why bother with it?

Because in more interesting music that you will *want* to play sometime, your fingers will have to make these movements. To learn to do them well, you need to do them over and over and over again. There are books with pages and pages and pages of only this kind of music. These are called *finger exercises*. No one other than a teacher will ever ask you to play such music. But anyone who has to listen to you play will be glad that you played it, over and over and over again. Without all that practice, you will probably never play very well.

After months of lessons and ever so many finger exercises, one day you discover that you can play real music. What you couldn't do before, you can do now. All that work pays off.

Perhaps your favorite thing in life will be playing a musical instrument. Or maybe it will be basketball, or dancing, or something else. It might even be algebra. Math has that effect on some people. A few people pick these things up and do them extremely well with hardly any effort. Most of us have to work at it.

With algebra, there are a lot of little things to learn. To learn them well, most people need to do them over and over and over again, like finger exercises for the harp. That's why we have homework. Some of these things will make you wonder why you are learning them. By themselves, they don't seem to mean much. Some are so simple, while others are more complicated, but they don't look like they could be important or useful. Then you start to put them together with other math ideas, and you discover they *are* important, and they *are* useful.

Here is an example: for *any* numbers a, b, and c:

$$(a+b)+c = a+(b+c)$$

It also works for multiplication:

$$(a*b)*c = a*(b*c)$$

But it doesn't work for subtraction or division. This is the **Associative Property**. It doesn't look like much, does it? But if you go far in your study of mathematics, you will eventually discover that this simple equation is one of the most important things you know. It is not an exaggeration to say that it has cosmic significance. If you don't go so far in your study of mathematics, you will still use the Associative Property a lot, even if you don't realize it. We use this so much, and it seems so natural, that it is often hard to notice.

Here is another example: for *any* numbers a and b:

$$a+b = b+a$$

It also works for multiplication:

$$a*b = b*a$$

But it doesn't work for subtraction or division. This is the **Commutative Property**. It also has cosmic significance, even if you don't see that now.

There are many other things to learn. You could think of them as finger exercises. You could also think of them as tools in a toolbox. You need to learn when to use them, and how to use them, and how to be sure they did what you wanted them to do.

You may still be wondering why you should learn these things at all. Here is one good reason: **algebra lets you change the structure of equations without changing their meaning**. That is what algebra *does*. Why is that important?

Let's say you have heard about a new shoe for sale down at the athletic store. Everyone is raving about them, so you go to see. You pick one up and look at it. You look at it from the front. You look at it from the side. You look at it from the top and the bottom. You even look inside. Algebra is like this. It helps you look at things from different directions, always being sure you really are looking at the

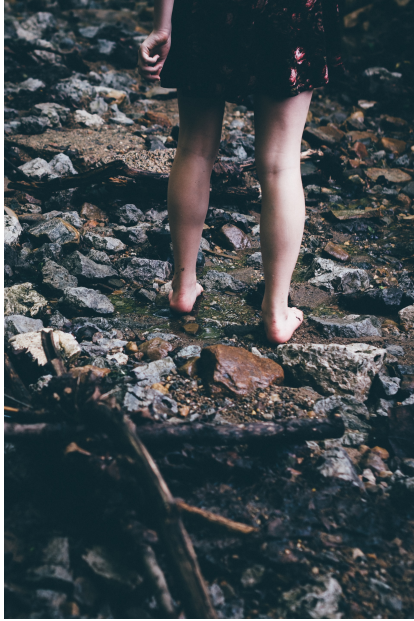


same thing. **Many of the remarkable things people make these days couldn't be made without looking at their mathematical descriptions first, from lots of different directions, before trying to make them.** Algebra can do that.

Or perhaps you have heard about a different kind of shoe at a different kind of store. These are shoes you might wear to a formal dance or on an elegant date. Everyone is raving about them, so you go to see. They are beautiful. They are also



complicated: maybe you haven't seen straps like that before. Of course, you have questions. Can you really get your feet into them? And can you walk in them without falling over? Because if you can't, it doesn't matter how beautiful they are. In a shoe store, you can answer these questions by trying them on. But important questions can't always be answered so easily. **Algebra converts many complicated questions and answers into simpler ones that mean the same thing, so you can understand them better before deciding what to do.**



Maybe you don't care about shoes, because you like to go barefoot. That can be nice, especially on the beach in the summer. But if there is snow on the ground, or sharp rocks and thorns in your path, you will wish for shoes. Now imagine you didn't even know that shoes exist. There would be places you couldn't go, even if you needed whatever was there. Algebra is like this, too. Even if you don't solve equations in your everyday life, there is a *style of thinking* that goes along with algebra, and it is useful for other things besides algebra. We might call it **Thinking On Purpose**. Does it surprise you to learn that thinking on purpose is something people don't do naturally? We have to learn how. Without this kind of thinking, much of modern life is like walking a hard path without shoes: very painful or simply not possible. Algebra is a good way to learn and practice Thinking On Purpose. You will need this in your life. You will also need to know when you are doing it, and when you aren't, and when other people aren't.

This doesn't happen overnight. Just as with learning to play a musical instrument, or learning to play basketball, or learning to dance, most people have to work at learning to do algebra. You have to decide it is important, and keep deciding it is important for a long time. Then you discover that your work has paid off and you really can do this. And, just as with playing real music on a challenging instrument, it even feels good.

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Bare feet photo by [Jordan Whitt](#) on [Unsplash](#)