Algebra

Variables

A variable is a letter that stands for a number. For example, when we used the letter "b" to stand for the base of a triangle, we were using the variable b. Variables are used in algebra.

Here are some examples of word phrases and their translations into algebra expressions:

|  |  |  |
| --- | --- | --- |
| **Word Phrase** | **Expression** | **Comment** |
| three times a number | 3x | A number next to a variable means multiply |
| half of a number | x/2 | "half of", "third of", "one fifth of" all mean multiply by fractions, or divide by the denominator |
| one minus 3 times a number | 1 - 3x |  |
| one *less than* 3 times a number | 3x - 1 | Tricky! "less than" means subtract from what follows the "less than" |
| a number *increased* by 5 | x + 5 | The word "increase" means add |
| a number *decreased* by 8 | x - 8 | The word "decrease" means subtract |
| 8 *more than* 5 times a number | 5x + 8 | "more than" means add |
| 6 *less than* 3 times a number | 3x - 6 | "less than" means subtract from what follows the "less than" |

This table shows some very common word sentences and their translations into algebra equations. They all have phrases like "I get", "the result is", or just "is" that make them equations.

|  |  |  |
| --- | --- | --- |
| **Sentence** | **Equation** | **Comment** |
| I subtract one from my number and *I get* 5 | x - 1 = 5 | "I get" is the equal sign |
| I multiply my number by 4 and *I get* 8 | 4x = 8 | "I get" is the equal sign |
| I take half of my number, decrease it by 6 and *the result is* 4 | x/2 - 6 = 4 | "the result is" is the equal sign |
| 3 less than half my age is 2 | x/2 - 3 = 2 | Here, the simple "is" is the equal sign |

Solving Algebra Equations

Solving equations like 3x + 5x + x = 729 is simple. In first grade, you learned:

3 ducks + 5 ducks + 1 duck = 9 ducks

So it’s no surprise that:

3x + 5x + x = 9x

So 3x + 5x = 729 gets replaced by 9x = 729. In algebra, this is called “combining like terms”.

Now, what to do with 9x = 729? Let’s go back to basic fractions:

What’s ½ of 2 elephants? It’s one elephant.

What’s ¼ of 4 marbles? It’s one marble.

So it’s no surprise that 1/9 of 9x is one x (or just plain x).

Going back to our original equation, we know that 9x and 729 are equal. If you take two numbers that are equal and divide them both by 9, the results will also be equal. In fact, if you do the same thing, no matter what, to two equal numbers, the results will always be equal. So, dividing both sides of our equation by 9:

9x/9 = 729/9

x = 81

Algebra = Absolute Fairness

Have you ever gotten upset because a sibling, or a classmate, got something that you didn’t? In algebra, absolute fairness is the rule. In algebra, the rule is:

*You can do whatever you want to one side of the equation as long as you are fair and do it to the other side.*

For example:

|  |  |  |  |
| --- | --- | --- | --- |
| 10N + 8 | = | 28 |  |
| 10N + 8 – 8 | = | 28 – 8 | (subtracting 8 from both sides) |
| 10N | = | 20 |  |
| 10N/10 | = | 20/10 | (dividing both sides by 10) |
| N | = | 2 |  |

The Distributive Property



What’s the area of the rectangle on the left?

What’s the area of the rectangle on the right?

If you take out the vertical bar, what’s the length of the new large rectangle?

What’s the area of the new large rectangle?

Now that you’ve proven it, write the distributive property in this box so you can keep it handy for homework time: