

## Discussion 1 – Balancing Equations August 24, 2022

### Statement

What is an equation?

An equation is a statement where two or more math expressions are equal with an equal sign separating them.

What's a mathematical expression?

A sentence (in math) like words on a page. They have a minimum of one constant or variable. They can include mathematical operations such as adding, subtracting, multiplying, and dividing but they are not necessary. (algebraic expressions)

*Ex:*  $x=0$ , here we have no algebraic expressions but this is still an equation.

What is a linear expression?

Formally, a sentence with one variable, one coefficient, and one constant. It has the possibility of two constants. Constants might multiply the variable or be added on

*Ex:*  $y=mx+b$ , where  $x$  is a variable and  $m$ ,  $b$  are constants

What is a linear equation?

Formally,  $y=mx+b$  where  $m$  is the slope,  $b$  is the  $y$ -intercept constant,  $y$  is the dependent variable, and  $x$  is the independent variable.

Linear expression=linear expression

Or

Linear expression=constant

### Balancing linear equations

We can add, subtract, multiply, and divide by constants - for division constants cannot equal 0 - to keep our equations balanced and reach a "solved equation". This is one where the variable is on one side and constants are on the other.

Can every linear equation be solved?

No! Consider  $x + 4 = x - 2$ , if we try to get variable  $x$  to one side, it disappears and we no longer have a variable to solve for.

Solvable equations will end up looking like this:

Variable = constant

Same constant = same constant

Different constant = different constant

## Curriculum

Balancing equations are introduced as basic addition and subtraction in early elementary with fill in the blank type problems such as these.

$$4 + \underline{3} = 7$$

$$\underline{9} - 3 = 6$$

A 6th or 7th grader might be introduced to equations like  $2x + 5 = 4x - 1$  and be asked to solve for  $x$  in these steps.

$$2x + 5 = 4x - 1$$

1. Subtract 5 from both sides, combine like terms.

$$2x = 4x - 6$$

2. Subtract  $4x$  from both sides, combine like terms.

$$-2x = -6$$

3. Divide each side by  $-2$ .

$$x = 3$$

How would you help a visual learner?

Algebra tiles, draw it out. If taking this approach, first make sure you only have numbers being added on and no numbers being subtracted. Subtraction is harder to visualize, so add one to both sides before starting.

## Order of Operations

Parentheses

Exponents

Multiplication

Division

Addition

Subtraction

$$\text{Ex: } (3 - 2)^4 * 5 + \frac{4}{2} = 7$$

What is the solution to this problem?

$$8 \div 2(2 + 2)$$

Is it 1 or 16?

A calculator will give 16

The answer depends on the interpretation of the reader so be clear and concise when writing out your problems for students to avoid issues like this.