

Topics: Manipulate and Solve Equations, Order of Operations, Solving for Variables

Materials List

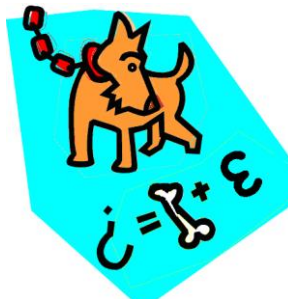
- ✓ Blank playing cards
- ✓ 20-sided dice, 1
- ✓ Scratch paper
- ✓ Tokens
- ✓ Optional: Blank labels
- ✓ Optional: Timer

This activity can be used to teach:

- Algebra (Common Core Math Standards: Grade 5, Operations & Algebraic Thinking, 1 & 2)
- Equations (Common Core Math Standards: Expressions & Equations, Grade 6, 2-6; Grade 7, 1)
- Problem Solving and Reasoning (Common Core Math Standards: Mathematical Practices Grades 4 - 8)

Occasions for an Equation!

Use Variables to Evaluate and Solve Equations!



This flexible game is two games in one. Students can either evaluate or solve algebraic equations. Both games reinforce order of operations, evaluating equations, and solving equations.

Assembly

1. Choose equations coordinated to the students' grade level and abilities. See sample equations on page 2.
2. Write one equation on each card. Optional: type up equations and print onto labels; place one label on each card.

Evaluating Expressions (for 4th to 8th grade students)

Playing the Game (for 2 - 6 players)

1. Each player has scratch paper; the container of tokens is placed in the center.
2. Shuffle cards and place face down.
3. Choose first player (e.g., die roll, draw card, youngest).
4. First player takes top card and places it right side up.
5. First player rolls the die. Each player takes the (same) number rolled, substitutes it for the variable in the equation on the card, and evaluates the equation.
For example if the equation is $2(x + 1) + 7x = ?$ and the number rolled is an 11, the x would be set equal to 11 giving:
 $2(11 + 1) + 7(11) = 2(12) + 7(11) = 24 + 77 = 101$
6. Players compare answers; if the answers are different players work the calculations together to determine the correct answer.
7. Each player with the correct answer earns one token.
8. The next player draws a new card from the deck, places it right side up, and rolls a new number. Play continues as in steps 5 to 7.
9. Winner is the player with the most tokens at the game's end (e.g., after a set time, after all cards have been played).

Solving Equations (for 6th to 8th grade students)

Playing the Game (for 2 - 6 players)

Play as above, except replace step 5 with the following:

5. First player rolls the die. Each player takes the (same) number rolled, substitutes it for the "?" in the equation on the card, and solves for the variable.

For example if the equation is $2(x + 1) + 7x = ?$ and the number rolled is an 11, the ? would be replaced by 11 giving: $2(x + 1) + 7x = 11$.

Solving for x :

$$2x + 2 + 7x = 11$$

$$2x + 7x = 11 - 2$$

$$9x = 9$$

$$x = 1$$

The Math Behind the Activity

This fun math activity gives students practice with evaluating and solving all types of equations! An equation is a mathematical statement that has two expressions separated by an equal sign. The expression on the left side of the equal sign has the same value as the expression on the right side. One or both of the expressions may contain variables. Variables, represented by letters (like x) are place holders for a value as in ($x = 5$) or for expressions as in ($x = z + y$).

Evaluating an equation involves substituting a specific value for the variable in the expression and calculating the result. Solving an equation means manipulating the expressions, using order of operations, and finding the values of the variable(s).

The order of operations means to always do what is possible within Parentheses first, then Exponents, then Multiplication and Division (from left to right), and then Addition and Subtraction (from left to right). If parentheses are enclosed within other parentheses, work from the inside out. A common technique for remembering the order of operations is the mnemonic abbreviation "PEMDAS", which is turned into the phrase "Please Excuse My Dear Aunt Sally". It stands for "Parentheses, Exponents, Multiplication and Division, and Addition and Subtraction".

Taking it Further

- Evaluate equations with two variables. Use the value of the first die roll for the first variable, a second die roll value for the second variable.
- Extend the difficulty by using a decimal or a fraction die.
- Have students create equations based on their lessons and test each other.

Web Resources (Visit www.raft.net/raft-idea?isid=638 for more resources!)

- Examples of types of equations - <http://www.sosmath.com/algebra/solve/solve0/solve0.html>
- Solving basic algebraic equations - <http://www.algebrahelp.com/lessons/equationbasics/>
- Order of operations - <http://www.mathforum.org/dr.math/faq/faq.order.operations.html>
- Khan Academy resources on equations and variables – <https://www.khanacademy.org/math/algebra/solving-linear-equations-and-inequalities>
- Teacher designed math courses from the New Jersey Center for Teaching & Learning – <https://njctl.org/courses/math>

Sample grade level equations:

Grade 4:

$$\begin{aligned}2x &= ? \\ x + x + x &= ? \\ 3a + 2 &= ? \\ 3(y) + 2(y) &= ? \\ 5\frac{1}{2}x &= ? \\ 7 - x &= ? \\ \frac{3}{4}y &= ? \\ 9 + 2y &= ? \\ -1 + (b - 3) &= ?\end{aligned}$$

Grade 5:

$$\begin{aligned}3(x + 5) &= ? \\ 10.5y + 2 &= ? \\ w - 10 &= ? \\ 5(x - 2) + 4(5 - x) &= ? \\ -9x + 2x &= ? \\ 9x - (-3x) &= ? \\ -10x + 8 &= ? \\ 5(y - 2) + y - 2 &= ? \\ \frac{1}{2}y + \frac{3}{4} &= ?\end{aligned}$$

Grade 6:

$$\begin{aligned}\frac{1}{2}y + \frac{3}{4}y &= ? \\ x/44 &= ? \\ x(2/3 \cdot 3/8) &= ? \\ c(5/c) + c &= ? \\ 3x + \frac{1}{2}x &= ? \\ x(4 - \frac{1}{2}x) &= ? \\ 4(x - \frac{3}{4}x) &= ? \\ \frac{1}{2}x - 4(\frac{1}{2}x) &= ?\end{aligned}$$

Grades 7 & 8:

$$\begin{aligned}x^2(5/x) + 1 &= ? \\ 2(x + 1) + 7x^2 &= ? \\ 2x - 1(x + 5) &= ? \\ 5 - 7y + 2(y + 1) &= ? \\ 3(2x + 5)^2 &= ? \\ (x - 3)(x + 3) &= ? \\ x(4x^2 - 2) &= ? \\ 3x^2 + 2x - 3 &= ? \\ 3(2x - 5) + 4(x - 2) &= ? \\ \frac{8a + 4(a - 3)}{3(a - 1)} &= ?\end{aligned}$$