DIG INTO EQUATIONS: POLYGON AREA PUZZLE

A Middle School Lesson About Equations

LESSON PLAN Part 1

Whole Class Student Page Building Equations Reproducible Polygon Puzzle Pieces (for demonstration)	• Show students puzzle pieces with areas *A*, *B*, and *C*. Explain to students that they will be writing equations about the areas of puzzle pieces where the letter inside of each piece represents its area. Demonstrate the equation $A = 2B$. **Is it a label or is it a variable?** For the polygon puzzle, the letter inside each piece could be interpreted as a label to identify the object or a variable that represents its area. For problems in this lesson, the italic letter inside is a variable that represents the area of the piece. To describe the area, we may say, "the shape with area *A*," "area *A*," or simply "*A*." ***What are some other equations we might write?*** Some possibilities are: $B = 2C$, $A = 4C$, $A = B + 2C$, and $A + B = 6C$.
Partners/Individuals Student Page Building Equations Reproducible Polygon Puzzle Pieces (1 set per group – cut up)	• Distribute puzzle pieces to groups. Ask students to work individually for about 5 minutes and create as many equations as they can. • Invite students to share equations with each other. This is a good opportunity for students to make viable arguments and critique the reasoning of others.
Whole Class Student Page Building Equations	• Ask students to share many equations by stating them orally or demonstrating them in front of the class. Keep a list of all true equations. Set a time limit since the number of possible equations is immense. • Ask questions that focus on interesting relationships. For example: ***What is the relationship between D and Q?*** They have the same area. ***Why?*** A square created with two *D* pieces exactly covers a square created with two *Q* pieces. If $2D = 2Q$, then $D = Q$. ***Write an equation using G and H that includes at least one fraction.*** $\frac{1}{6} H = G$. ***Find two F pieces and four D pieces. Write an expression for this area as the sum of two terms.*** $2F + 4D$. ***Factor this expression and write it as the product of two terms.*** $2(F + 2D)$.

LESSON PLAN Part 2

Partners/Individuals Student Page Expressions and Equations Reproducible Polygon Puzzle Pieces (intact)	• Students refer to the intact Puzzle Pieces located at the end of this packet. Encourage student exploration as individuals or with partners as they find missing areas of pieces from given information, explain their reasoning about equations, and practice writing equations for one variable in terms of another. Discuss problems as needed.

Adapted especially for NCTM 2016 - from *MathLinks*: Grade 8 (Lesson 8.3)

BUILDING EQUATIONS

1. Build equations based upon the areas of the shapes. Record several in the table below.

   Example: $A = 2B$.

2. How could you sort these equations into categories?

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EXPRESSIONS AND EQUATIONS

1. Given: H = 36 square units;

   G = _____; $\frac{1}{3}J$ = _____; $A + B$ = _____

2. Explain why $2G + H = P + 2(N + D)$.

3. Find D if $G = 3$, $H = 18$, $P = 12$, and $N = 2$.

4. Finish the Equation column (the first two are done as examples

Given expression	Written in terms of this variable	Equation
A	B	$A = 2B$
B	A	$B = \frac{1}{2}A$
$B + C$	D	$B + C$ = _____
J	A	
$2(B + C)$	J	

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POLYGON PUZZLE PIECES