

Geometry Lesson 24

Objective: TSW start to prove algebraic expressions.

Date: _____

Period: _____

_____ - An argument that uses logic to show that a conclusion is true.

Properties of Equality

Property	Example
Addition Property of Equality	If $a = b$, then _____.
Subtraction Property of Equality	If $a = b$, then _____.
Multiplication Property of Equality	If $a = b$, then _____.
Division Property of Equality	If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$
Symmetric Property of Equality	If $a = b$, then _____.
Reflexive Property of Equality	$a = a$
Transitive Property of Equality	If $a = b$ and $b = c$, then $a = c$.
Substitution Property of Equality	If $a = b$, then b can be substituted for a in any expression.

An algebraic proof shows step-by-step how a problem is solved. Each step has to be justified with one of the properties above, or by a property of arithmetic.

For example, if a step required adding a number to both sides of an equation, it would be justified by the Addition Property of Equality.

Whenever a step requires that you perform basic mathematical operations on a single side of the equation (like addition, subtraction, multiplication, or division), the step is justified by the term, "Simplify."

Most proofs begin by presenting the facts of a problem. The first line restates what you have already been told, and is justified as "Given."

Example 1 Writing an Algebraic Proof

a. Solve this equation. Provide a justification for each step.

$$2(x + 1) = x + 9$$

SOLUTION

b. Solve this equation. Provide a justification for each step.

$$\frac{3x-1}{5} = \frac{2x+3}{3}$$

SOLUTION

Example 2 Verifying Algebraic Reasoning

The steps of the algebraic proof for solving the equation $2(a + 1) = -6$ are given below in the correct order. However, the justifications for each step are out of order. Determine the correct order for the justifications.

SOLUTION

$2(a + 1) = -6$	Simplify.
$2a + 2 = -6$	Distributive Property
$2a + 2 - 2 = -6 - 2$	Division Property of Equality
$2a = -8$	Given
$\frac{2a}{2} = \frac{-8}{2}$	Subtraction Property of Equality
$a = -4$	Simplify.

Example 3 Application: Finding Dimensions

The area of a rectangular patio is 28 square feet. The patio's length is $(3x + 1)$ feet and the patio's width is $2x$ feet. Find the dimensions of the patio. Provide a justification for each step.

SOLUTION

The formula for the area of a rectangle is $A = lw$, so

There are two solutions to this factorization, $3x + 7$, and $x - 2$. However, the solution to $3x + 7$ is negative. It does not make sense for a side of the rectangle to have a negative length, so that solution is thrown out. Therefore,

Now, substitute $x = 2$ into the expressions for length and width of the rectangle to find the dimensions.

Therefore, the patio is ___ feet long and ___ feet wide.

You Try!!!!

c. The steps of the proof below are given in the correct order. However, the justifications for each step are out of order. Determine the correct order of the justifications.

$\frac{2}{3}x + 6 = 4 - 2x$	Given
$2x + 18 = 12 - 6x$	Subtraction Property of Equality
$2x = -6 - 6x$	Multiplication Property of Equality
$8x = -6$	Addition Property of Equality
$x = -\frac{2}{3}$	Division Property of Equality

d. The area of the rectangular floor of a shed is 40 yd^2 . The length of the shed is $(x + 2)$ yd and the width is $(x - 1)$ yd. Find the dimensions of the shed. Provide a justification for each step.