Geometry Unit 2: Lesson 2-6 Algebraic Proofs

Goals: --Use algebra to write two column proofs
--Use properties of equality to write geometric proofs.

OAS: G.RL.1.1 Understand the use of undefined terms, definitions, postulates, and theorems in logical arguments/proofs.

Vocabulary:
Algebraic Proof: A proof made up of a period of algebraic statements. The properties of equality provide many justifications for algebraic proofs.
Two –Column Proof: A proof with statements and reasons organized into two columns.
Formal Proof: Another name for a two-column proof.

Algebraic Proofs

Algebraic Proofs are proofs that make up a series of algebraic statements. Properties of real numbers we use in algebra:

Key Concept **Properties of Real Numbers** For Your FOLDABLE

The following properties are true for any real numbers a, b, and c.

Addition Property of Equality	If $a = b$, then $a + c = b + c$.
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$.
Multiplication Property of Equality	If $a = b$, then $a \cdot c = b \cdot c$.
Division Property of Equality	If $a = b$ and $c \neq 0$, then, $\frac{a}{c} = \frac{b}{c}$.
Reflexive Property of Equality	$a = a$
Symmetric Property of Equality	If $a = b$, then $b = a$.
Transitive Property of Equality	If $a = b$ and $b = c$, then $a = c$.
Substitution Property of Equality	If $a = b$, then a may be replaced by b in any equation or expression.
Distributive Property	$a(b + c) = ab + ac$

Commutative Property of Addition
$a + b = b + a$

Commutative Property of Multiplication
$a \cdot b = b \cdot a$

Associative Property of Addition
$(a + b) + c = a + (b + c)$

Associative Property of Multiplication
$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Ex) Prove that if $-5(x + 4) = 70$, then $x = -18$. Write a justification for each step using a two-column proof.

$-5(x + 4) = 70$	Given
$-5 \cdot x + (-5) \cdot 4 = 70$	Distributive property
$-5x - 20 = 70$	Substitution Property of Equality
$-5x - 20 + 20 = 70 + 20$	Addition Property of Equality
$-5x = 90$	Substitution Property of Equality
$\frac{-5x}{-5} = \frac{90}{-5}$	Division Property of Equality
$x = -18$	Substitution Property of Equality

<u>Geometric Proof</u>

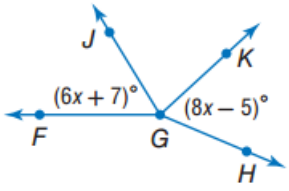
Geometric proofs are very similar to algebraic proofs. Many of the properties of equality used in algebra are also true in geometry.

Some other geometric relationships are:

Property	Segments	Angles
Reflexive	$AB = AB$	$m\angle 1 = m\angle 1$
Symmetric	If $AB = CD$, then $CD = AB$.	If $m\angle 1 = m\angle 2$, then $m\angle 2 = m\angle 1$.
Transitive	If $AB = CD$ and $CD = EF$, then $AB = EF$.	If $m\angle 1 = m\angle 2$ and $m\angle 2 = m\angle 3$, then $m\angle 1 = m\angle 3$.

Example 3 Write a Geometric Proof

If $\angle FGJ \cong \angle JGK$ and $\angle JGK \cong \angle KGH$, then $x = 6$. Write a two-column proof to verify this conjecture.



Given: $\angle FGJ \cong \angle JGK$, $\angle JGK \cong \angle KGH$, $m\angle FGJ = 6x + 7$, $m\angle KGH = 8x - 5$

Prove: $x = 6$

Proof:

Statements	Reasons
1. $\angle FGJ \cong \angle JGK$; $\angle JGK \cong \angle KGH$	**1.** Given
2. $m\angle FGJ = m\angle JGK$; $m\angle JGK = m\angle KGH$	**2.** Definition of congruent angles
3. $m\angle FGJ = m\angle KGH$	**3.** Transitive Property of Equality
4. $6x + 7 = 8x - 5$	**4.** Substitution Property of Equality
5. $6x + 7 + 5 = 8x - 5 + 5$	**5.** Addition Property of Equality
6. $6x + 12 = 8x$	**6.** Substitution Property of Equality
7. $6x + 12 - 6x = 8x - 6x$	**7.** Subtraction Property of Equality
8. $12 = 2x$	**8.** Substitution Property of Equality
9. $\frac{12}{2} = \frac{2x}{2}$	**9.** Division Property of Equality
10. $6 = x$	**10.** Substitution Property of Equality
11. $x = 6$	**11.** Symmetric Property of Equality