2.6 Prove Statements About Segments and Angles

Goal: Write proofs using geometric theorems.

Given: $3x - 9 = 0$, Prove: $x = 3$

Statements	Reasons
1. $3x - 9 = 0$	1. Given
2. $3x = 9$	2. Addition Postulate
3. $x = 3$	3. Division Postulate

The two-column proof is a formal way to organize your reasons to show a statement is true. The two-column proof has numbered statements on the left side, which are made one at a time until you reach the conclusion and corresponding reasons on the right side (which include definitions, properties, postulates, and theorems-statements that can be proven) that show an argument in logical order.

Use a property of equality to complete the statement.

1. If $m\angle 1 = m\angle 3$, then $m\angle 3 =$ __?__. $\angle 1$

2. If $AB = CD$ and $CD = TU$, then __?__. $AB = TU$

3. If $RS = WX$, then __?__ $+ AB =$ __?__ $+ AB$. RS, WX

4. If $m\angle EFG = 28°$ and $m\angle GFH = 62°$, $28,$ Substitution
   then __?__ $+ 62° = m\angle EFG + m\angle GFH$.

Solve. Give a reason for each step.

1. $-5x + 18 = 3x - 38$ **2.** $-3(x - 5) = 2(x + 10)$

Identify the property of equality.

3. If $m\angle 3 = m\angle 5$ and $m\angle 5 = m\angle 8$, then $m\angle 3 = m\angle 8$.   T

4. If $CD = EF$, then $EF = CD$.   S

Proof - an argument that uses logic to show that a statement is
     true

Two - column proof - a form of proof in which the statements are
                    written in the left hand column and the
                    reasons are written in the right hand column

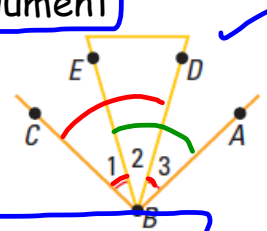| (Conclusions)	(Justifications)
<u>Statements</u>	<u>Reasons</u>
Given	Definitions
	Properties
	Theorems
Prove	Postulates

4 Key Parts to a Proof -
   Given, To Prove, Picture or Drawing, & Argument

Write a two-column proof

✓ **GIVEN** ▶ $m\angle 1 = m\angle 3$
✓ **PROVE** ▶ $m\angle EBA = m\angle DBC$

STATEMENTS	REASONS
$m\angle 1 = m\angle 3$	GIVEN
$m\angle 2 + m\angle 3 = m\angle EBA$	Angle Addition Postulate
$m\angle 1 + m\angle 2 = m\angle DBC$	Angle Additi Post
$m\angle 3 + m\angle 2 = m\angle DBC$	Substitution Prop
$m\angle EBA = m\angle DBC$	Transitive Prop

Congruence of Segments

Segment congruence is reflexive, symmetric, and transitive.

Reflexive	For any segment AB, $\overline{AB} \cong \overline{AB}$.
Symmetric	If $\overline{AB} \cong \overline{CD}$, then $\overline{CD} \cong \overline{AB}$.
Transitive	If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$.

Congruence of Angles

Angle congruence is reflexive, symmetric, and transitive.

| **Reflexive** | For any angle A, $\angle A \cong \angle A$. |
| **Symmetric** | If $\angle A \cong \angle B$, then $\angle B \cong \angle A$. |
| **Transitive** | If $\angle A \cong \angle B$ and $\angle B \cong \angle C$, then $\angle A \cong \angle C$. |

Name the property illustrated by the statement.

1   If $\angle R \cong \angle T$ and $\angle T \cong \angle P$, then $\angle R \cong \angle P$.   *Transitive*

2   If $\overline{NK} \cong \overline{BD}$, then $\overline{BD} \cong \overline{NK}$.   *Symmetric*

3   $\overline{CD} \cong \overline{CD}$ *Reflexive*

4   If $\angle Q \cong \angle V$, then $\angle V \cong \angle Q$.   *Symmetric*

Writing a Two-Column Proof

In a proof, you make one statement at a time, until you reach the conclusion. Because you make statements based on facts, you are using deductive reasoning. Usually the first statement-and-reason pair you write is given information.

Copy or draw diagrams and label given information to help develop proofs.
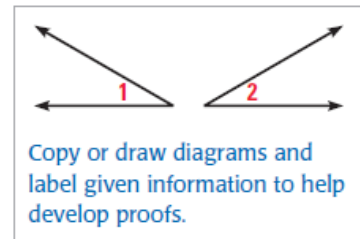
Proof of the Symmetric Property of Angle Congruence

GIVEN ▶ $\angle 1 \cong \angle 2$

PROVE ▶ $\angle 2 \cong \angle 1$

Statements based on facts that you know or on conclusions from deductive reasoning

STATEMENTS	REASONS
1. $\angle 1 \cong \angle 2$	1. **Given**
2. $m\angle 1 = m\angle 2$	2. Definition of congruent angles
3. $m\angle 2 = m\angle 1$	3. Symmetric Property of Equality
4. $\angle 2 \cong \angle 1$	4. Definition of congruent angles

The number of statements will vary.

Remember to give a reason for the last statement.

Definitions, postulates, or proven theorems that allow you to state the corresponding statement

Use properties of equality

Prove this property of midpoints: If you know that M is the midpoint of $\overline{AB}$, prove that AB is two times AM and AM is one half of AB.

GIVEN ▶ M is the midpoint of $\overline{AB}$.

PROVE ▶ ~~a. $AB = 2 \cdot AM$~~

b. $AM = \frac{1}{2}AB$

A ——— M ——— B
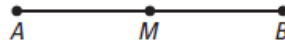
STATEMENTS	REASONS
M is midpoint of $\overline{AB}$	Given
$\overline{AM} = \overline{MB}$	Definition of Midpoint
$\overline{AM} + \overline{MB} = \overline{AB}$	Segment Addition Postulate
$\overline{AM} + \overline{AM} = \overline{AB}$	Substitution Prop
$2\overline{AM} = \overline{AB}$	Simplify/Combine Like Terms
$\overline{AM} = \frac{1}{2}\overline{AB}$	Division Prop

HW: PG 108 #'s 3, 5-7, 8-12, 17, 18, 21, 24, 26

You Want Proof? I'll Give You Proof!

THEN A MIRACLE OCCURS...
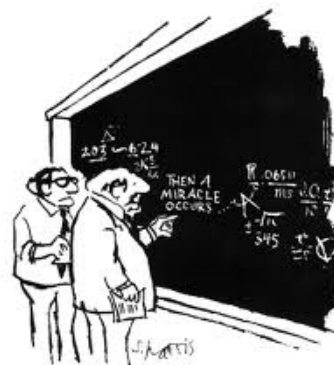
"I think you should be more explicit here in step two."