2-6 Proving Angles Congruent

© **Content Standard**
G.CO.9 Prove theorems about lines and angles. Theorems include: . . . vertical angles are congruent . . .

Objective To prove and apply theorems about angles

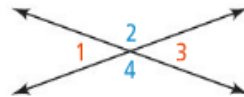A <u>theorem</u> is a conjecture or a statement that you prove true.

Essential Understanding You can use given information, definitions, properties, postulates, and previously proven theorems as reasons in a proof.

take note

Theorem 2-1   Vertical Angles Theorem
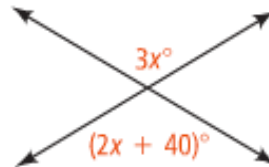
Vertical angles are congruent.
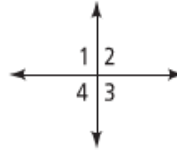
$\angle 1 \cong \angle 3$ and $\angle 2 \cong \angle 4$

✅ **Got It?   1.** What is the value of x?

$3x°$

$(2x + 40)°$

$3x = 2x + 40$
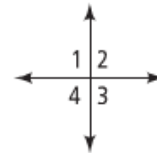
$x = 40$

ⓒ **Problem 2** **Proof Using the Vertical Angles Theorem**

Given: ∠1 ≅ ∠4

Prove: ∠2 ≅ ∠3

Statements	Reasons
1) ∠1 ≅ ∠4	1) Given
2) ∠4 ≅ ∠2	2) ~~Vertical angles are~~ **Vertical ∠s Thm**
3) ∠1 ≅ ∠2 —	3) Transitive Property of Congruence
4) ∠1 ≅ ∠3 —	4) ~~Vertical angles are~~ **Vertical ∠s Thm**
5) ∠2 ≅ ∠3	5) Transitive Property of Congruence

✅ **Got It?** **2. a.** Use the Vertical Angles Theorem to prove the following.

Given: ∠1 ≅ ∠2

Prove: ∠1 ≅ ∠2 ≅ ∠3 ≅ ∠4

Statement	Reason
1. ∠1 ≅ ∠2 —	1. Given
2. ∠1 ≅ ∠3 — —	2. Vertical ∠s Thm.
3. ∠2 ≅ ∠4 —	3. Vertical ∠s Thm.
4. ∠2 ≅ ∠3 —	4. Transitive Prop. of ≅
5. ∠3 ≅ ∠4 —	5. Transitive Prop. of ≅
6. ∠1 ≅ ∠4	6. Transitive Prop. of ≅
7. ∠1 ≅ ∠2 ≅ ∠3 ≅ ∠4	7. Transitive Prop. of ≅

The proof in Problem 2 is two-column, but there are many ways to display a proof. A paragraph proof is written as sentences in a paragraph. Below is the proof from Problem 2 in paragraph form. Each statement in the Problem 2 proof is red in the paragraph proof.

Proof **Given:** $\angle 1 \cong \angle 4$

Prove: $\angle 2 \cong \angle 3$

Proof: $\angle 1 \cong \angle 4$ is given. $\angle 4 \cong \angle 2$ because vertical angles are congruent. By the Transitive Property of Congruence, $\angle 1 \cong \angle 2$. $\angle 1 \cong \angle 3$ because vertical angles are congruent. By the Transitive Property of Congruence, $\angle 2 \cong \angle 3$.
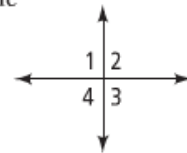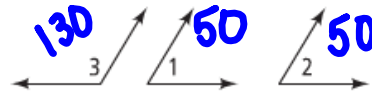
take note
Theorem 2-2   Congruent Supplements Theorem

Theorem	**If . . .**	**Then . . .**
If two angles are supplements of the same angle (or of congruent angles), then the two angles are congruent.	∠1 and ∠3 are supplements and ∠2 and ∠3 are supplements	∠1 ≅ ∠2

130   **60**   **50**

3   1   2

You will prove Theorem 2-2 in Problem 3.

take note
Theorem 2-3   Congruent Complements Theorem

Theorem	**If . . .**	**Then . . .**
If two angles are complements of the same angle (or of congruent angles), then the two angles are congruent.	∠1 and ∠2 are complements and ∠3 and ∠2 are complements	∠1 ≅ ∠3

30   **30**
60 2   1   3

You will prove Theorem 2-3 in Exercise 13.

Theorem 2-4

Theorem	**If . . .**	**Then . . .**
All right angles are congruent.	∠1 and ∠2 are right angles	∠1 ≅ ∠2
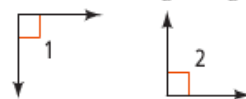
1   2

All rt. ∠s are ≅

You will prove Theorem 2-4 in Exercise 18.

Theorem 2-5

Theorem	**If . . .**	**Then . . .**
If two angles are congruent and supplementary, then each is a right angle.	∠1 ≅ ∠2, and ∠1 and ∠2 are supplements	$m\angle 1 = m\angle 2 = 90$

X   **X**
1   2
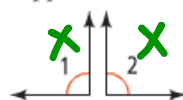
$$x + x = 180$$
$$2x = 180$$
$$x = 90$$

You will prove Theorem 2-5 in Exercise 23.

Name

2.6

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