



You will use algebraic proofs to write two-column proofs.

You will use properties of equality to write geometric proofs.

## Properties of Real Numbers

Addition Property of Equality	Add same amount to both sides of an Eqa.
Subtraction Property of Equality	Subt. same amt from both sides of Equ.
Multiplication Property of Equality	Multiply both sides by same amount
Division Property of Equality	Divide both sides by same amt

## Properties of Real Numbers, cont

Reflexive Property of Equality	$5 = 5$ $a = a$
Symmetric Property of Equality	$x = 3$ $3 = x$
Transitive Property of Equality	if $a = b$ and $b = c$ then $a = c$
Substitution Property of Equality	Replace something with an equal amount
Distributive Property of Equality	$2(x - 3) = 2x - 6$

**Example**Solve  $6x + 2(x - 1) = 30$ . Write a justification for each step.**Algebraic Steps**

1)  $6x + 2(x - 1) = 30$

2)  $\underline{6x} + \underline{2x} - 2 = 30$

3)  $8x - 2 = 30$

4)  $8x - 2 + 2 = 30 + 2$

5)  $8x = 32$

6)  $\frac{8x}{8} = \frac{32}{8}$

7)  $\underline{x} = 4$

**Properties / Reasons**1) Given2) Dist. Prop3) Subst4) Add Prop5) Subst.6) Div Prop7) Subst

## Complete each proof.

1. Given:  $\frac{4x + 6}{2} = 9$

? \* Prove:  $x = 3$

Proof:

Statements

Reasons

a.  $\frac{4x + 6}{2} = \underline{9}$

a. Given

b.  $\underline{2} \left( \frac{4x + 6}{2} \right) = 2(\underline{9})$

b. Mult. Prop.

c.  $4x + 6 = 18$

c. Subst.

d.  $4x + 6 \underline{-6} = 18 \underline{-6}$

d. Sub Prop

e.  $4x = \underline{12}$

e. Substitution

f.  $\frac{4x}{4} = \frac{\underline{12}}{4}$

f. Div. Prop.

✓ g.  $\underline{x = 3}$

g. Substitution

2. Given:  $4x + 8 = x + 2$

\* Prove:  $x = -2$

Proof:

Statements

Reasons

a.  $4x + 8 = x + 2$

a. Given

b.  $4x + 8 - x =$   
 $x + 2 - x$

b. Subtr. Prop

c.  $3x + 8 = 2$

c. Substitution

d.  $\overset{-8}{\quad} \overset{-8}{\quad}$   
\_\_\_\_\_

d. Subtr. Prop.

e.  $3x = -6$   
\_\_\_\_\_

e. Substitution

f.  $\frac{3x}{3} = \frac{-6}{3}$

f. Div Prop

✓ g.  $x = -2$   
\_\_\_\_\_

g. Substitution

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

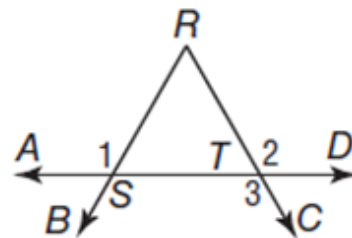
### Example

Write a two-column proof to verify this conjecture.

**Given:**  $m\angle 1 = m\angle 2$

**Prove:**  $m\angle 1 = m\angle 3$

**Proof:**



Statements

Reasons

1.  $m\angle 1 = m\angle 2$

1. Given

2.  $m\angle 2 = m\angle 3$

2. Vert.  $\angle$ 's

3.  $m\angle 1 = m\angle 3$

3. Trans. Prop

# Exercises

State the property that justifies each statement.

1. If  $m\angle 1 = m\angle 2$ , then  $m\angle 2 = m\angle 1$ .

2. If  $m\angle 1 = 90$  and  $m\angle 2 = m\angle 1$ , then  $m\angle 2 = 90$ .

3. If  $AB = RS$  and  $RS = WY$ , then  $AB = WY$ .

Symmetric

Substitution

Transitive



## Exercises

4. If  $AB = CD$ , then  $\frac{1}{2}AB = \frac{1}{2}CD$ . *Mult Prop*

5. If  $m\angle 1 + m\angle 2 = 110$  and  $m\angle 2 = m\angle 3$ ,  
then  $m\angle 1 + m\angle 3 = 110$ . *Subst.*

6.  $RS = RS$  *Reflexive*

## Exercises

7. If  $AB = RS$  and  $TU = WY$ ,  
then  $AB + TU = RS + WY$ .

8. If  $m\angle 1 = m\angle 2$  and  $m\angle 2 = m\angle 3$ ,  
then  $m\angle 1 = m\angle 3$ .

Add Prop  
trans.

9. If the formula for the area of a triangle is  $A = \frac{1}{2}bh$ , then  $bh$  is equal to 2 times the area of the triangle. Write a two-column proof to verify this conjecture.

**Given:**  $A = \frac{1}{2}bh$

~~**Prove:**~~  $bh = 2A$

**Proof:**

Statements	Reasons
$A = \frac{1}{2}bh$ (2)                      (2)	Given
$2A = bh$	Mult by 2
<del><math>bh = 2A</math></del>	Subst.
	Symm.