

## 9/26/19 - Warm Up Problem

Show that the conjecture is false by finding a counterexample.

1. The sum of two positive numbers is always smaller than their product.

$$\begin{array}{l} 1 + 1 = 2 \\ 1 \times 1 = 1 \end{array}$$

2. The square of a number is always greater than the number.

$$1^2 = 1$$

3. The product of two prime numbers is always odd.

$$2 \cdot 3 = 6$$

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Fill in the missing justifications for each proof.

1. Given:  $\frac{4x+6}{2} = 9$   
 Prove:  $x = 3$

Statement	Justification
1. $\frac{4x+6}{2} = 9$	
2. $4x+6 = 18$	
3. $4x = 12$	
4. $x = 3$	

3. Given:  $5(n-3) = 4(2n-7) - 14$   
 Prove:  $n = 9$

Statement	Justification
1. $5(n-3) = 4(2n-7) - 14$	
2. $5n - 15 = 8n - 28 - 14$	
3. $5n - 15 = 8n - 42$	
4. $5n = 8n - 27$	
5. $-3n = -27$	
6. $n = 9$	

5. Given:  $5(n-1) = 20$   
 Prove:  $n = 5$

Statement	Justification

2. Given:  $8x - 5 = 2x + 1$   
 Prove:  $x = 1$

Statement	Justification
1. $8x - 5 = 2x + 1$	
2. $6x - 5 = 1$	
3. $6x = 6$	
4. $x = 1$	

4. Given:  $2x - 15 - x = 21 + 10x$   
 Prove:  $x = -4$

Statement	Justification
1. $2x - 15 - x = 21 + 10x$	Given
2. $x - 15 = 21 + 10x$	Simplify
3. $-15 = 21 + 9x$	Subtr. Prop.
4. $-36 = 9x$	Subtr. Prop.
5. $-4 = x$	Division Prop.
6. $x = -4$	Symmetric Prop. of =

6. Given:  $4r - 5 = 13 + 2r$   
 Prove:  $r = 9$

Statement	Justification
$4r - 5 = 13 + 2r$	Given
$2r - 5 = 13$	Subtr. Prop.
$2r = 18$	Addition Prop.
$r = 9$	Division Prop.

## Section 2.5 - Reasoning in Algebra

Goals: Use properties of equality and congruence

### Properties of Equality and Congruence

Property	Example	Explanation
Reflexive Property of Equality	$a = a$ $5 = 5$	Any number is equal to itself.
Reflexive Property of Congruence	$\overline{RT} \cong \overline{RT}$ or $\angle 5 \cong \angle 5$	Any figure is congruent to itself.
Symmetric Property of Equality	If $a = b$ , then $b = a$ .	The sides of an equation can be switched.
Symmetric Property of Congruence	If $\overline{LM} \cong \overline{RT}$ , then $\overline{RT} \cong \overline{LM}$ .	The sides of a congruence statement can be switched.
Transitive Property of Equality	If $a = b$ and $b = c$ , then $a = c$ . $x = 5$ $y = 5$ $\text{so}$ $x = y$	If two numbers are equal to the same number, then they are equal to each other.
Transitive Property of Congruence	If $\angle A \cong \angle B$ and $\angle B \cong \angle C$ , then $\angle A \cong \angle C$ .	If two figures are congruent to the same figure, then they are congruent to each other.
Substitution Property of Equality	If $x + y = z$ and $x = 5$ , then $5 + y = z$ .	If two expressions are equal, one can replace the other in an equation.

## Equal and Congruent - What's the Difference?

\*Numbers can be equal to each other.

\*Figures can be congruent to each other.

The length of a segment and the measure of an angle are numbers. Numbers can be equal.

$$MN = RT \qquad m\angle ABC = m\angle GHJ$$

Segments and angles are figures. Figures can be congruent.

$$\overline{MN} \cong \overline{RT} \qquad \angle ABC \cong \angle GHJ$$

## Which property of equality or congruence justifies each statement?

1. If  $\overline{ST} \cong \overline{QR}$ , then  $\overline{QR} \cong \overline{ST}$ . *Symm. Prop.*

2.  $XY = XY$  *Reflexive Prop.*

3. If  $x = 9$  and  $x + y = 28$ , then  $9 + y = 28$ . *Subst. Prop.*

4. If  $\angle ABC \cong \angle DEF$  and  $\angle ABC \cong \angle GHJ$ ,  
then  $\angle DEF \cong \angle GHJ$ .

*Trans. Prop.*

## Using Substitution and Transitive Properties

The Substitution Property and the Transitive Properties are used in proofs to combine two equations or congruence statements together.

What new equation or statement could you write?

Which property are you using?

$$\angle RST \cong \angle \underline{UVW} \text{ and}$$

$$\angle \underline{UVW} \cong \angle XYZ$$

$$y + 3x = z \text{ and}$$

$$y = 4z$$

$$m\angle 1 + m\angle 2 = \underline{180}$$

$$m\angle 3 + m\angle 4 = \underline{180}$$

$$\underline{AB} + BC = AC$$

$$AB = \underline{2 \cdot BC}$$

$$\angle RST \cong \angle XYZ$$

Trans Prop. of  $\cong$

$$4z + 3x = z$$

Subst. Prop.

$$m\angle 1 + m\angle 2 = m\angle 3 + m\angle 4$$

Transitive Prop. of  $=$

$$2 \cdot BC + BC = AC$$

Subst. Prop

## Proofs using Substitution and Transitive Property

**Given:**  $x = 2y + 7$

$x = 4y - 13$

**Prove:**  $y = 10$

Statements	Justifications
1. $x = 2y + 7$	Given
2. $x = 4y - 13$	Given
3. $2y + 7 = 4y - 13$	Trans. Prop. of $=$ (1,2)
4. $7 = 2y - 13$	Subtr. Prop.
5. $20 = 2y$	Addition Prop.
6. $10 = y$	Division Prop.
7. $y = 10$	Symmetric Prop. of $=$

**Assignment:**

finish Concept 6 WS #1 - due by Monday 10/7

Identify the property that is being shown in each statement.

7. Given that  $m\angle BCA = m\angle DBC$  and  $m\angle BCA = m\angle ADB$ , we can conclude that  $m\angle DBC = m\angle ADB$ .

*Trans. Prop. of =*

8. Given that  $\overline{HI} \cong \overline{JK}$ , we can conclude that  $\overline{JK} \cong \overline{HI}$ .

9. Given that  $\angle 3 \cong \angle 4$  and  $\angle 4 \cong \angle 5$ , we can conclude that  $\angle 3 \cong \angle 5$ .

10. Given that  $XY = MN$  and  $XY + YZ = XZ$ , we can state that  $MN + YZ = XZ$ .

Fill in the missing justifications in each proof.

5. Given:  $a = 2b + 6$   
 $a = 9b - 8$

Prove:  $b = 2$

Statement	Justification
1. $a = 2b + 6$	
2. $a = 9b - 8$	
3. $2b + 6 = 9b - 8$	
4. $6 = 7b - 8$	
5. $14 = 7b$	
6. $2 = b$	
7. $b = 2$	

6. Given:  $3b + d = f$   
 $d = 2b$

$f = g$

Prove:  $g = 5b$

Statement	Justification
1. $3b + d = f$	
2. $d = 2b$	
3. $f = g$	
4. $3b + 2b = f$	
5. $5b = f$	
6. $5b = g$	
7. $g = 5b$	

Complete each proof. You may not need all of the rows.

5. Given:  $m = n + 5$   
 $2m = n$

Prove:  $m = -5$

Statement	Justification
1. $m = n + 5$	Given
2. $2m = n$	Given
3. $m = 2m + 5$	Subst. Prop. (1, 2)
4. $-m = 5$	Subtr. Prop.
5. $m = -5$	Division Prop.
6.	
7.	

6. Given:  $g = 2h$   
 $g + h = k$   
 $k = m$

Prove:  $m = 3h$

Statement	Justification
1.	
2.	
3.	
4.	
5.	
6.	
7.	