Example #2: Solve: $2x + 3 = 9 - x$

| | Statement | Reason |
|---|---|---|
| 1. | $2x + 3 = 9 - x$ | Given |
| 2. | $-3 \quad -3$ | Subtraction Prop. of Equality |
| 3. | $2x = 6 - x$ | Substitution |
| 4. | $+x \quad +x$ | Addition Prop. of Equality |
| 5. | $3x = 6$ | Substitution |
| 6. | $3 \quad 3$ | Division Prop. of Equality |
| 7. | $x = 2$ | Substitution. |

**Additional Properties:**

**Distributive Property:** $a(b + c) =$ $ab + ac$

Example: $5(3x - 4) = 15x - 20$ ; $-2(2x - 6) = -4x + 12$

**Reflexive Property:** $a =$ $a$

Example: $AB = AB$ ; $m\angle A = m\angle A$

**Symmetric Property:** If $a = b$, then $b = a$

Example: If $AB = CD$ then $CD = AB$; If $m\angle A = m\angle B$ then $m\angle B = m\angle A$

**Transitive Property:** If $a = b$ and $b = c$ then $a = c$

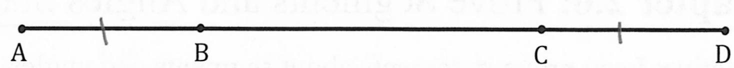
Example: If $AB = CD$ and $CD = EF$, then $AB = EF$

If $m\angle A = m\angle B$ and $m\angle B = m\angle C$, then $m\angle A = m\angle C$

Example #3: Prove.

**Given:** $AB = CD$

**Prove:** $AC = BD$

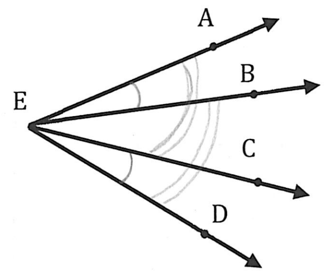



| | Statement | Reason |
|---|---|---|
| 1. | $AB = CD$ | Given |
| 2. | $BC = BC$ | Reflexive Property |
| 3. | $BD = CD + BC$ | Segment Addition |
| 4. | $AC = AB + BC$ | Segment Addition |
| 5. | $AC = CD + BC$ | Substitution |
| 6. | $AC = BD$ | Transitive Property |

Example #4: Prove.

**Given:** $m\angle AEB = m\angle CED$

**Prove:** $m\angle AE\cancel{V}C = m\angle BED$




| Statement | Reason |
|---|---|
| 1. $m\angle AEB = m\angle CED$ | 1. Given |
| 2. $m\angle BEC = m\angle BEC$ | 2. Reflexive |
| 3. $m\angle BED = m\angle CED + m\angle BEC$ | 3. Angle Addition |
| 4. $m\angle AEC = \underbrace{m\angle AEB}_{=} + m\angle BEC$ | 4. Angle Addition |
| 5. $m\angle AEC = m\angle CED + m\angle BEC$ | 5. Substitution property |
| 6. $m\angle AEC = m\angle BED$ | 6. Transitive Property |

Example #5: Name the property of equality the statement illustrates.

a.) If $m\angle 6 = m\angle 7$, the $m\angle 7 = m\angle 6$. Symmetric Property

b.) If $JK = KL$ and $KL = 12$, then $JK = 12$ Transitive Property

c.) $m\angle W = m\angle W$ Reflexive Property

Example #6: Use the property to complete the statement

a.) Addition Property of Equality: If $x = 3$, then $14 + x =$ 14 + 3 or 17

b.) Substitution Property of Equality: If $m\angle A = 45°$, then $3(m\angle A) =$ 3(45°) or 135°

c.) Multiplication Property of Equality: If $m\angle B = 60°$, then $\frac{1}{2}(m\angle B) = 30°$

## **Chapter 2.6:** Prove Segments and Angles Statements

Objective: I can prove statements about segments and angles.

Review:

1. Use the true statements below to determine whether you know the conclusion is true or false.

If Dan goes shopping, then he will buy a pretzel.
If the mall is open, then Jodi and Dan will go shopping.
If Jodi goes shopping, then she will buy pizza.
The mall is open.

1.) Dan bought pizza

False (mall is open → shopping → pretzel)

2.) Jodi and Dan went shopping.

True (mall is open → shopping)

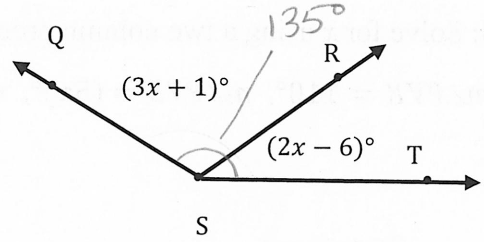
3.) Jodi bought a pizza

True (mall is open → shopping → pizza)

4.) Jodi had some of Dan's pretzel

False; (not enough info, maybe?)

2. Given: $m\angle QST = 135°$, fing $m\angle QSR$




$3x+1+2x-6=135$

$5x-5=135$
$+5 \quad +5$

$\frac{5x}{5}=\frac{140}{5}$

$x=28$

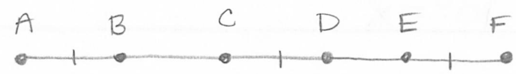
**Proof:** A logical argument that shows a statement it true.

**Postulate:** A statement accepted without proof.

**Theorem:** A statement that can be proven.
** true statement deduced by other true statements

**Congruence of Segments:** **(Theorem2.1)**

If two segments are congruent, then they are




1. Reflexive: $\overline{AB} \cong \overline{AB}$, $\overline{BA} \cong \overline{BA}$, $\overline{AB} \cong \overline{BA}$
2. Symmetric: If $\overline{AB} \cong \overline{CD}$, then $\overline{CD} \cong \overline{AB}$
3. Transitive: If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$

**Congruence of Angles:** **(Theorem2.2)**

If two angles are congruent, then they are

1. Reflexive: $\angle A \cong \angle A$
2. Symmetric: $\angle A \cong \angle B$
3. Transitive: $\angle A \cong \angle B$ and $\angle B \cong \angle C$, then $\angle A \cong \angle C$

Example #1: Name the property illustrated.

a.) $\overline{CD} \cong \overline{CD}$ Reflexive Property

b.) If $\overline{EF} \cong \overline{XY}$ and $\overline{PS} \cong \overline{EF}$ then $\overline{PS} \cong \overline{XY}$ Transitive Property

c.) If $\angle Q \cong \angle V$, then $\angle V \cong \angle Q$ Symmetric Property

Example #2: use the given property to finish the statement.

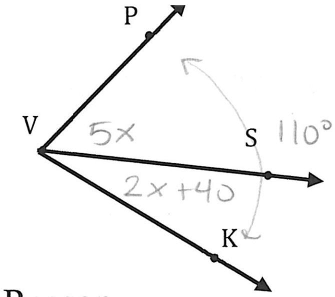
a.) Transitive Property of Angle Congruence: If $\angle A \cong \angle F$ and $\angle F \cong \angle X$ then $\angle$ A $\cong \angle$ X.

b.) Symmetric Property of Segment Congruence: If $\overline{BD} \cong \overline{EN}$ then $\overline{EN} \cong \overline{BD}$.

c.) Reflexive Property of Angle Congruence: $\angle L \cong \angle$ L.

Example #3: Solve for $x$ using a two column proof.

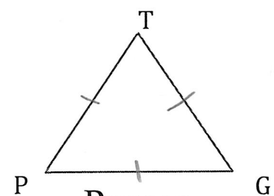
**Given:** $m\angle PVK = 110°,\ m\angle PVS = (5x)°,\ m\angle SVK = (2x + 40)°,$




| Statement | Reason |
|---|---|
| 1. $m\angle PVK = 110°,\ m\angle PVS = (5x)°\ m\angle SVK = (2x+40)°$ | 1. Given |
| 2. $m\angle PVK = m\angle PVS + m\angle SVK$ | 2. Angle Addition |
| 3. $110° = 5x + 2x + 40$ | 3. Substitution |
| 4. $110° = 7x + 40$ | 4. Substitution |
| 5. $-40 \quad -40$ | 5. Substraction Prop. of Equality |
| 6. $70° = 7x$ | 6. Substitution |
| 7. $\overline{7} \quad \overline{7}$ | 7. Division Prop. of Equality |
| 8. $10° = x$ | 8. Substitution |

Example #4: Prove

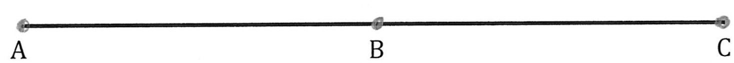
**Given:** $\overline{GT} \cong \overline{PT} \cong \overline{PG}$
**Prove:** The perimeter of $\triangle\ PGT\ is\ 3 \cdot \overline{PT}$




| Statement | Reason |
|---|---|
| 1. $\overline{GT} \cong \overline{PT} \cong \overline{PG}$ | 1. Given |
| 2. $GT = PT = PG$ | 2. Def$^{n}$ of congruent segments |
| 3. $P = GT + PT + PG$ | 3. Def$^{n}$ of perimeter |
| 4. $P = PT + PT + PT$ | 4. Substitution |
| 5. The perimeter of $\triangle PGT = 3 \cdot \overline{PT}$ | 5. Distributive Property |

Example #5: Prove

**Given:** $AC = AB + AB$
**Prove:** $AB = \cancel{AB}$ BC



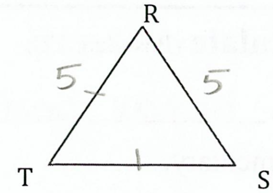

| Statement | Reason |
|---|---|
| 1. $AC = AB + AB$ | 1. Given |
| 2. $AC = AB + BC$ | 2. Segment Addition |
| 3. $AB + AB = AB + BC$ | 3. Substitution |
| 4. $-AB \quad -AB$ | 4. Subtraction |
| 5. $AB = BC$ | 5. |

Example #6: Prove

**Given:** $RT = 5,\ RS = 5,\ \overline{RT} \cong \overline{TS}$

**Prove:** ~~The perimeter of $\triangle PGT$ is $3 \cdot \overline{PT}$~~

$\overline{RS} \cong \overline{TS}$




| Statement | Reason |
| --- | --- |
| 1. $RT=5,\ RS=5,\ \overline{RT} \cong \overline{TS}$ | 1. Given |
| 2. $RT = TS$ | 2. Def$^n$ of congruent segments |
| 3. $RS = RT$ | 3. Transitive Property of = |
| 4. $RS = TS$ | 4. Transitive Property of = |
| 5. $\overline{RS} \cong \overline{TS}$ | 5. Def$^n$ of congruent segments |

## **Chapter 2.7:** Prove Angle Pair Relationships

Objective: I can prove angle pair relationships

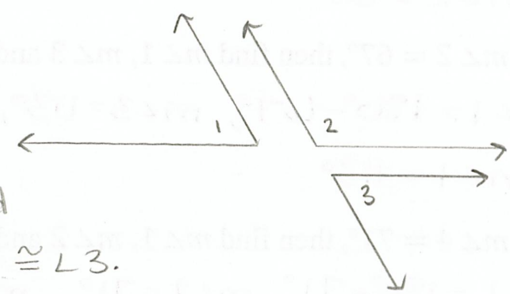
**Right Angles Congruence Theorem** (Theorem 2.3):

All right angles are Congruent

**Congruent Supplements Theorem** (Theorem 2.4):

Add upto 180°

If two angles are supplementary to the Same angle (or to congruent angles), then they are congruent.

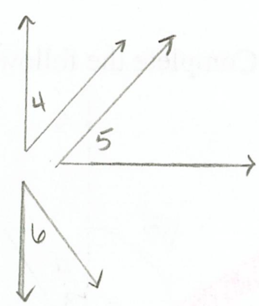



If $\angle 1$ and $\angle 2$ are supplementary and $\angle 2$ and $\angle 3$ are supplementary, then $\angle 1 \cong \angle 3$.

**Congruent Complements Theorem** (Theorem 2.5):

Add upto 90°

If two angles are complementary to the same angles (or to congruent angles), then they are Congruent.



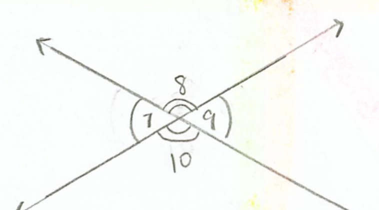

If $\angle 4$ and $\angle 5$ are complementary and $\angle 5$ and $\angle 6$ are complementary, then $\angle 4 \cong \angle 6$.

**Vertical Angles Congruence Theorem** (Theorem 2.6):

Vertical Angles are congruent

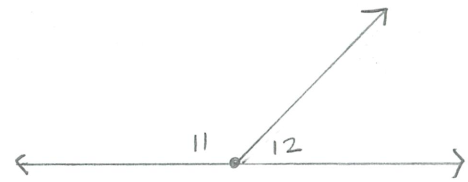
$\angle 7 \cong \angle 9$

$\angle 8 \cong \angle 10$



**Linear Pair Postulate** (Postulate 12):

If two angles form a linear pair,
then they are supplementary.



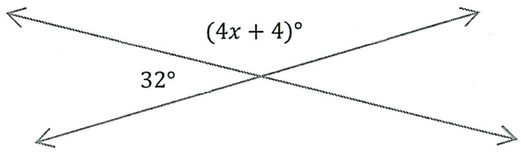

$\angle 11$ and $\angle 12$ are a linear pair

$\therefore \angle 11$ and $\angle 12$ are supplementary

$m\angle 11 + m\angle 12 = 180°$

symbol for therefore

Example #1: Find *x*.




$32 + 4x + 4 = 180°$

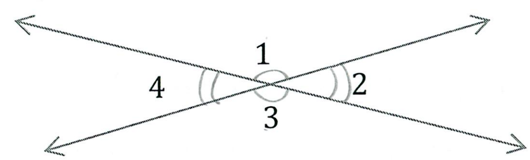
$4x + 36 = 180°$

$-36 \quad -36$

$\frac{4x}{4} = \frac{144}{4}$

$x = 36$

Example #2: Use the diagram to answer the question.




a. If $m\angle 1 = 112°$, then find $m\angle 2$, $m\angle 3$ and $m\angle 4$.

$m\angle 2 = 180° - 112°$, $m\angle 3 = 112°$, $m\angle 4 = 68°$

$m\angle 2 = 68°$

b. If $m\angle 2 = 67°$, then find $m\angle 1$, $m\angle 3$ and $m\angle 4$.

$m\angle 1 = 180° - 67°$, $m\angle 3 = 113°$, $m\angle 4 = 67°$

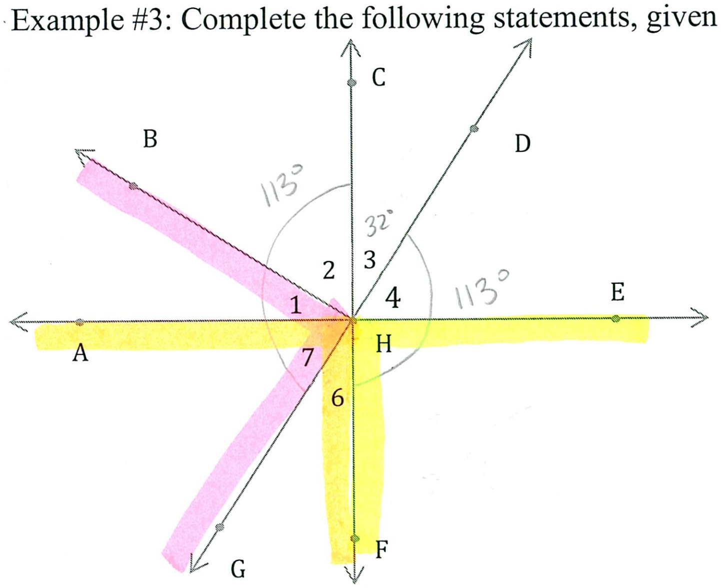
$m\angle 1 = 113°$

c. If $m\angle 4 = 71°$, then find $m\angle 1$, $m\angle 2$ and $m\angle 3$.

$m\angle 1 = 180° - 71°$, $m\angle 2 = 71°$, $m\angle 3 = 109°$

$m\angle 1 = 109°$

Example #3: Complete the following statements, given that $m\angle FHE = m\angle BHG = m\angle AHF = 90°$.




a. If $m\angle 6 = 27°$, then $m\angle 1 =$ 27°

$m\angle 7 = 90° - 27° = 63°$; $m\angle 1 = 90° - 63° = 2$

b. If $m\angle 3 = 32°$, then $m\angle 2 =$ 58°

$m\angle 2 = 90° - 32°$

c. If If $m\angle DHF = 113°$, then $m\angle CHG =$ 113°