

# Honors Geometry

## Unit 2 Similarity, Congruence & Proofs

### Triangle Relationships

**MCC9-12.G.CO.10** Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

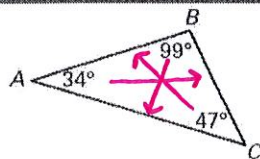
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### Relationships Between Sides & Angles Theorem

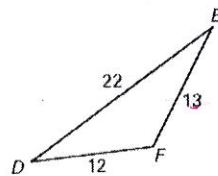
- **Longer Side Theorem:** If one side of a triangle is longer than another side, then the angle opposite the longer side is larger than the angle opposite the shorter side.
- **Larger Angle Theorem:** If one angle of a triangle is larger than another angle, then the side opposite the larger angle is longer than the side opposite the smaller angle.

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Examples: Write the measurements of each triangle in order from least to greatest.



$\overline{BC}$   
 $\overline{AB}$   
 $\overline{AC}$



$\angle E$   
 $\angle D$   
 $\angle F$

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### Possible Side Lengths

- **Triangle Inequality Theorem:** The sum of the lengths of any two sides of a triangle is greater than the length of the third side.
- Examples: Is it possible to construct a triangle with the given side lengths? Justify.

1. 5, 7, 13

$5+7=12$   
**No!**  $12 > 13$   
not true

2. 6, 9, 12

**Yes!**  
 $6+9=15$   $15 > 12$  ✓  
 $6+12=18$   $18 > 9$  ✓  
 $9+12=21$   $21 > 6$  ✓

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Example 14 10 ?

- A triangle has one side of length 14 another of length 10. Describe the possible lengths of the third side.

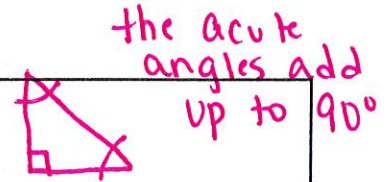
$$14 + 10 = 24$$

Third side

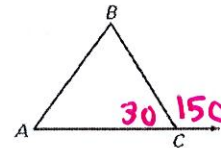
- less than 24
  - greater than 4
- $$4 < x < 24$$

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## Angle Theorems



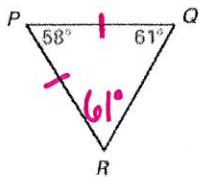
- Triangle Sum Theorem:** The sum of the measures of the interior angles of a triangle is  $180^\circ$
- Corollary to the Triangle Sum Theorem:** The acute angles of a right triangle are complementary (sum to  $90^\circ$ )
- Exterior Angle Theorem:** The measure of an exterior angle of a triangle is equal to the sum of measures of the two nonadjacent interior angles.



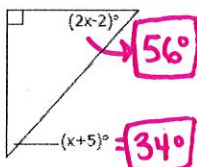
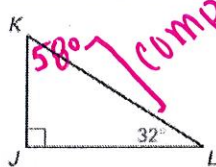
$\angle A + \angle B$  have to add up to be  $150^\circ$

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Examples: Find the missing angle measures.



Isosceles triangle



$$90 + (2x - 2) + (x + 5) = 180$$

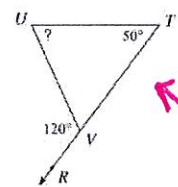
$$3x + 93 = 180$$

$$3x = 87$$

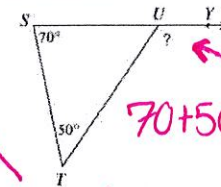
$$x = 29$$

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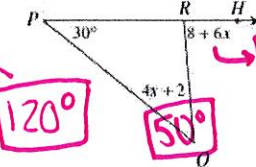
Examples: Find the missing angle measures.



$$120 - 50 = 70^\circ$$



$$70 + 50 = 120^\circ$$



$$60^\circ$$

$$4x + 2 + 30 = 8 + 6x$$

$$4x + 32 = 8 + 6x$$

$$2x = 24$$

$$x = 12$$

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