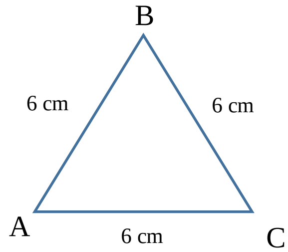
Geometry
Unit 6: Similarity

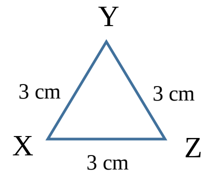
Priority Standard:

Unit 6 “I can” Statements:

1. I can simplify ratios
2. I can solve problems by writing and solving proportions and using the geometric mean.
3. I can use proportions to find missing lengths in geometric problems
4. I can use proportions to identify similar polygons
5. I can use the AA Similarity Postulate to prove triangle similarity
6. I can use the SSS Similarity Theorem to prove triangle similarity
7. I can use the SAS Similarity Theorem to prove triangle similarity
8. I can use proportion theorems to find missing lengths in geometric problems
9. I can perform dilations

Unit 6-Section 1: Ratios, Proportions and the Geometric Mean





Ratio:

Example #1: Simplify the ratio. (Check out the conversions chart on page 921)

a.) 76cm:8 cm

b.) $\frac{4 \text{ ft}}{24 \text{ in}}$

c.) 10 mL: 3 L

d.) 33yd: 9ft

Example #2: The measures of the angle in ΔBCD are in the extended ratio of 2:3:4. Find the measures of the angles.

Example #3: A triangle's angle measures are in the extended ratio of 1:4:5. Find the measures of the angles.

Example #4: The perimeter of a rectangular table is 21 ft and the ratio of its lengths to its width is 5:2. Find the length and width of the table.

Proportion:

An equation that states that ___________ ratios are ___________ .

A Property of Proportions:

If ____ = ____ where $b \neq 0$ and $d \neq 0$, then ________________

Example #5: Solve the proportion:

a.) $\frac{3}{4} = \frac{x}{16}$

b.) $\frac{x-3}{3} = \frac{2x}{9}$

Example #6: You want to find the total number of rows of boards that make up 24 lanes at a bowling alley. You know that there are 117 rows in 3 lanes. Find the total number of row of board that make up the 24 lanes.

Geometric Mean:

The geometric mean of two positive numbers a and b is the positive number x that satisfies ____ = ____

Therefore:

Example #7: Find the geometric mean of…

a.) 4 and 25

b.) 14 and 16

c.) 6 and 20

Unit 6-Section 2: Use Proportions to Solve Geometric Problems

Scale Drawing:

A drawing that is the same shape (__________________) as the object it represents

Scale:

A __________ that describes how the _____________________ in a drawing are related to the ___________ dimensions of the object.

Example #1: Suppose the scale of a model of the Eiffel Tower is 1 inches; 20 feet. *Explain* how to determine how many times taller the actual tower is than the model.

Example #2: The scale of a diagram for a field hockey field is 1 inch=50yards.

a.) Find the length of the actual field if the length of the diagram is 2 inches.

b.) Find the width of the actual field if the width of the diagram is 1.25 inches.

Example #3: A basket manufacturer has a headquarters in an office building that has the same shape as a basket they sell.

a.) The bottom of the basket is a rectangle with length 15 inches and width 10 inches. The base of the building is a rectangle with length 192 feet. What is the width of the base of the building?

b.) About how many times as long as the bottom of the basket is the base of the building?

Additional Properties of Proportions:

2. If two ratios are equal, then ____________________

____

3. If you interchange the means of a proportion then,

____

4. In a proportion, if you add the value of each ratio's denominator to its numerator, then

____

____

Example #4: Complete the statement- What property was used?

a.) If $\frac{8}{x} = \frac{3}{y}$, then $\frac{8}{3} =$

b.) If $\frac{14}{3} = \frac{x}{y}$, then $\frac{17}{3} =$

c.) If $\frac{8}{x} = \frac{3}{y}$, then $\frac{x}{8} =$

Example #5: Decide whether the statement is true or false.

a.) If $\frac{8}{m} = \frac{n}{9}$, then $\frac{8+m}{m} = \frac{n+9}{9}$

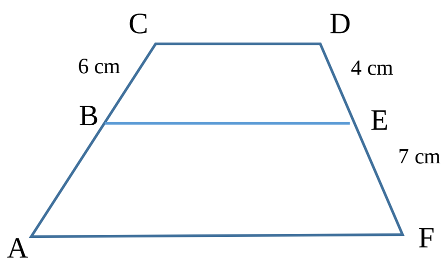
b.) If $\frac{5}{7} = \frac{x}{y}$, then $\frac{7}{5} = \frac{x}{y}$

c.) If $\frac{d}{2} = \frac{g+10}{11}$, then $\frac{d}{g+10} = \frac{2}{11}$

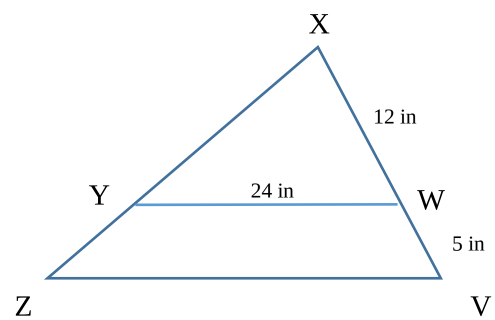
d.) If $\frac{4+x}{4} = \frac{3+y}{y}$, then $\frac{x}{4} = \frac{3}{y}$

Example #6: Use the diagram and the given information to find the unknown length.

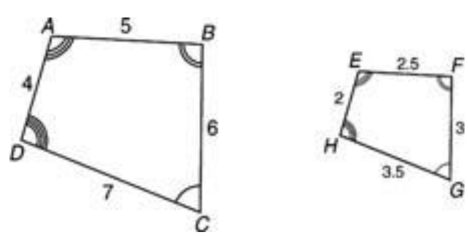
a) Given $\frac{CB}{BA} = \frac{DE}{EF}$ find BA



b.) Given $\frac{XW}{XV} = \frac{YW}{ZV}$ find ZV.



Unit 6-Section 3: Use Similar Polygons

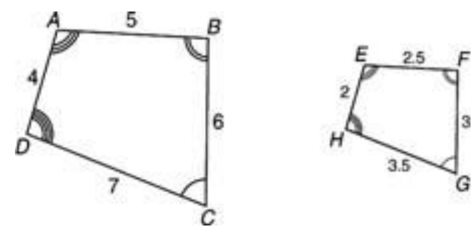


Two polygons are <u>**similar polygons**</u> if… 1. ____

2. ____

<u>**Scale Factor:**</u> is the ratio of the lengths of two ____ of two similar polygons.

Example #1: In the diagram above, polygons ABCD and EFGH are similar.



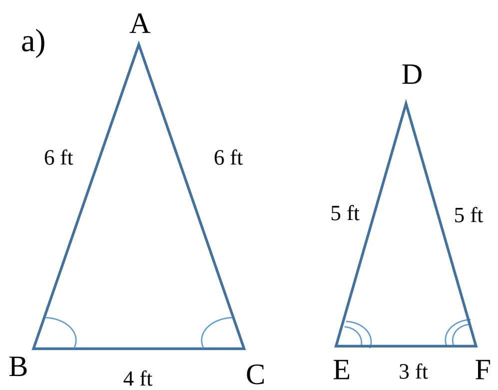
a.) List all pairs of congruent angles

b.) Check that the ratios of the corresponding side lengths are equal.

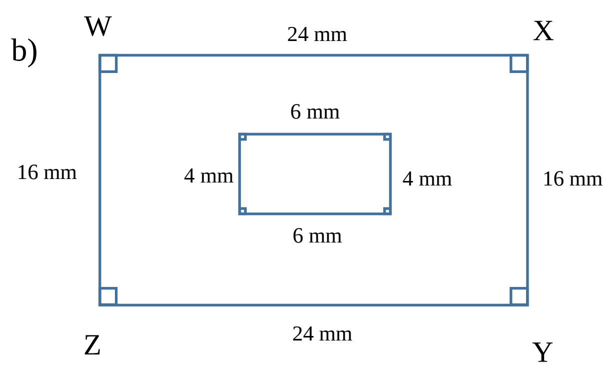
c.) Write the ratios of the corresponding side length in a **statement of proportionality.**

Example #2: Determine whether the polygons are similar. If they are write a similarity statement and find the scale factor.

a)

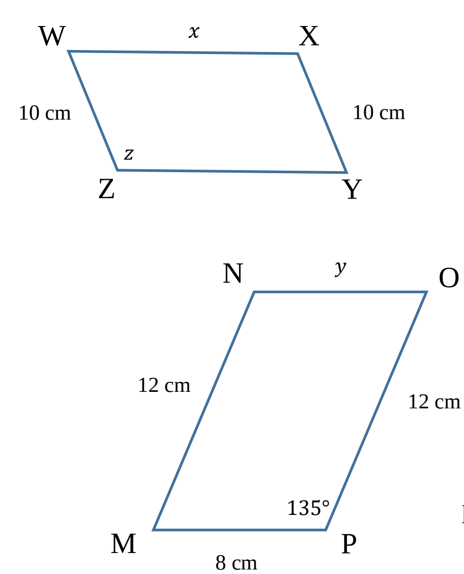


b)



Example #3: In the diagram $WXYZ \sim MNOP$

a.) Find the scale factor of WXYZ to MNOP



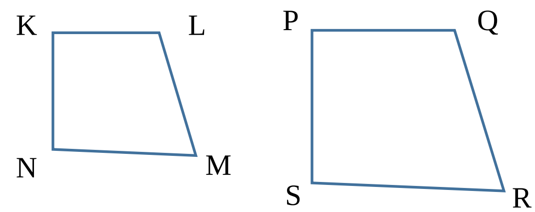
b.) Find the value of x, y and z

c.) Find the perimeter of WXYZ

d.) Find the perimeter of MNOP

Perimeter of Similar Polygons Theorem **(Theorem 6.1):**

If two polygons are similar, then the ratio of their perimeters is _______________ to the ratios of their corresponding side lengths.



If KLMN~PQRS, then ____________________________ = _____ = _____ = _____ = _____

Example #4: Basketball: A larger cement court is being poured for a basketball hoop in place of a smaller one. The court will be 20 feet wide and 25 feet long. The old court was similar in shape, but only 16 feet wide.

a.) Find the scale factor of the new court to the old court.

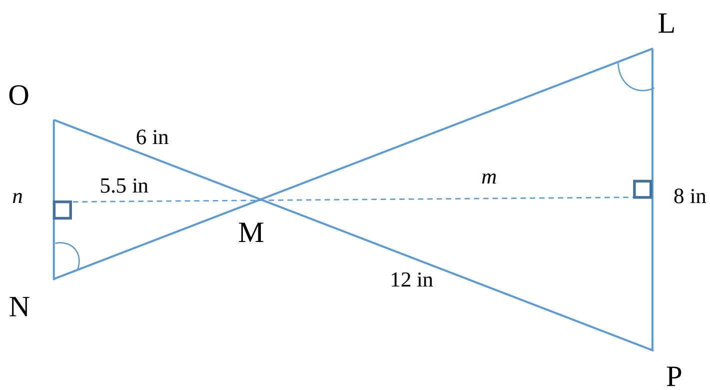
b.) Find the perimeters of the new court and the old court.

<u>Corresponding Lengths in Similar Polygons:</u>

If two polygons are similar, then the ratio of any two corresponding lengths (examples____________________ ____________________________) in the polygons is equal to the _____________________________________ of the similar polygons.

Similarity vs. Congruence:

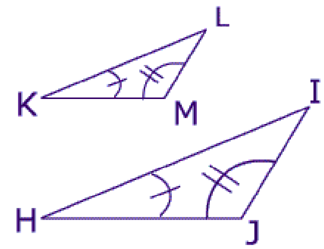
Example #5: $\triangle MNO \sim \triangle MLP$. Find the values of m and n.



Unit 6-Section 4: Prove Triangles Similar by AA

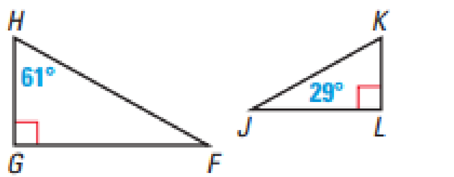
Angle-Angle (AA) Similarity Postulate (Postulate 22):

If two angles of one triangle are ______________________ to two angles of another triangle, then the two triangles are ______________________.

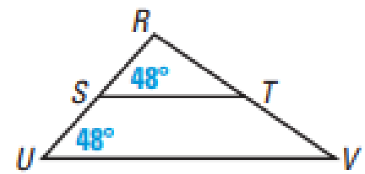


Example #1: Determine whether the triangles are similar. If they are, write a similarity statement. Explain your reasoning.

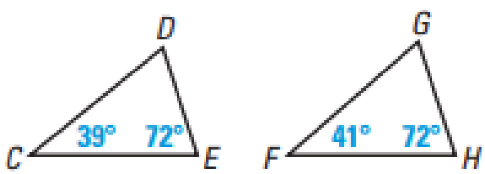
a.)



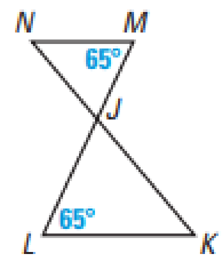
b.)



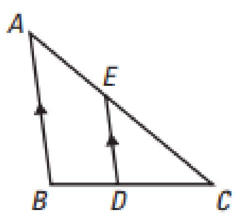
c.)



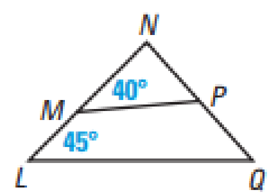
d.)



e.)



f.)



Example #2: Use the diagram to complete the statement

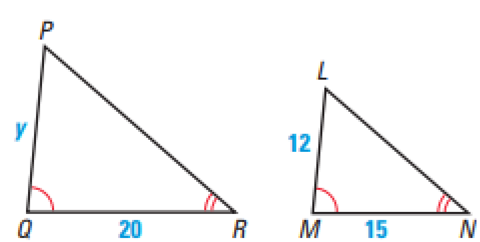
a.) $\triangle PQR \sim$ ______

b.) $\frac{LM}{PQ} = \frac{\quad}{QR}$

c.) $\frac{12}{y} = \frac{15}{\quad}$

d.) $y =$ _______

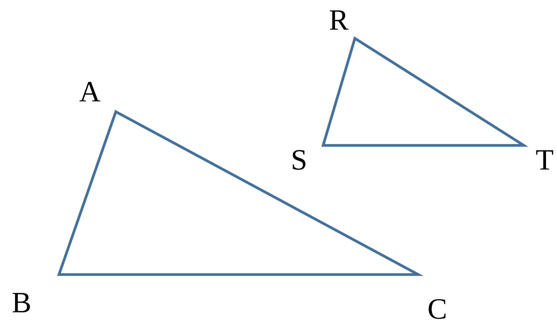
e.) The scale factor of $\triangle LMN$ and $\triangle PQR$ is ______



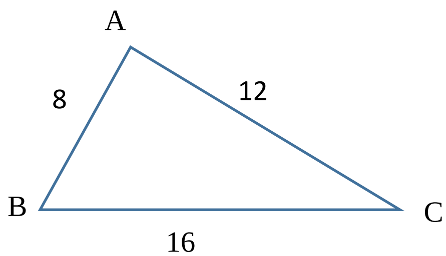
Unit 6-Section 5: Prove Triangles Similar by SSS and SAS

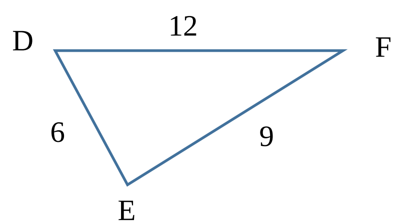
Side-Side-Side (SSS) Similarity Theorem **(Theorem 6.2):**

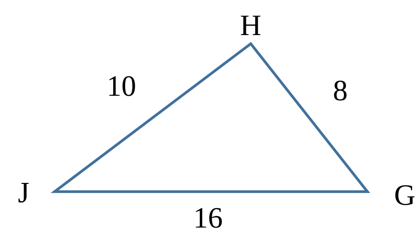
If the corresponding side lengths of two triangles are ______________________, then the triangles are similar.



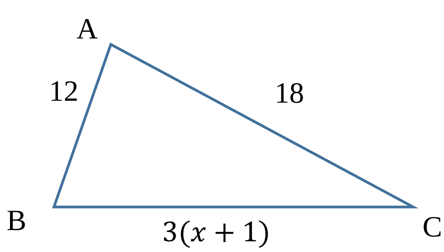
Example #1: Is either $\triangle EDF$ and $\triangle GHJ$ similar to $\triangle ABC$?

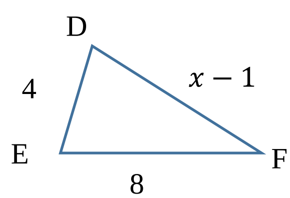






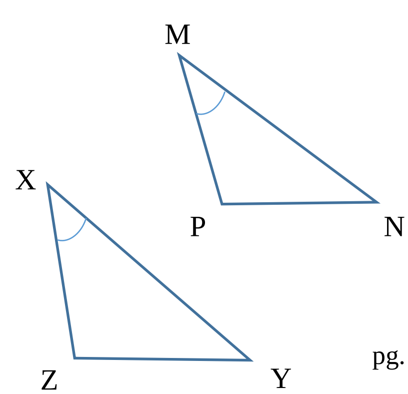
Example #2: Find the value of x that makes $\triangle ABC \sim \triangle DEF$





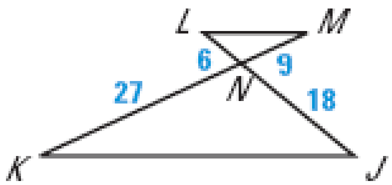
Side-Angle-Side (SAS) Similarity Theorem **(Theorem 6.3):**

If an angle of one triangle is ___________________ to an angle of a second triangle and the lengths of the sides ____________________ these angles are __________________________, then the triangles are similar.

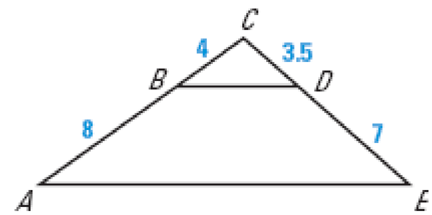


Example #3: Determine if the two triangles are similar by SAS.

a.) ΔLNM and ΔJNK

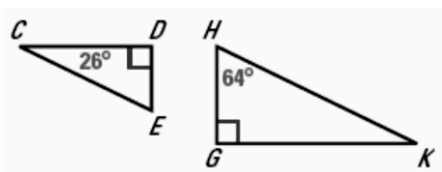


b.) ΔCDB and ΔCEA

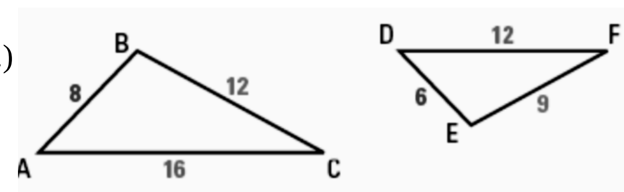


Example #4: Determine whether the triangles are similar. If they are, state what postulate or theorem you used and write a similarity statement.

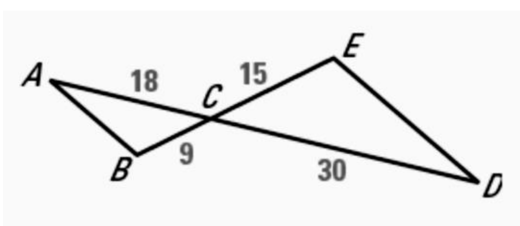
a.)



b.)

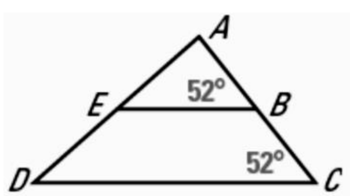


c.)

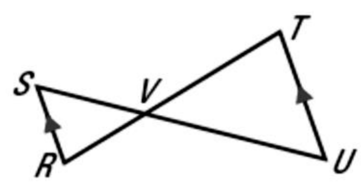


Example #5: Show that the two triangles are similar. Write a similarity statement.

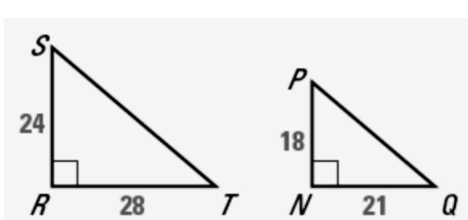
a.) ΔABE and ΔACD



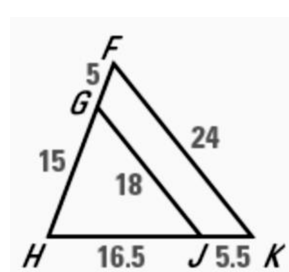
b.) ΔSVR and ΔUVT



c.) ΔSRT and ΔPNQ



d.) ΔHGJ and ΔHFK

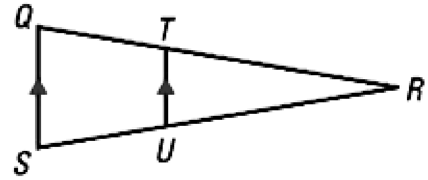


8.) A flagpole casts a shadow that is 50 feet long. At the same time, a woman standing nearby who is five feet four inches tall casts a shadow that is 40 inches long. How tall is the flagpole to the nearest foot?

Unit 6-Section 6: Use Proportion Theorems

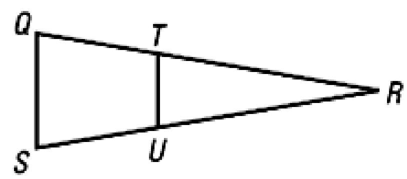
Triangle Proportionality Theorem (Theorem 6.4)**:**

If a line ___________________ to one side of a triangle ___________________ the other two sides, then it divides the two sides ___________________.

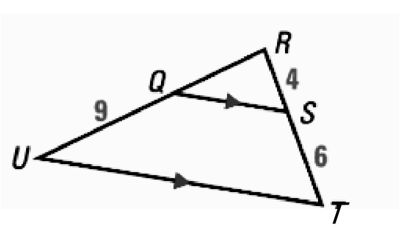


Converse of the Triangle Proportionality Theorem (Theorem 6.5):

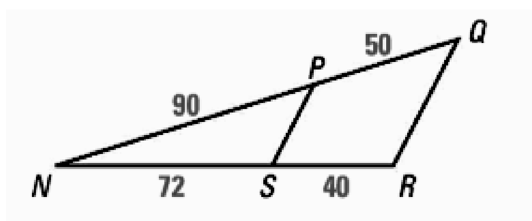
If a line divides two sides of a triangle ___________________, then it is ___________________to the third side.



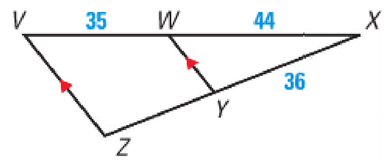
Example #1: In the diagram, $\overline{QS} \parallel \overline{UT}$, RS = 4, ST = 6, and QU = 9.
What is the length of $\overline{RQ}$?



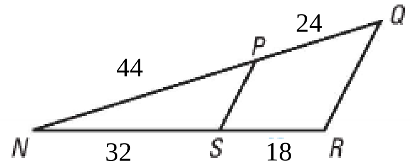
Example #2: Determine whether $\overline{PS} \parallel \overline{QR}$



Example #3: Find the length of $\overline{YZ}$.

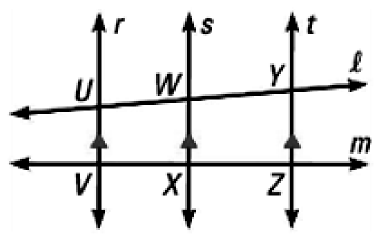


Example #4: Determine whether $\overline{PS} \parallel \overline{QR}$.



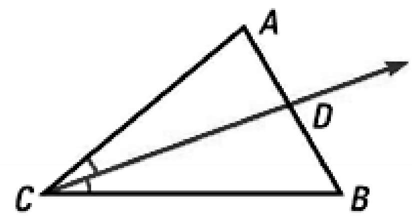
Theorem 6.6:

If three __________________ lines intersect two transversals, then they divide the transversals __________________.

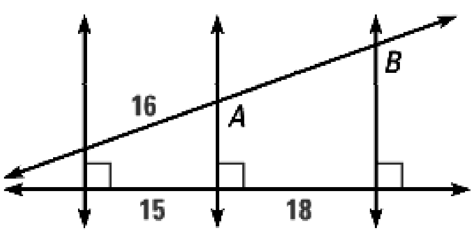


Theorem 6.7:

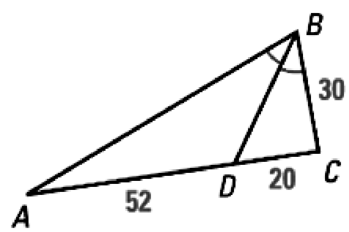
If a ray __________________ an angle of a triangle, then it divides the opposite side into segments whose lengths are __________________ to the lengths of the other two sides.



Example #5: Find the length of $\overline{AB}$.

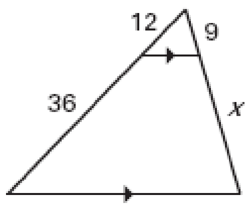


Example #6: Find the length of $\overline{AB}$.

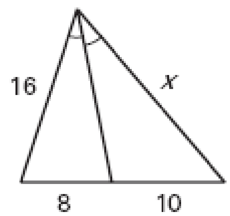


Example #7: Use the diagrams to find the value of each variable.

a.)



b.)



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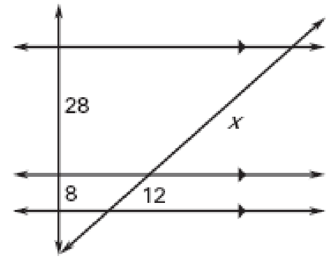
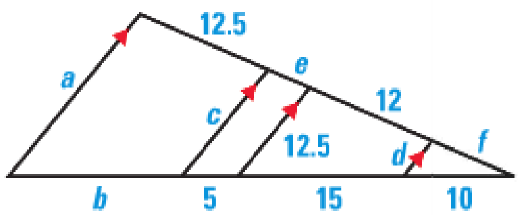


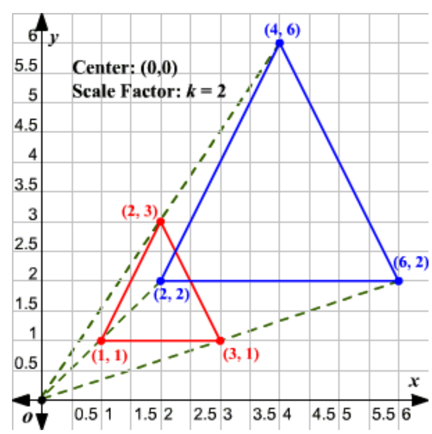
d.)



Unit 6- Section 7: Perform Similarity Transformations

Dilation: A dilation is a transformation that _________________ or _________________ a figure to create a similar figure

Center of Dilation: In a dilation, a figure is __________________ or __________________ with respect to a fixed point called the ____.



Scale Factor of a Dilation: The scale factor "_____" of a dilation is the __________________ of a side length of the ___________to the corresponding side length of the __________________figure.

Reduction: A dilation where _______________________

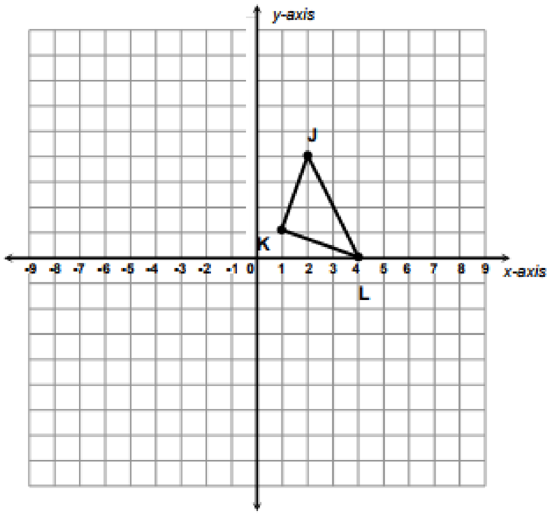
Enlargement: A dilation where _______________________

Coordinate Notation for a Dilation: You can describe a dilation with respect to the origin with the notation $(x, y) \rightarrow (kx, ky)$, where k is the ______________________________.

If $0 < k < 1$, the dilation is a ______________________.

If $k > 1$, the dilation is an __________________

Example #1:



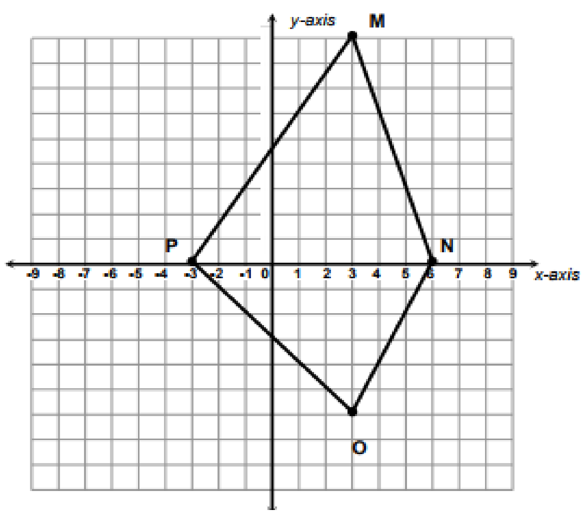
Graph the dilated image of triangle JKL using a scale factor of 2 and (0,0) as the center of dilation.

J: __________ J': __________

K: __________ K': __________

L: __________ L': __________

Example #2:



Graph the dilated image of quadrilateral MNOP using a scale factor of 1/3 and the origin as the center of dilation.

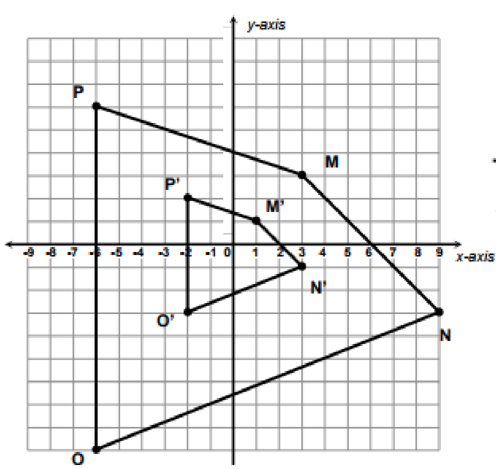
M: __________ M': __________

N: __________ N': __________

O: __________ O': __________

P: __________ P': __________

Example #3:



Describe the dilation of quadrilateral MNOP, using the origin as the center.

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