**UNIT 5: SIMILARITY**

I can define, identify and illustrate the following terms:

- Similar
- Similar Polygons
- Ratio
- Proportion
- Cross products
- Similarity Ratio
- Similarity Statement
- Scale Factor
- Indirect measurement
- Geometric Mean
- SSS ~
- SAS ~
- AA ~

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Dates, assignments, and quizzes subject to change without advance notice.

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**Monday, 2/13/12**

**Ratios and Proportions**

- I can write and simplify ratios.
- I can solve problems using ratios.
- I can solve problems using proportions.

PRACTICE: Ratio and Proportions Worksheet

**Tuesday, 2/14/12**

**Similar Figures**

- I can determine if polygons are similar.
- I can write similarity ratios and statements for similar polygons.
- I can use the properties of similar polygons to solve problems.

PRACTICE: Similar Figures Worksheet

**Block Day, 2/15-16/12**

**Similar Triangles**

- I can determine if two triangles are similar using similarity postulates/theorems.
- I can use the properties of similar polygons to solve problems.

PRACTICE: Similar Triangles Worksheet

**Friday, 2/17/12**

**Geometric Mean (8.1)**

- I can apply similarity relationships in right triangles to solve problems.
- I can use geometric means.

PRACTICE: Geometric Mean Worksheet

**Tuesday, 2/21/12**

Review

PRACTICE: REVIEW WORKSHEET

**Block Day, 2/22-23/12**

**Test Unit #11: Similarity**
Notes: Ratios

A ________ compares two numbers by division. The ratio of $a$ and $b$ is expressed as ________ or
________ or ______.

Examples
In Mr. Alexander’s Geometry class, there are 12 boys and 16 girls. Write the following ratios.

1. Boys to Girls
2. Girls to Students
3. Girls to Boys

4. In the United States House of Representatives there are 435 seats. Of those, 70 are occupied by women. Write the ratio of men to women in the US House of Representatives.

You can also use ratios to solve problems.

6. The ratio of the lengths of an isosceles triangle is 4:4:7, and its perimeter is 52.5 cm. What are the lengths of the sides of the triangle?

One common ratio is slope, which is the comparison of the ________ ___ ___ to the ________ ___ ___.
This can also be expressed as ____________, the ________ ___ _________ or _____.

7. Write the ratio expressing the slope of the line.
8. Write the slope as a ratio for points A(7, 9) and B(2, -6).

Notes: Proportions

A proportion is an equation stating that two ________ are equal. You solve proportions by __________
_____________________. When you cross multiply you create ________ cross products. For example in
the proportion $\frac{a}{b} = \frac{c}{d}$, $ad = ____$. Once you have cross multiplied you need to __________ for the
variable using algebra. (There are 4 ways to set up any proportion and still get the correct answer.)

9. $\frac{4}{10} = \frac{k}{65}$
10. $\frac{4}{p} = \frac{p}{9}$
11. $\frac{3}{x+3} = \frac{4}{x+8}$
12. Given that $\frac{a}{b} = \frac{5}{7}$, complete the following equations.

\[ 7a = \quad b = \quad \frac{a}{5} = \quad \frac{7}{b} = \]

To solve an application using proportions follow these steps:

1. Read the problem carefully
   a. Are there any “tricks”? (percents, feet and inches mixed, multiple steps, etc)
2. Draw a picture (if needed)
3. Set up a proportion
4. Solve the problem

13. The scale of a map of downtown Dallas is 1.5 cm: 300 m. If the distance between Union Station and the Dallas Public Library is 6 cm, what is the actual distance?

14. The $250,000 budget for a local shelter is allocated proportionally to the men’s and women’s departments according to the population in the shelter by gender. If there are 1946 women and 399 men in the shelter, what amount rounded to the nearest dollar is allocated to the men’s department.

15. After an election in a small town, the newspaper reported that 42% of the registered voters actually voted. If 12,000 people voted, how many people are registered to vote in the town?

16. A student wanted to find the height of a statue of a pineapple in Nambour, Australia. She measured the pineapple’s shadow at 8 ft 9in and her own shadow at 2 ft. The student’s height is 5 ft 4 in. What is the height of the pineapple?

17. The Lincoln Memorial in Washington, D.C., is approximately 57 m long and 36 m wide. If you would want to make a scale drawing of the base of the building using a scale of 1 cm: 15 m, what would be the dimensions of the scale drawing?
1. Write the cross products for \( \frac{s}{t} = \frac{u}{w} \)

2. Write the ratio expressing the slope of each line.

3. Given that 2 points on line \( m \) are (-5, 0) and (1, -6) write a ratio that expresses the slope of line \( m \).

4. During the 2003 NFL Season, the Dallas Cowboys won 10 of their 16 regular season games. What is the ratio of wins to losses?

5. The ratio of the side lengths of a quadrilateral is 2: 4: 5: 7, and its perimeter is 36 m. What is the length of the shortest side?

6. The ratio of the angle measures in a triangle is 5: 12: 19. What is the measure of the largest angle?

7. The ratio of the side lengths of an isosceles triangle is 4: 4: 7, and its perimeter is 52.5 cm. What is the length of the base of the triangle?

Solve the following proportions

9. \( \frac{x}{2} = \frac{40}{16} \)

10. \( \frac{y}{3} = \frac{27}{y} \)

11. \( \frac{3x}{5} = \frac{15}{x} \)

12. \( \frac{x-6}{4} = \frac{x-9}{2} \)

13. An 18-inch stick breaks into three pieces. The ratio of the lengths of the pieces is 1: 4: 5. Which of these is NOT a length of one of the pieces?

A) 1.8 inches  B) 3.6 inches  C) 7.2 inches  D) 9 inches

14. Which of the following is equivalent to \( \frac{3}{5} = \frac{x}{y} \)?

A) \( \frac{3}{y} = \frac{5}{x} \)  B) \( 3x = 5y \)  C) \( \frac{x}{3} = \frac{y}{5} \)  D) \( 3(5) = xy \)

15. A recipe for salad dressing calls for oil and vinegar in a ratio of 5 parts oil to 2 parts vinegar. If you use 1 \( \frac{1}{4} \) cups of oil, how much vinegar will you need?

A) \( \frac{1}{2} \)  B) \( \frac{5}{8} \)  C) 2 \( \frac{1}{2} \)  D) 6 \( \frac{1}{4} \)
16. Find the length of \( \overline{A'B'} \) after the dilation.

17. Which of the following could NOT be an enlargement or reduction (dilation) of the original painting?

A. 4 in  6 in
B. 9 in  13 in
C. 10 in  15 in
D. 12 in  18 in

18. **Vocabulary** Finding distances using similar triangles is called _____?____.
   (indirect measurement or scale drawing)

19. **Measurement** To find the height of a dinosaur in a museum, Amir placed a mirror on the ground 40 ft from its base. Then he stepped back 4 ft so that he could see the top of the dinosaur in the mirror. Amir’s eyes were approximately 5 ft 6 in. above the ground. What is the height of the dinosaur?

20. **Measurement** Jenny is 5 ft 2 in. tall. To find the height of a light pole, she measured her shadow and the pole’s shadow. What is the height of the pole?

21. **Space Exploration** The scale of this model of the space shuttle is 1 ft : 50 ft. In the actual space shuttle, the main cargo bay measures 15 ft wide by 60 ft long. What are the dimensions of the cargo bay in the model?

22. A blueprint for a museum uses a scale of \( \frac{1}{4} \) in.: 1 ft.
   One of the rooms on the blueprint is \( 3\frac{3}{4} \) in. long.
   How long is the actual room?
   \[ \text{F} \ 4 \text{ ft} \quad \text{G} \ 15 \text{ ft} \quad \text{H} \ 45 \text{ ft} \quad \text{I} \ 180 \text{ ft} \]
Notes: Similar Figures

Figures that are similar (___) have the same ______ but not necessarily the same _______.
To prove figures similar their corresponding angles must be ______________ and their corresponding sides must be ______________.

Example: Identify the pairs of congruent angles and proportional sides in the following figure.

\[
\begin{align*}
\angle A \equiv & \quad AB \sim \quad \\
\angle B \equiv & \quad AD \sim \quad \\
\angle K \equiv & \quad JK \sim \quad \\
\angle L \equiv & \quad KL \sim \quad \\
\end{align*}
\]

A similarity statement can be written to show that polygons are similar. Ex: \(\triangle ABC \sim \triangle DEF\)

Example: Write a similarity statement for the figures above.

A similarity ratio is a ratio that compares the __________ of the corresponding sides of two similar polygons. The ratio is written in the same order as the ___________ _________.

Example: Write a similarity ratio for the figures above.

Example) Determine if each pair of polygons are similar. If so, write the similarity statement and the similarity ratio.

a) \[
\begin{array}{c}
\text{I} \\
\text{F} \\
\end{array}
\]

b) \[
\begin{array}{c}
\text{U} \\
\text{G} \\
\end{array}
\]

Discussion:

1. Two similar polygons have a similarity ratio of 1:1. What can you say about the two polygons?
2. Are all congruent figures similar?
3. Can similar figures be congruent?
Similar Figures Worksheet

For each pair of figures below, identify each pair of congruent angles and proportional sides.

1. 
2.

Determine whether the polygons are similar. If so, write the similarity ratio and a similarity statement.

3. $\triangle RSO \sim \triangle UXZ$
   - Similar: Y or N
   - Similarity Statement: 
   - Similarity Ratio:

4. rectangles $ABCD \sim JKL M$
   - Similar: Y or N
   - Similarity Statement: 
   - Similarity Ratio:

5. **Hobbies** The ratio of the model car’s dimensions to the actual car’s dimensions is $\frac{1}{50}$. The model has a length of 3 in. What is the length of the actual car?

6. $\squareJKLM \sim \square NOPQ$. If $\angle K = 75^\circ$, name two 75° angles in $\square NOPQ$.

7. Solve for $x$
   - $ABCD \sim EFGH$
   - $\triangle MNP \sim \triangle XYZ$

8. Solve for $x$.
   - $\triangle CGL \sim \triangle MPS$. The similarity ratio of $\triangle CGL$ to $\triangle MPS$ is $\frac{3}{2}$. What is the length of $PS$?

9. Which value of $y$ makes the two rectangles similar?
   - $A$ 3
   - $B$ 8.2
   - $C$ 25.2
   - $D$ 28.8

10. $\triangle GCL \sim \triangle MPS$. The similarity ratio of $\triangle GCL$ to $\triangle MPS$ is $\frac{3}{2}$. What is the length of $PS$?
    - $F$ 8
    - $G$ 12
    - $H$ 50
    - $I$ 75
There are 3 ways you can prove triangles similar WITHOUT having to use all sides and angles.

**Angle- Angle Similarity (AA~)** – If two angle of one triangle are ___________ to two corresponding angles of another triangle, then the triangles are similar.

**Side- Side- Side Similarity (SSS~)** – If the three sides of one triangle are ________________ to the three corresponding sides of another triangle, then the triangles are similar.

**Side-Angle- Side Similarity (SAS~)** – If two sides of one triangle are ________________ to two corresponding sides of another triangle and their included angles are ________________, then the triangles are similar.

**Examples: Determine if the triangles are similar. If so, tell why and write the similarity statement and similarity ratio.**

- **Triangle 1:**
  - Similar : Y or N  Why:________
  - Similarity Statement :_______~__________
  - Similarity Ratio :__________

- **Triangle 2:**
  - Similar : Y or N  Why:________
  - Similarity Statement :_______~__________
  - Similarity Ratio :__________

- **Triangle 3:**
  - Similar : Y or N  Why:________
  - Similarity Statement :_______~__________
  - Similarity Ratio :__________
SIMILAR TRIANGLES ASSIGNMENT – PART 1

1. Similar : Y or N Why:_________
   Similarity Statement : _______ ~ _________
   Similarity Ratio : _________

2. Similar : Y or N Why:_________
   Similarity Statement : _______ ~ _________
   Similarity Ratio : _________

3. $\triangle ABC \sim \triangle XYZ$, find AB.

4. If $\triangle CAT$ is similar to $\triangle PIT$, what is the length of $p$?

5. $\triangle EFG \sim \triangle HJG$, find FG.

6. If $\triangle CAT$ is similar to $\triangle PIT$, what is the length of TP?

7. Draw $\triangle JKL$ and $\triangle MNP$. Determine if you can conclude that $\triangle JKL \sim \triangle MNP$ based on the given information. If so, which postulates or theorem justifies your response?

8. **ERROR ANALYSIS** Which solution for the value of $y$ is incorrect? Explain the error.

9. $\square ABCD \sim \square EFGH$. Which similarity postulate or theorem lets you conclude that $\triangle BCD \sim \triangle FGH$?
   - A) AA
   - B) SSS
   - C) SAS
   - D) None of these
Notes: Similar Triangles Properties

If there is a line that is ____________ to one side of a triangle and it ______________ the other two sides, then it divides the sides it intersects ________________. This also causes a nested triangle to occur. So you could have the proportion small triangle to large triangle. Complete the proportions for each figure.

Ex. 1

Ex. 2

Now that you can write the proportions, you can solve problems.

Ex. 3

Ex. 4

An angle bisector of a triangle divides the opposite side into 2 segments whose lengths are _________________ to the lengths of the other 2 sides.

Ex. 5

Ex. 6 Find RV

Ex. 7 Find y

You can also use similar triangles to find the missing coordinates.

Given that $\triangle AOB \sim \triangle COD$, find the missing coordinates and the scale factor.

Ex. 9
SIMILAR TRIANGLES ASSIGNMENT – PART 2

1. \( \frac{TA}{AR} = \frac{TI}{TR} \)
   \( \frac{TA}{TR} = \frac{IO}{TO} \)
   \( \frac{TA}{TR} = \frac{RO}{TO} \)

2. \( \frac{OR}{AN} = \frac{ES}{NG} \)
   \( \frac{RE}{AG} = \frac{AG}{NG} \)
   \( \frac{RA}{OA} = \frac{GE}{DE} \)

In the figure, \( \overline{BC} \parallel \overline{DE} \parallel \overline{FG} \). Complete each proportion.

3. \( \frac{DF}{BD} = \frac{CE}{CE} \)
4. \( \frac{DF}{EG} = \frac{CG}{EG} \)

5. \( \frac{BF}{DF} = \frac{CE}{EG} \)
6. \( \frac{BD}{CE} = \frac{EG}{EG} \)

7. Find \( AB \)

8. Find the length of \( CM : \) __________

9. Given that \( RT \parallel AC \), \( SR = 9 \), \( AR = 3 \) and \( ST = 12 \), find \( SC \)

10. Solve for \( x = \) __________

11. Find the value of \( k \) _______

12. \( \Delta ACB \) find \( x \) so that \( \overline{DE} \parallel \overline{CB} \)
   \( DC = 6 \), \( AD = 2 \), \( AE = 4 \) \( EB = x - 3 \)
13. **Travel** The map shows the area around Herald Square in Manhattan, New York, and the approximate length of several streets. If the numbered streets are parallel, what is the length of Broadway between 34th St. and 35th St. to the nearest foot?

14. On the map, 1st St. and 2nd St. are parallel. What is the distance from City Hall to 2nd St. along Cedar Rd.?
   - A 1.8 mi
   - B 3.2 mi
   - C 4.2 mi
   - D 5.6 mi

15. Find x

16. Find y

17. \( \triangle FEG \sim \triangle HEJ \). Find the coordinates of \( F \) and the scale factor.

18. Given that \( \triangle AEB \sim \triangle CED \), find the coordinates of \( C \) and the scale factor.

19. Given that \( \triangle LKM \sim \triangle NKP \), find the coordinates of \( P \) and the scale factor.
The geometric mean of two positive numbers is the positive square root of their products. For \( \frac{a}{x} = \frac{x}{b} \), the x is the geometric mean.

**Examples: Find the geometric mean of the given numbers.**

a. 4 and 9  

b. 6 and 15  

c. 2 and 8  

The altitude to the hypotenuse of a right triangle forms two triangles that are ________________ to each other and to the original triangle. In other words, there are ________ similar triangles: a small one, a medium one, and a large one.

**Examples:**

Ex 1: \( m = 2, n = 10, h = \) _____

Ex 2: \( m = 2, n = 10, b = \) _____

You draw the similar triangles:
You Try Example

\[ n = 27, \ c = 30, \ b = \text{______} \]

You draw the similar triangles:

GEOMETRIC MEAN ASSIGNMENT

1. \[ m = 3, \ h = 9, \ n = \text{______} \]

You draw the triangles:

2. \[ m = 4, \ n = 6, \ b = \text{______} \]

You draw the triangles:
3. \( n = 12.8, \ h = 9.6, \ m = \) _____

You draw the triangles:

Find the geometric mean between the two given numbers.
4. 2 and 50
5. 4 and 16

6. In the proportion \( \frac{2}{8} = \frac{8}{32} \), which number is the geometric mean of the other two numbers?

7. Write a similarity statement comparing the three triangles in the diagram.