Name: _____

Write your questions here!

4.3 Proportions & Cross Multiplication

PROPORTIONS A **proportion** is an equation that states that two ratios are equivalent. The general form of a proportion is given below.

READING
This proportion is read "*a* is to *b* as *c* is to *d*."

$$\frac{a}{b} = \frac{c}{d} \text{ where } b \neq 0,\ d \neq 0$$

If one of the numbers in a proportion is unknown, you can solve the proportion to find the unknown number. To solve a proportion with a variable in the numerator, you can use the same methods you used to solve equations.

Examples: Solve the proportions:

$$\frac{22}{6} = \frac{x}{15} \qquad \frac{9}{2} = \frac{m}{12} \qquad \frac{5}{13} = \frac{k-4}{39}$$

$$\frac{3r}{5} = \frac{36}{15} \qquad \frac{7}{112} = \frac{c-3}{8}$$

In the first four games of the season, a soccer team scored a total of ten goals. If this trend continues, how many goals will the team score in the eighteen remaining games of the season?

Proportions are useful for solving for an unknown.

For instance, $\frac{x}{5} = \frac{6}{15}$

$$\frac{a}{b} = \frac{c}{d} \rightarrow a \cdot d = b \cdot c \qquad \frac{7}{x} = \frac{10}{11}$$

Write your questions here!

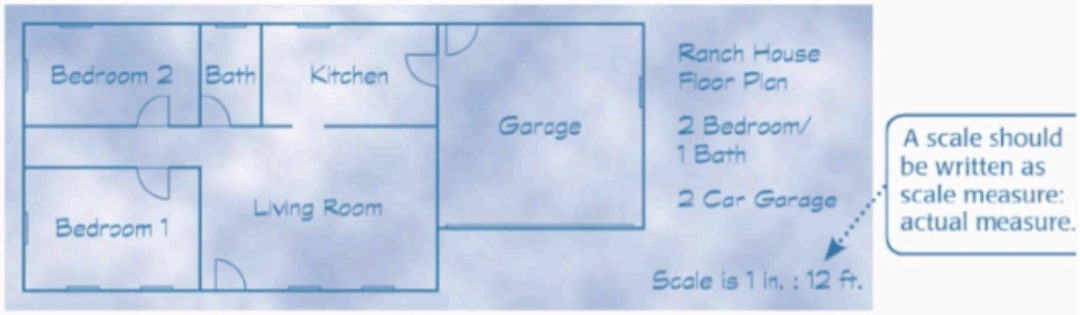
Examples:

$$\frac{3k}{27} = \frac{2}{3} \qquad \frac{7}{3} = \frac{2x+5}{x} \qquad \frac{6}{4+2w} = -\frac{2}{w-10}$$

You try 2:

$$\frac{d+1}{4} = \frac{3d+6}{7} \qquad \frac{c-8}{-2} = \frac{11-4c}{11}$$

SCALE DRAWINGS AND SCALE MODELS The floor plan below is an example of a *scale drawing*. A **scale drawing** is a two-dimensional drawing of an object in which the dimensions of the drawing are in proportion to the dimensions of the object. A **scale model** is a three-dimensional model of an object in which the dimensions of the model are in proportion to the dimensions of the object.



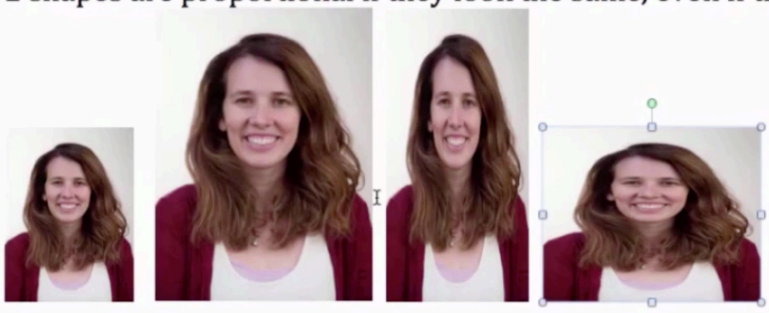
Use a metric ruler to estimate the distance from Cincinnati, Ohio to Cleveland:

Write your questions here!

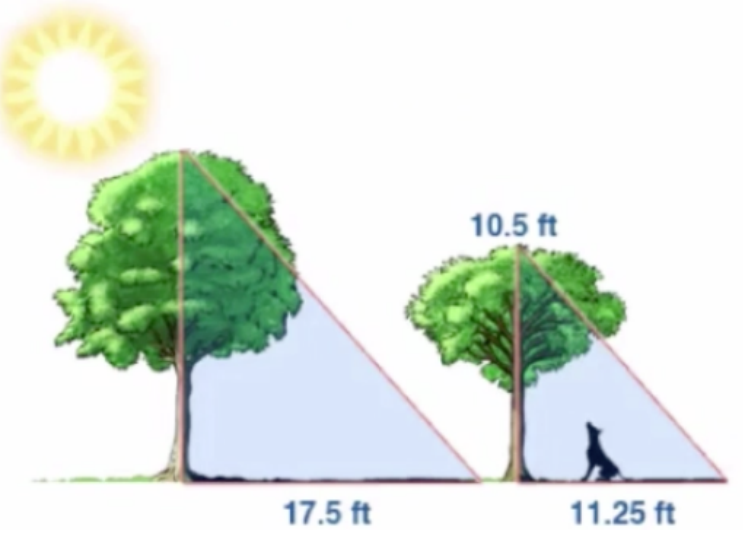
You Try! The ship model kits sold at a hobby store have a scale of 1 ft : 600 ft. A completed model of the Queen Elizabeth II is 1.6 feet long. Estimate the actual length of the Queen Elizabeth II.

Proportional

2 shapes are proportional if they look the same, even if they are different sizes.



Proportional Proportional These 2 are not Proportional



Now, summarize your notes here!

4.3 PRACTICE PROBLEMS

Solve the proportions below using the "*Do or Undo Table*" or the "*Onion Method.*"
Round each answer to the nearest hundredth.

1. $\frac{2}{5} = \frac{x}{3}$

2. $\frac{c}{8} = \frac{11}{4}$

3. $\frac{16}{7} = \frac{m}{21}$

4. $\frac{5}{8} = \frac{t}{24}$

5. $\frac{p}{20} = \frac{8}{4}$

6. $\frac{16}{48} = \frac{n}{36}$

WRITING AND SOLVING PROPORTIONS. Write the sentence as a proportion. Then, solve the proportion.

7. *b* is to 10 as 7 is to 2

8. 12 is to 18 as *d* is to 27

9. $\frac{b}{0.5} = \frac{9}{2.5}$

10. $\frac{2.1}{7.7} = \frac{v}{8.8}$

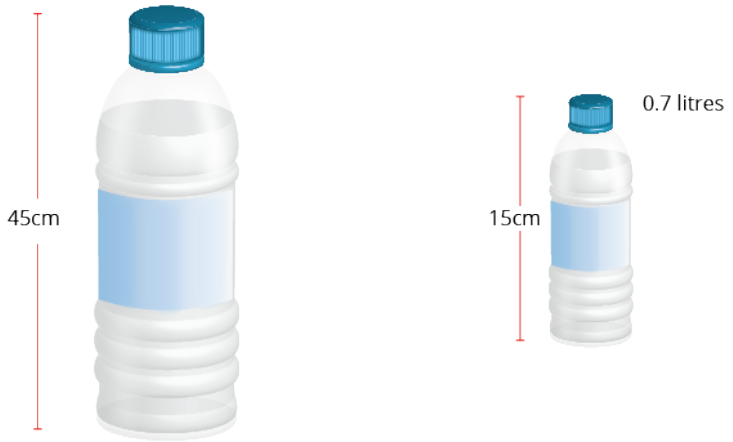
11. $\frac{3a}{4} = \frac{36}{12}$

12. $\frac{6r}{10} = \frac{36}{15}$

13. $\frac{m+3}{8} = \frac{40}{64}$

14. $\frac{7}{112} = \frac{c-3}{8}$

15. How many liters are in the first bottle?



16. Duane paid $2.24 for 8 apples. Joanne bought 5 apples at the same rate. How much did Joanne pay for the apples?

Solve each proportion. Round your answers to the nearest hundredth.

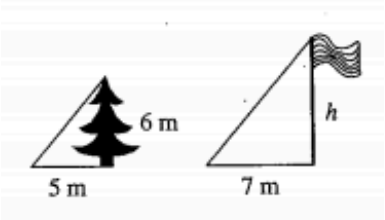
17.

$$\frac{v}{4.9} = \frac{5.4}{6.1}$$

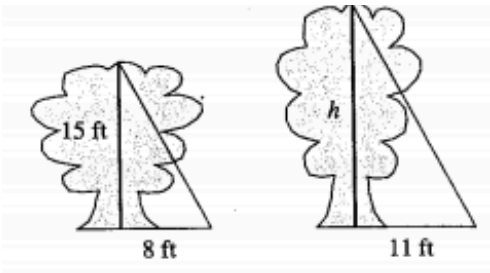
18.

$$\frac{7.7}{3.6} = \frac{2.3}{b}$$

19. Find the height of the flagpole.



20. Find the height of the tree.



Solve the proportions below using the *Cross Multiplication Method.*
Leave your answer as a fraction in simplest form.

21.

$$\frac{2}{3} = \frac{4}{x}$$

22.

$$\frac{13}{6} = \frac{52}{z}$$

23.

$$\frac{5m}{6} = \frac{10}{12}$$

24. (Hint: Put the – sign in the top!)

$$-\frac{49}{7} = \frac{a+7}{6}$$

25.

$$\frac{8}{12} = \frac{r}{r+1}$$

26.

$$\frac{11}{w} = \frac{33}{w+24}$$

27.

$$\frac{24}{5z+4} = \frac{4}{z-1}$$

28. (Hint: Put the – sign in the top!)

$$\frac{k-8}{7+k} = -\frac{1}{5}$$

29.

$$\frac{m+1}{4} = \frac{3m+6}{7}$$

Solve each proportion. Round each answer to the nearest hundredth.

30.

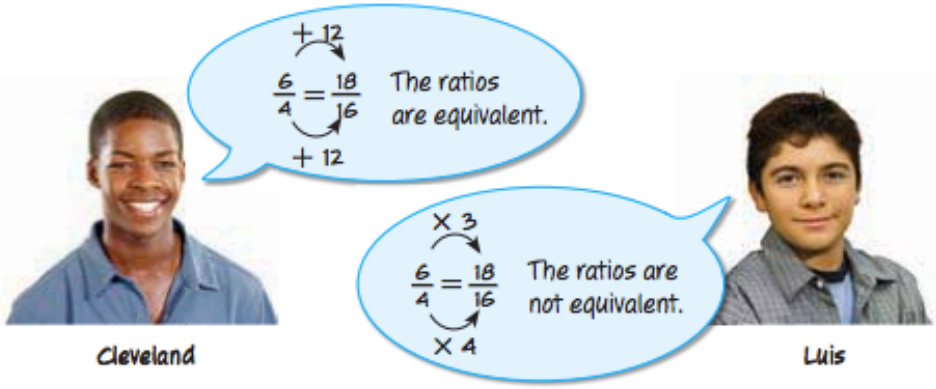
$$\frac{n+0.3}{n-3.2} = \frac{9}{2}$$

31.

$$\frac{4}{b-3.9} = \frac{2}{b+1}$$

Find the student error.

32. Cleveland and Luis are determining whether the ratios $\frac{6}{4}$ and $\frac{18}{16}$ are equivalent. Who is correct? Explain.



Setup a proportion for the following story problems and solve.

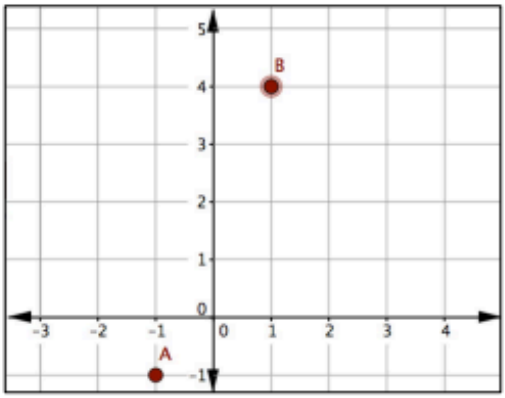
33. The cost of sending 20 pages using a commercial fax machine is $18. At this rate, how much will it cost to send 30 pages using the same fax machine?

34. During the first day of a trip, Mario drove 168 mi and used 6 gal of gasoline. At this rate, how many gallons of gasoline will Mario use for a 588-mile trip?

35. The ratio of boys to girls in a science class is 2:3. There are 18 girls in the class. How many students in the class are boys?

36. A recent school bond passed with 3 out of every 4 votes in favor of the bond. A total of 2550 people voted against the bond. How many people voted in favor of the bond?

37. An oak tree casts a shadow of 14 ft. A 30 ft flagpole casts a shadow of 6 ft. How tall is the oak tree? (*Draw a picture*)	38. A 1000 ft building near the Sears Tower in Chicago casts a shadow of 400 ft. The Sears Tower is 1454 ft tall. How long a shadow does the Sears Tower cast? (*Draw a picture*)

1. Solve: $-8 - \frac{x}{5} = -10$	2. Simplify: $-5 - (-4x - 2)$	3. Describe how to move from Point A to Point B:  _____ units in the y direction _____ units in the x direction
4. Solve: $-18 - 2x = -10$	5. Simplify: $12 - 3x = 15$	6. Describe how to move from point C(3, -1) to Point D(-3, 3):

4.2 APPLICATION

1. Solve for x: $\frac{2}{x-1} = \frac{12}{5x+4}$

2. Solve for x: $\frac{14}{3} = \frac{4x+10}{x}$

3. ***Mountainous Snowboarding.*** One day, the ratio of skiers to snowboarders on the mountain at a ski resort was 13 : 10. The resort sold a total of 253 lift tickets during the day.

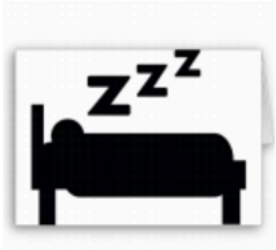
   a. Find the ratio of snowboarders on the mountain to all of the snowboarders and skiers on the mountain.

   b. Use the ratio from part (a) to find the number of lift tickets sold to snowboarders during the day.

4. ***Like!*** It took 7.2 minutes to upload 8 digital pictures from your computer to Facebook. At this rate, how long will it take to upload 20 photographs.

5. ***Scale Model.*** An exhibit at DoDEA-Europe headquarters in Sembach included a scale model of the new Kaiserslautern High School being built on Vogelweh Kaserne. The model was built using a scale of 1 cm : 18 inches. Find the height of the new school ***<u>In feet</u>***, if the model is 30 cm tall at its highest point.

6. During the summer, Mr. Brust does a lot of napping (and snoring)! In a typical nap, Mr. Brust will snore on average 320 times (or the ratio of naps to snores is 1 nap : 320 snores). Find the total number of times Mr. Brust snored last summer during naps in July and August if he took one nap everyday.



7. **Fireworks!** The diameter of the burst of firework is proportional to the diameter of the shell of the firework.

a. Use the information (90 ft burst; 2 inch shell) to find the burst diameter for a 4.75-inch shell.

b. Make a table of burst diameters for 2,3,4,5, and 6 inch shells. Use your answer to check part (a).

Shell Diameter	2	3		4.75		6
Burst Diameter						

8. ***Multiple Proportions.*** Suppose you know one proportion where 12 is to 72 as x is to 24 while at the same time, x is to 36 as y is to 81. Find y. (Hint: Solve for x first! Then, solve for y.)

9. **3 Act Math Activity**

Act 1 – How tall is the building?

Low Guess	Guess	High Guess

Act 2 – What information do you need?

Act 3 - Solution

10. **3 Act Math Activity**

Act 1 – How tall is the light post in the photo?

Low Guess	High Guess	Actual Guess

Act 2 – What information/tools do you need?

Act 3 - Solution