

Similarity Notes #1

Name: Key

Ratios and Proportions

A ratio is a comparison of two quantities using division.

Example: $\frac{a}{b}$

A ratio can be represented in the following ways:

1. $\frac{3}{2}$
2. 3 : 2
3. 3 to 2

Extended ratios can be used to compare three or more quantities. The expression $a : b : c$ means that the ratio of the first two quantities is $a : b$, the ratio of the last two quantities is $b : c$, and the ratio of the first and last quantities is $a : c$.

Examples:

1. Give each ratio in simplest form:

(a) $8 : 2$
 $4 : 1$

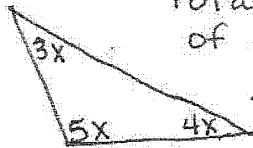
(b) $\frac{24}{36} = \frac{2}{3}$

(c) $13xy : 39x$
 $y : 3$ $\frac{13xy}{39x} = \frac{y}{3}$

2. Extended Ratios Examples: The ratio of the measures of the angles in a triangle is 3 : 4 : 5. Find the measures of the angles.

$\frac{3}{4}$ is equivalent to $\frac{3x}{4x}$, therefore 3:4:5 can be written as 3x:4x:5x

Total measures of angles in a $\Delta = 180^\circ$



$3x + 4x + 5x = 180$
 $12x = 180$
 $x = 15$

$3x = 3(15) = 45^\circ$
 $4x = 4(15) = 60^\circ$
 $5x = 5(15) = 75^\circ$

A proportion is an equation stating that two ratios are equal.

Example: $\frac{\text{extreme } a}{\text{mean } b} = \frac{\text{mean } c}{\text{extreme } d}$

The numbers a and d are called the extremes of the proportion, while the numbers b and c are called the means of the proportion.

The product of the extremes ad and the product of the means bc are called cross products.

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To Solve for an Unknown in a Proportion:

Cross Multiply.

$$\frac{a}{b} = \frac{c}{d} \text{ then } ad = bc$$

Examples:

1. Solve for x.

(a) $\frac{3}{4} = \frac{6}{x}$
 $3x = 24$
 $x = 8$

(b) $3 : 5 = 6 : x$
 $\frac{3}{5} = \frac{6}{x}$
 $3x = 30$
 $x = 10$

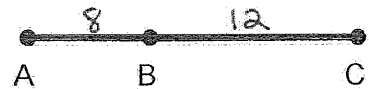
(c) $-2 : (x-3) = 6 : (x+5)$
 $\frac{-2}{x-3} = \frac{6}{x+5}$
 $2(x+5) = 6(x-3)$
 $2x+10 = 6x-18$
 $-4x = -28$
 $x = 7$

Now you try!

2. (a) Reduce: $\frac{15}{60}$
 $\frac{1}{4}$

(b) Solve for x.
 $\frac{6}{18} = \frac{8}{x}$
 $6x = 144$
 $x = 24$

(c) Solve for x.
 $\frac{3}{x+3} = \frac{2}{x+1}$ $3(x+1) = 2(x+3)$
 $3x+3 = 2x+6$
 $x = 3$



3. Given: AB = 8 and BC = 12; State the following ratios.

(a) AB : BC
 $\frac{8}{12} = \frac{2}{3}$

(b) AC : BC
 $\frac{20}{12} = \frac{5}{3}$

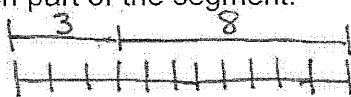
(c) AB : AC
 $\frac{8}{20} = \frac{2}{5}$

4. Will the following ratios form a proportion?

(a) $\frac{6}{24}$ and $\frac{4}{16}$ $\frac{96=96}{\text{Yes}}$

(b) $\frac{2}{9} = \frac{3}{10}$ $\frac{20 \neq 27}{\text{no}}$

5. A segment is divided in the ratio of 3 : 8. If the segment is 44 cm long, find the length of each part of the segment.



$\frac{44}{11} = 4$ each segment unit

$3 \cdot 4 = 12 \text{ cm}$
 $4 \cdot 8 = 32 \text{ cm}$

6. Two complementary angles are in the ratio of 2 : 7. Find the measure of each angle.

Complementary \angle s sum 90°
 $2x + 7x = 90^\circ$
 $9x = 90^\circ$
 $x = 10$

$2x = 2 \cdot 10 = 20^\circ$
 $7x = 7 \cdot 10 = 70^\circ$
 20° and 70°

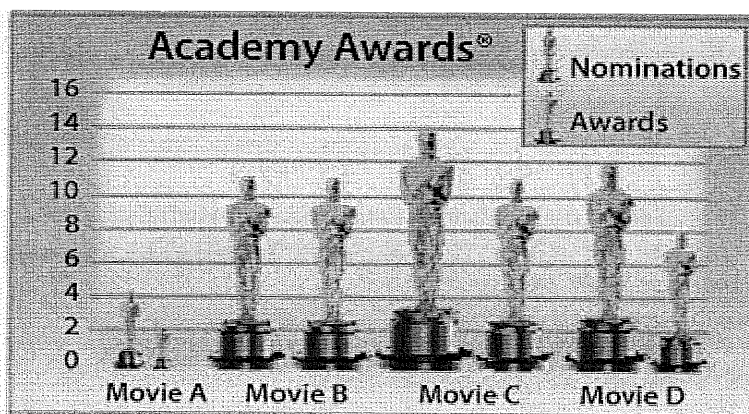
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 Ratios and Proportions: Homework Solutions



Check Your Understanding

Step-by-Step Solutions begin on page B14.

- Example 1**
- PETS** Out of a survey of 1000 households, 460 had at least one dog or cat as a pet. What is the ratio of pet owners to households? **23:50**
 - SPORTS** Thirty girls tried out for 15 spots on the basketball team. What is the ratio of open spots to the number of girls competing? **1:2**
- Example 2**
- The ratio of the measures of three sides of a triangle is 2:5:4, and its perimeter is 165 units. Find the measure of each side of the triangle. **30, 75, 60**
 - The ratios of the measures of three angles of a triangle are 4:6:8. Find the measure of each angle of the triangle. **40, 60, 80**
- Example 3** Solve each proportion.
- $\frac{2}{3} = \frac{x}{24}$ **16**
 - $\frac{x}{5} = \frac{28}{100}$ **1.4**
 - $\frac{2.2}{x} = \frac{26.4}{96}$ **8**
 - $\frac{x-3}{3} = \frac{5}{8}$ **4.875**
- Example 4**
- MODELING** Ella is baking apple muffins for the Student Council bake sale. The recipe that she is using calls for 2 eggs per dozen muffins, and she needs to make 108 muffins. How many eggs will she need? **18**



- Of the films listed, which had the greatest ratio of Academy Awards to number of nominations? **Movie B; 1:1**
- Which film listed had the lowest ratio of awards to nominations? **Movie A; 1:2**
- GAMES** A video game store has 60 games to choose from, including 40 sports games. What is the ratio of sports games to video games? **2:3**
- The ratio of the measures of the three sides of a triangle is 9:7:5. Its perimeter is 191.1 inches. Find the measure of each side. **81.9 in., 63.7 in., 45.5 in.**
- The ratio of the measures of the three sides of a triangle is 3:7:5, and its perimeter is 156.8 meters. Find the measure of each side. **31.4 m, 73.2 m, 52.3 m**
- The ratio of the measures of the three sides of a triangle is $\frac{1}{4}:\frac{1}{8}:\frac{1}{6}$. Its perimeter is 4.75 feet. Find the length of the longest side. **2.2 ft**
- The ratio of the measures of the three sides of a triangle is $\frac{1}{4}:\frac{1}{3}:\frac{1}{6}$, and its perimeter is 31.5 centimeters. Find the length of the shortest side. **7 cm**

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Find the measures of the angles of each triangle.

17. The ratio of the measures of the three angles is 3:6:1. **54, 108, 18**
18. The ratio of the measures of the three angles is 7:5:8. **63, 45, 72**
19. The ratio of the measures of the three angles is 10:8:6. **75, 60, 45**
20. The ratio of the measures of the three angles is 5:4:7. **56.25, 45, 78.75**

Solve each proportion.

21. $\frac{5}{8} = \frac{y}{3}$ $\frac{15}{8}$ 22. $\frac{w}{6.4} = \frac{1}{2}$ **3.2** 23. $\frac{4x}{24} = \frac{56}{112}$ **3** 24. $\frac{11}{20} = \frac{55}{20x}$ **5**
25. $\frac{2x+5}{10} = \frac{42}{20}$ **8** 26. $\frac{a+2}{a-2} = \frac{3}{2}$ **10** 27. $\frac{3x-1}{4} = \frac{2x+4}{5}$ **3** 28. $\frac{3x-6}{2} = \frac{4x-2}{4}$ **5**

29. **NUTRITION** According to a recent study, 7 out of every 500 Americans aged 13 to 17 years are vegetarian. In a group of 350 13- to 17-year-olds, about how many would you expect to be vegetarian? **about 5**

30. **CURRENCY** Your family is traveling to Mexico on vacation. You have saved \$500 to use for spending money. If 269 Mexican pesos is equivalent to 25 United States dollars, how much money will you get when you exchange your \$500 for pesos? **5380 pesos**

► **ALGEBRA** Solve each proportion. Round to the nearest tenth.

31. $\frac{2x+3}{3} = \frac{6}{x-1}$ **3, -3.5** 32. $\frac{x^2+4x+4}{40} = \frac{x+2}{10}$ **2, -2** 33. $\frac{9x+6}{18} = \frac{20x+4}{3x}$ **12.9, -0.2**
34. The perimeter of a rectangle is 98 feet. The ratio of its length to its width is 5:2. Find the area of the rectangle. **490 ft²**
35. The perimeter of a rectangle is 220 inches. The ratio of its length to its width is 7:3. Find the area of the rectangle. **2541 in²**
36. The ratio of the measures of the side lengths of a quadrilateral is 2:3:5:4. Its perimeter is 154 feet. Find the length of the shortest side. **22 ft**
37. The ratio of the measures of the angles of a quadrilateral is 2:4:6:3. Find the measures of the angles of the quadrilateral. **48, 96, 144, 72**
38. **SUMMER JOBS** In June of 2000, 60.2% of American teens 16 to 19 years old had summer jobs. By June of 2006, 51.6% of teens in that age group were a part of the summer work force.
a. Has the number of 16- to 19-year-olds with summer jobs increased or decreased since 2000? Explain your reasoning. **See margin.**
b. In June 2006, how many 16- to 19-year-olds would you expect to have jobs out of 700 in that age group? Explain your reasoning. **See margin.**