

RATIO, PROPORTION AND PROBABILITY

The student will be able to:

1. Perform basic operations and demonstrate an understanding of ratio, proportion and probability.

- Write ratios—using the word “to”, with a colon, or as a fraction (e.g., 5 to 10, 5:10, 5/10)
- Simplify ratios
- Write equivalent ratios
- Determine if two ratios are proportional
- Set up a proportion to fit a situation
- Cross-multiply and divide to find the unknown in a proportion
- Determine when it’s appropriate to use ratios or proportions to solve problems and set them up correctly
- Predict the probability of an event
- Express probability as a ratio and percent
- Find independent probability (1st event does **not** affect the 2nd)
- Find dependent probability (result of 1st event **does** affect the 2nd)

2. Apply appropriate strategies to solve word problems involving ratios, proportions, and probability.

- Be able to write a ratio to show the comparison of two amounts
- Correctly set up proportions to fit the situation
- Set up two ratios, one with an unknown; find the unknown by multiplying the cross products and dividing by the known amount.
- Use proportions to solve the following types of problems:
 - Percent problems $\frac{\text{Part}}{\text{Whole}} = \frac{? \% \text{ part}}{100\%}$
 - Scale maps and drawings $\frac{\text{One inch}}{10 \text{ miles}} = \frac{\text{Inches on map}}{? \text{ actual miles}}$
 - Increase or decrease recipes $\frac{1 \text{ tsp. salt}}{\text{Serve 6}} = \frac{? \text{ tsp. salt}}{\text{Serve 12}}$
 - Find unknown sides of similar figures
 - Figure out production based on a unit rate
 - Figure out the missing part when you know one part and the ratio
(The plant has one woman employee for every 3 men. There are 56 men. How many women?)
 - Solve circle graphs
 - Reduce proper or improper fractions
- Determine if the answer makes sense

Using Ratio and Proportion to Solve Many Types of Problems

*Many kinds of problems can be solved by using proportions. Using “the box” to solve proportion problems enables students to label the problem information thus eliminating a big source of confusion. For each problem the process is the same: multiply the two diagonal numbers and divide that product by the only number that remains in the grid. The answer to this division will fit in the missing grid square, completing the proportion. To check any proportion problem, the product of each diagonal **should be equal**.*

Examples on next page.....

A “Standard” Proportion Problem

Example: Pam uses 2 pounds of sugar for every 3

| | |
|------------------------|------------------------|
| Sugar (pounds) 2 | Sugar (pounds) x |
| Fruit (quarts) 3 | Fruit (quarts) 9 |

| | |
|--------------------|---------|
| Part (is) 36 | % 20 |
| Whole (of) x | 100 |

Percentage
 Example: 36 is 20% of what number?
 Notice “the part” is associated with “is.”
 “The whole” is associated with “of.”
 Method: $36 \times 100 = 3,600$ $3,600 \div 20 = 180$ $x=180$

| | |
|-------------------|--------|
| Change 700 | % x |
| Original 2,500 | 100 |

Percentage of Increase or Decrease
 Example: May’s property taxes went up from \$2,500 to \$3,200. By what percent did they increase?
 First find the CHANGE (difference).

$$\begin{array}{r} 3,200 \\ - 2,500 \\ \hline 700 \end{array}$$

 Remember to use the ORIGINAL in the lower left corner.
 Method: $700 \times 100 = 70,000$ $70,000 \div 2,500 = 28$ $x=28\%$

| | |
|-----------------------------|---------------------------------|
| Linda’s height 5 feet | Flagpole’s height x |
| Linda’s shadow 7 feet | Flagpole’s shadow 35 feet |

“Flagpole Problem”
 Example: Linda is 5 feet tall and casts a shadow that’s 7 feet long. If a flagpole next to Linda casts a shadow that is 35 feet long, how tall is the flagpole?
 (Hint: Go outside and demonstrate this on a sunny day!)
 Method: $5 \times 35 = 175$ $175 \div 7 = 25$ $x = 25$ feet

| | |
|------------------|----------------|
| Little side 4 | Big side x |
| Little base 6 | Big base 12 |

Similar Triangles
 If these two triangles are similar, what is the length of side x?
 Method: $4 \times 12 = 48$ $48 \div 6 = 8$ Side $x = 6$

| | |
|--------------|---------------|
| Ounces 32 | Ounces 224 |
| Quarts 1 | Quarts x |

Changing Units of Measurement

Example: How many quarts are there in 224 ounces?

Use the unit conversion for two of the grid squares.

e.g. 32 ounces = 1 quart

Method: $1 \times 224 = 224$ $224 \div 32 = 7$ $x = 7$ quarts

Susan Bulp

Recommendations for teaching ratio, proportion, and probability

- Use protractors and rulers to draw and measure similar triangles of different sizes. Compare the length of the sides.
- Use simple examples from recipes or scale drawings to get intuitive answers, then set up proportions to show how they work.
- Have students make up their own questions that require proportions for solution.
- Make sure you link the words with the numbers.
- Demonstrate probability using a variety of activities such as the probability of drawing cards from a deck or flipping a coin

Essential Ratio, Proportion and Probability Vocabulary

- **Congruent figures:** geometric figures that are the same size *and* shape
- **Dependent Probability:** the 1st event **does** affect the 2nd event
- **Equivalent fractions:** different fractions which name the same amount, such as $\frac{2}{4}$ and $\frac{3}{6}$
- **Independent Probability:** 1st event does **not** affect the results of the 2nd event
- **Probability:** the number of favorable outcomes compared to the number of possible outcomes
- **Proportion:** two equal ratios
- **Ratio:** a way of comparing two numbers using division
- **Similar figures:** proportional figures that are the same shape, but are different sizes



Name _____

Date _____

Ratios, Proportions, & Probability Assessment

Write each ratio in three ways. Write your answer in simplest form.

| | |
|--|---|
| 1. 14 black marbles, 7 blue marbles, and 8 brown marbles ratio of black marbles to all the marbles | 2. 9 black marbles, 19 white marbles, 10 green marbles, and 3 orange marbles ratio of all the marbles to black marbles |
| 3. 11 black marbles, 9 violet marbles, and 17 green marbles ratio of all the marbles to green marbles | 4. 19 black marbles and 2 blue marbles ratio of blue marbles to black marbles |

Write three equivalent ratios for each ratio.

| | | |
|---------|-----------|------------------|
| 5. 5:10 | 6. 3 to 4 | 7. $\frac{5}{7}$ |
|---------|-----------|------------------|

State whether the ratios are proportional. Write *yes* or *no*.

| | | | |
|---------------------------------|----------------------------------|-----------------------------------|-----------------------------------|
| 8. $\frac{8}{7} = \frac{2}{28}$ | 9. $\frac{11}{2} = \frac{6}{33}$ | 10. $\frac{40}{50} = \frac{4}{5}$ | 11. $\frac{1}{10} = \frac{4}{40}$ |
|---------------------------------|----------------------------------|-----------------------------------|-----------------------------------|

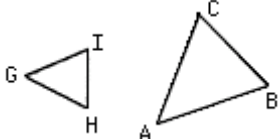
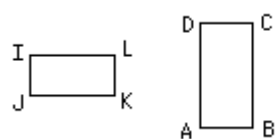
Find the missing number.

| | | | |
|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| 12. $\frac{9}{4} = \frac{45}{n}$ | 13. $\frac{3}{10} = \frac{n}{30}$ | 14. $\frac{8}{n} = \frac{40}{35}$ | 15. $\frac{n}{9} = \frac{20}{45}$ |
|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|

Solve.

| | |
|--|---|
| <p>16. 150 pages in 3 days = _____ pages in 9 days</p> | <p>17. 96 miles in 2 hours = _____ miles in 4 hours</p> |
| <p>18. 106 meters in 2 seconds = _____ meters in 5 seconds</p> | <p>19. 81 seats in 9 rows = _____ seats in 6 rows</p> |

Use a proportion to find the unknown length in the pair of similar figures. (drawings are not drawn to scale)

| | | | | | | | | | | | | | | | |
|--|-------------|------------|------------|-------------|------------|------------|---|------------|------------|------------|------------|------------|------------|------------|------------|
| <p>20.</p>  <p>length of sides:</p> <table style="width: 100%;"> <tr> <td style="width: 50%;">IH = 88 cm</td> <td style="width: 50%;">AC = 56 cm</td> </tr> <tr> <td>GH = 40 cm</td> <td>CB = 154 cm</td> </tr> <tr> <td>GI = _____</td> <td>AB = 70 cm</td> </tr> </table> | IH = 88 cm | AC = 56 cm | GH = 40 cm | CB = 154 cm | GI = _____ | AB = 70 cm | <p>21.</p>  <p>length of sides:</p> <table style="width: 100%;"> <tr> <td style="width: 50%;">JK = 18 ft</td> <td style="width: 50%;">DA = 54 ft</td> </tr> <tr> <td>IJ = 12 ft</td> <td>BC = 54 ft</td> </tr> <tr> <td>LI = 18 ft</td> <td>CD = _____</td> </tr> <tr> <td>KL = 12 ft</td> <td>AB = 36 ft</td> </tr> </table> | JK = 18 ft | DA = 54 ft | IJ = 12 ft | BC = 54 ft | LI = 18 ft | CD = _____ | KL = 12 ft | AB = 36 ft |
| IH = 88 cm | AC = 56 cm | | | | | | | | | | | | | | |
| GH = 40 cm | CB = 154 cm | | | | | | | | | | | | | | |
| GI = _____ | AB = 70 cm | | | | | | | | | | | | | | |
| JK = 18 ft | DA = 54 ft | | | | | | | | | | | | | | |
| IJ = 12 ft | BC = 54 ft | | | | | | | | | | | | | | |
| LI = 18 ft | CD = _____ | | | | | | | | | | | | | | |
| KL = 12 ft | AB = 36 ft | | | | | | | | | | | | | | |

Write the probability.

| | |
|---|--|
| <p>22. A bag contains 4 yellow marbles, 9 green marbles, 4 blue marbles, 4 red marbles, and 15 purple marbles. What is the probability of pulling out a green marble?</p> <p>___ out of ___</p> | <p>23. If one letter is chosen at random from the word <i>mathematics</i>, what is the probability that the letter chosen is the letter "a"?</p> <p>___ out of ___</p> |
|---|--|

Solve the following. Simplify if possible.

1. Charles worked a total of 30 hours last week. He worked 10 hours on Monday. What fraction of his work hours for the week did he complete on Monday?
2. An adult education class has 15 students. 5 are teenagers. What is the ratio of teenagers to older students?
3. Molly wants to know the height of the flagpole in front of the town hall. She sees that it casts a shadow 24 feet long. She drives a stake into the ground beside the flagpole. The stake is 4 feet high. Its shadow is 2 feet long. How tall is the flagpole? (make a drawing to help solve this problem)
4. Sandy is making cookies for a bake sale. Her recipe makes 2 dozen cookies, but she wants to take 6 dozen to the sale. If the original recipe calls for 1 teaspoon of vanilla, how much vanilla will she need for 6 dozen cookies?
5. Maria traveled 400 miles in 5 hours. How many miles did she travel **per** hour ?
6. The scale on a map says 1 inch equals 150 miles. How many miles apart are two cities if you measure $4\frac{1}{2}$ inches between them?
7. Wisline spent \$29.00 for 2 cans of paint. How much will she spend if she buys 7 gallons at the same rate?
8. John typed 5 pages in 20 minutes. What is the ratio of typed pages to minutes?

Student Inventory Ratio, Proportion & Probability

Name _____

Date _____

*Answer each question below by putting a check mark after Yes or I need more work.
If you check yes, prove it by answering the question.*

1. I can write ratios.

10 green M & M's, 12 yellow, 8 red, 12 brown. What is the ratio of yellow M & M's to all the M & M's? _____

Yes _____ I need more work _____

2. I can write equal ratios.

Write 2 equal ratios for $1/3$. _____

Yes _____ I need more work _____

3. I can determine if ratios are proportional.

Does $2/3 = 8/12$ _____ Does $12/15 = 17/20$ _____ Answer yes or no.

Yes _____ I need more work _____

4. I can find the unknown in a proportion.

$3/8 = X/24$ $X =$ _____

Yes _____ I need more work _____

5. I can set up proportions to solve word problems.

If Cait reads 85 pages in 2 hours, how many hours will it take her to read 255 pages?

Proportion _____ Answer _____

Yes _____ I need more work _____

6. I can express probability using a ratio.

If you roll a die one time, what is the probability that you will roll a 2 or a 6? _____

Yes _____ I need more work _____

7. I can express probability using percent.

If you roll a die 1 time, what is the probability that you will roll a 2 or 3?

Express your answer in percent form. _____

Yes _____ I need more work _____

8. I can use ratio and proportion to solve a variety word problems.

Yes _____ I need more work _____