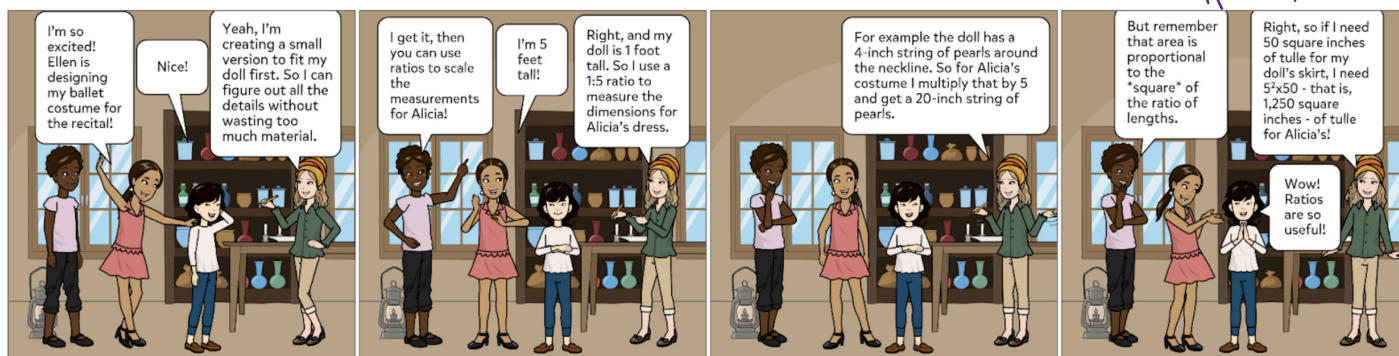




# Ratio Rate Rhythm

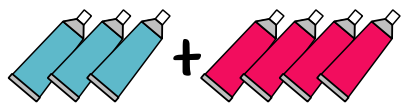


**Definition:** A ratio is used to compare the relative quantities of two (or more) groups. You can write them a number of different ways:

2 : 5     $\frac{2}{5}$     2 to 5

## So how are ratios used?

Let's say that Ellen makes her favorite shade of purple dye by mixing every **3 ounces of blue dye** with **4 ounces of red dye**. If she has a total of 15 ounces of blue dye, how many ounces of red dye does she need to keep the same shade of purple?



The ratio of **blue : red** = **3:4**.

So if we put 15 in the blue position of the ratio, notice that with **3:4** as the base ratio,  $15 = 3 \times 5$  so we scale both sides of the ratio up by a factor of 5.

$4 \times 5 = 20$ , so we need **20 ounces of red dye**.

**Parts of a whole:** Grace's class has a ratio of girls to boys of **6:5**. If there are **33** students in the class, how many of them are girls?

1. **First add:** With a ratio of **6:5**, one set of girls plus boys is  $6 + 5 = 11$  students.
2. **Then divide:** In a class of **33**, there are  $33 \div 11 = 3$  sets - this is the scale factor.
3. **Lastly multiply:** Scale the ratio - **multiply by 3**.  $6:5 = 18:15$ ; there are **18 girls**.
4. **Check:** With **18 girls** and **15 boys**, the total is indeed **33 students**.

## EXAMPLE

Ratios behave a lot like fractions and can be simplified like fractions. Let's take a look at an example. Choose the ratio below which is not equivalent to the other 4. (Simplify them like fractions!)

42:63

26:39

46:69

57:76

34:51

All of these simplify to 2:3 except 57:76.

## Proportion

**Definition:** A **proportion** is an equation showing that two ratios are equal.

Fill in the missing value in the proportion:

$$\frac{9}{8} = \frac{\square}{64}$$

Since we multiply the denominator (8) by 8 to get 64, we multiply the numerator (9) by 8 as well to get 72.

$$\frac{9}{8} = \frac{72}{64}$$



## Cross Multiplication

When you have an equation between two fractions, you can **cross-multiply** to simplify the equation.

The girls can write this proportion to find the number of rhinestones in 40 inches:

$$\frac{3}{7} = \frac{40}{x} \quad \text{where } x \text{ is the value we want to find.}$$

You can't multiply 3 by an integer to get 40, so instead you can cross-multiply. This means multiply 3 times  $x$ , and set that equal to 7 times 40, like criss-crossing across the equals sign!

$$3x = 7 \times 40; 3x = 280; x = \frac{280}{3} = 93 \frac{1}{3}.$$

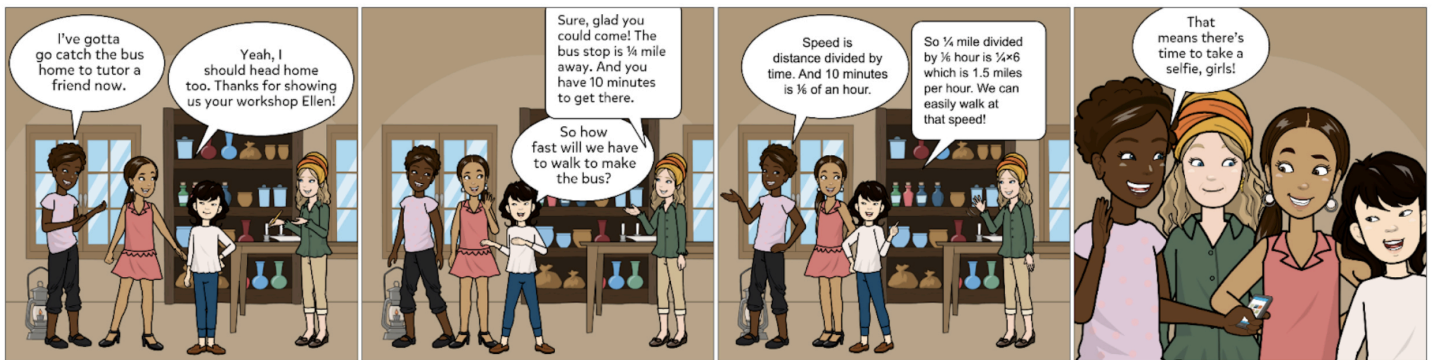
Always check your answer to make sure it makes sense! Ellen can't use a fraction of a rhinestone! So she will use 93 rhinestones around the part of the skirt that is 40 inches around.

# Rate

**Definition:** A **rate** is a special kind of ratio that describes how much of one quantity there is for one unit of another quantity. If you use the word “per”, that tells you that you are working with a rate!

*Some examples of rates are: miles per hour, inches per year, dollars per pound, & words per minute!*

A commonly used rate is **speed** =  $\frac{\text{distance}}{\text{time}}$ .



## ▶ TRY IT YOURSELF!

If you have a car that can travel up to 35 miles per hour, what is the least amount of time it would take to travel 98 miles? If you wanted to travel 98 miles in two hours, how fast would the car need to go?



# Ratio Rate Rhythm Practice Problems!

## WORD PROBLEMS

1. In a math competition, Grace's team attempted 36 problems and correctly answered 28 of them. What is the ratio of the team's correct answers to incorrect answers, in simplest terms?
2. For every 3 math problems Alicia solves, she gets to stay up 7 minutes past her bedtime. If she solves 24 problems, how many minutes past her bedtime does she get to stay up?
3. The 260 kids at the science fair each did a project in either ecology, robotics, or math. The ratio of projects in these areas was 6:2:5. How many students did a project in math?
4. Chien-Shiung gets ice cream 4 out of every 9 times she goes to the grocery store. If she got ice cream 32 times this past year, how many times did she go to the grocery store and NOT buy any ice cream?
5. Alicia can run 15 kilometers in 2 hours. At this rate, how many minutes does it take her to run 1 kilometer?
6. If  $2 : x^2 = 2x : 125$ , then what is the value of  $x$ ?
7. Ellen runs twice as fast as she walks. She left home and walked for 20 minutes on her way to Grace's house. Then she ran the rest of the way. If she started running at the halfway point, how long did it take her to get to Grace's house?
8. After Chien-Shiung's plant started sprouting leaves, each leaf doubled its length and width every day for the next 3 days. If one leaf had an area of 2 square millimeters on Sunday, what was its area 3 days later?