Name: _____

Skill Builder — Problem Solving with Rates

Solving mathematical problems often involves using rates. In this skill sheet, you will learn that you can turn rates upside down to help you solve a problem. An upside down rate is called a reciprocal rate.

Steps for solving problems are included on the skill sheet. Build your confidence in solving problems by following the steps. First, analyze the units and figure out the unit for the answer. Next, solve the arithmetic portion of the problem. Finally, put the two together to report your answer.

A rate may be written as its reciprocal because no matter how you write it the rate gives you the same amount of one thing per amount of the other thing. For example, you can write 5 cookies/ $1.00 or $1.00/5 cookies. For $1.00, you know you will get 5 cookies no matter how you write the rate. In these practice problems, you will choose how you will write each rate to solve problems.

1. Reciprocal rates

In the space provided, write the reciprocal rate of each given rate. The first one is done for you.

1. $\frac{1 \text{ year}}{365 \text{ days}} = \frac{365 \text{ days}}{1 \text{ year}}$

2. $\frac{12 \text{ inches}}{\text{foot}} =$

3. $\frac{3 \text{ small pizzas}}{\$10.00} =$

4. $\frac{36 \text{ pencils}}{3 \text{ boxes}} =$

5. $\frac{18 \text{ gallons of gasoline}}{360 \text{ miles}} =$

2. Solving problems

Steps for solving problems are listed below. Use these five steps for each of the following problems. Remember, after you have set up your problem, analyze and cancel the units by crossing them out, then do the arithmetic, and provide the answer. Remember that the answer always consists of a number and a unit.

Step 1	What quantity or rate are you asked for in the problem? Write it down.
Step 2	What do you know from reading the problem? List all known rates and quantities.
Step 3	Arrange the known quantities and rates to get an answer that has the right units. This arrangement might include a formula.
Step 4	Plug in the values you know.
Step 5	Solve the problem and write the answer with a number and a unit.

In problems 1 and 2, you will be shown how to set up steps 1-4. For step 5, you will need to solve the problem and write the answer as a number and unit.

1. Downhill skiing burns about 600 calories per hour. How many calories will you burn if you downhill ski for 3.5 hours?

   Step 1 Looking for *calories.*

   Step 2 600 calories/hour; 3.5 hours

   Step 3 $$\frac{\text{calories}}{\text{hour}} \times \text{hours} = \text{calorie}$$

   Step 4 $$\frac{600 \text{ calories}}{\text{hour}} \times 3.5 \text{ hours} = \text{calories}$$

   Step 5 Answer:

2. How many cans of soda will John drink in a year if he drinks 3 sodas per day? (Remember that there are 365 days in a year.)

   Step 1 Looking for *cans of soda per year.*

   Step 2 3 sodas/day; 365 days/year

   Step 3 $$\frac{\text{soda}}{\text{day}} \times \frac{\text{days}}{\text{year}} = \frac{\text{sodas}}{\text{year}}$$

   Step 4 $$\frac{3 \text{ sodas}}{\text{day}} \times \frac{365 \text{ days}}{\text{year}} = \frac{\text{sodas}}{\text{year}}$$

   Step 5 Answer:

3. How many heartbeats will a person have in a week if he has an average heart rate of 72 beats per minute? (Remember the days/week, hours/day, and minutes/hour.

Step 1 Looking for *number of heartbeats per week*.

Step 2 72 heartbeats/minute, 7 days/week, 24 hours/day, 60 minutes/hour

Step 3

$$\frac{\text{heartbeats}}{\text{minute}} \times \frac{\text{minutes}}{\text{hour}} \times \frac{\text{hours}}{\text{day}} \times \frac{\text{days}}{\text{week}} = \frac{\text{heartbeats}}{\text{week}}$$

Step 4

$$\frac{72 \text{ heartbeats}}{\text{minute}} \times \frac{60 \text{ minutes}}{\text{hour}} \times \frac{24 \text{ hours}}{\text{day}} \times \frac{7 \text{ days}}{\text{week}} = \frac{\text{heartbeats}}{\text{week}}$$

Step 5 Answer:

3. Practice with problem solving

Using the five problem-solving steps, solve the following problems on your own. Be sure to read the problem carefully. Show your work in the blank provided.

Step 1	What quantity or rate are you asked for in the problem? Write it down.
Step 2	What do you know from reading the problem? List all known rates and quantities.
Step 3	Arrange the known quantities and rates to get an answer that has the right units. This arrangement might include a formula.
Step 4	Plug in the values you know.
Step 5	Solve the problem and write the answer with a number and a unit.

1. How much will you pay for 5.00 pounds of shrimp if the cost is 2.00 pounds for $10.99?

2. How many miles can you get on one tank of gas if your tank holds 18.0 gallons and you get 22.0 miles per gallon?

3. What is your rate in miles/hour if you run at a speed of 2.2 miles in 20 minutes?

4. Suppose for your cookout you need to make 100 hamburgers. You know that 2.00 pounds will make 9.00 hamburgers. How many pounds will you need?

5. What is your mass in kilograms if you weigh 120 pounds? (There are approximately 2.20 pounds in one kilogram.)

6. Mt. Everest is 29,028 feet high. How many miles is this? (There are 5,280 feet in one mile.)

7. Susan works 8.0 hours a day and makes $7.00 per hour. How much money does Susan earn in one week if she works 5.0 days per week?

8. How many years will it take a major hamburger fast food chain to sell 45,000,000 burgers if it sells approximately 12,350 burgers per day?

9. Your science teacher needs to make more of a salt-water mixture. The concentration of the mixture that is needed is 35.0 grams of salt in 100 milliliters of water. How many grams of salt will be needed to make 1,500 milliliters of the salt-water?

10. A cart travels down a ramp at an average speed of 5.0 centimeters/second. What is the speed of the cart in miles/hour? (Remember there are 100 cm per meter, 1000 meters/kilometer, and 1.6 kilometer per mile.)

11. A person goes to the doctor and will need a 3-month prescription of medicine. The person will be required to take 3 pills per day. How many pills will the doctor write the prescription for assuming there are 30 days in a month?

12. If you are traveling at 65 miles per hour, how many feet will you be traveling in one second?