

Math Skills

Conversion Factors

After you study each sample problem and solution, work out the practice problems on a separate sheet of paper. Write your answers in the spaces provided.

PROBLEM

A flight from Chicago to New York costs \$0.240/km. If the distance between the two cities is 1,075 km, what is the total cost of the flight?

SOLUTION

Step 1: List the given and unknown values.

Given: distance between cities = 1,075 km

cost per distance = \$0.240/km

Unknown: total cost = ?

Step 2: Write down the equation that converts distance to cost of the flight.

$$\text{total cost of flight} = \frac{\text{cost of flight}}{1 \text{ km of travel}} \times \text{distance between cities}$$

or

$$\text{total cost of flight} = \text{cost per distance} \times \text{distance between cities}$$

Step 3: Multiply the distance between cities by the conversion factor, and solve.

$$\text{total cost of flight} = \frac{\$0.240}{\text{km}} \times 1075 \text{ km}$$

$$\text{total cost of flight} = \$258$$

PRACTICE

- You have been saving pennies in a jar, and you now have 125 pennies. You want to know the total mass of the pennies before you take them to the bank. If the average penny has a mass of 2.50 g, what is the total mass of the pennies?**

- You take the pennies to the bank and exchange them for nickels. Calculate the mass of 25 nickels if each nickel has a mass of 5.00 g. Which has a greater mass, \$1.25 in pennies or \$1.25 in nickels?**

Math Skills *continued*

3. A hand of bananas is a small bunch made up of 5 bananas (each banana is called a finger). If a large bunch of bananas is made up of 10 hands, how many bananas does it contain?
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4. **A tree bears 73 individual pieces of fruit each year. Suppose you own an orchard that contains 120 of these trees.**
- a. How much fruit will the orchard produce each year?**
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- b. The upkeep and care of the orchard costs you \$850 a year. At what price will you have to sell each piece of fruit just to break even?**
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5. A supermarket sells milk in containers of various sizes and charges consumers by the liter. How much does a plastic jug of milk with a volume of 3.79 L cost if the milk sells for \$0.760/L?
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PROBLEM

An automobile's crankshaft makes about 2,400 revolutions each minute, or 2,400 rpm, when the car travels 65 mi/h. How many revolutions does the crankshaft make after 25 s?

SOLUTION

Step 1: List the given and unknown values.

Given: rotation rate of crankshaft = 2,400 rpm
time engine = 25 s

Unknown: total number of revolutions = ?

Step 2: Write down the conversion factor that converts the number of crankshaft revolutions per minute to the number of revolutions per second.

Multiply revolutions per minute by minutes per second.

$$\text{rotation rate of crankshaft} = \frac{\text{revolutions}}{\text{minute}} \times \frac{\text{minutes}}{\text{second}}$$

Math Skills *continued*

Step 3: Multiply the time the engine runs by this conversion factor, and solve.

$$\text{total number of revolutions} = \left(\frac{\text{revolutions}}{\text{minute}} \times \frac{\text{minutes}}{\text{second}} \right) \times \text{time engine runs}$$

$$\begin{aligned} \text{total number of revolutions} &= \left(\frac{2,400 \text{ rev}}{\text{min}} \times \frac{1 \text{ min}}{60 \text{ s}} \right) \times 25 \text{ s} \\ &= \frac{40 \text{ rev}}{1.0 \cancel{\text{ s}}} \times 25 \cancel{\text{ s}} \end{aligned}$$

$$\text{total number of revolutions} = 1,000 \text{ rev}$$

PRACTICE

6. You are pouring hot chocolate into cups for yourself and some friends. Calculate the number of cups of hot chocolate that you can pour from a pitcher if the pitcher's volume is 4.3 L and the volume of each cup is 170 cm³.

7. **A pie can be cut into eight slices. What is the minimum number of pies you would need if you were to serve a slice of pie with each cup of hot chocolate in item 6? How many slices of pie would be left over?**

8. Although a story is often the same as a floor in a building, you cannot tell exactly how tall a building is by knowing the number of stories it has because the height of stories can vary. The International Financial Center, in Taipei, Taiwan, has 101 stories and reaches 448 m above street level. The building is about 12 m taller than Chicago's 110-story Sears Tower.

a. What is the height of each story in the Sears Tower?

b. What is the height of each story in the International Financial Center?

PROBLEM

Venus is the only planet in the solar system that takes a longer time to rotate than it does to revolve around the sun. As a result, a day is longer than a year on Venus. If a day on Venus equals 243.0 Earth days and a year on Venus equals 224.7 Earth days, how many Venus years are in a Venus day?

SOLUTION**Step 1: List the given and unknown values.****Given:** 1 Venus year = 224.7 Earth days

1 Venus day = 243.0 Earth days

Unknown: number of Venus years in a Venus day = ?**Step 2: Write down the conversion factor that converts Venus days to Venus years.**

$$\frac{\text{Venus years}}{\text{Venus day}} = \frac{1 \text{ Venus year}/224.7 \text{ Earth days}}{1 \text{ Venus day}/243.0 \text{ Earth days}}$$

Step 3: Multiply the number of Venus days by this conversion factor, and solve.

$$\begin{aligned} \text{Venus years in a Venus day} &= 1 \text{ Venus day} \times \frac{1 \text{ Venus year}/224.7 \text{ Earth days}}{1 \text{ Venus day}/243.0 \text{ Earth days}} \\ &= \frac{243.0}{224.7} \text{ Venus years} \end{aligned}$$

$$\text{Venus years in a Venus day} = 1.081 \text{ Venus years}$$

PRACTICE

9. Suppose you are making a 650 km trip in an automobile. The car is able to travel an average distance of 54 km on 1.0 gallon of gasoline. How much will the trip cost if the price of gasoline is \$1.20/gal?
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10. A landfill for a county with a population of 65,000 people has a volume of approximately $2.0 \times 10^6 \text{ m}^3$. If the county produces $6.2 \times 10^7 \text{ kg}$ of garbage each year and the density of the garbage is assumed to be 410 kg/m^3 , how many years will it take the landfill to fill?
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11. **A chandelier has sockets for 12 light bulbs. Suppose there are 75 of these chandeliers in an auditorium. If a box of light bulbs contains four bulbs, what is the minimum number of boxes needed to fill all of the sockets in all of the chandeliers?**
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12. A method for obtaining water for desert areas involves the removal of salt from sea water. The simplest way to remove the salt is through distillation, a process in which sea water is evaporated and then condensed as salt-free water. If there are 26.84 g of sodium chloride in 1.00 kg of sea water, what mass of sodium chloride can be recovered from $7.400 \times 10^6 \text{ kg}$ of sea water?
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PROBLEM

A family in your neighborhood is moving to another state, and you are helping them pack their books ahead of time. They have 755 books, and the average book has a mass of 3.5 kg. If a box can hold 49 kg, how many boxes will be needed?

SOLUTION

Step 1: List the given and unknown values.

Given: number of books = 755 books
 mass of each book = 3.5 kg/book
 mass of book held by each box = 49 kg/book

Unknown: number of boxes = ? boxes

Step 2: Write down the conversion factor that converts the mass of books in a box to the number of books in a box. Divide the mass of books that a box can hold by the mass of one book.

$$\text{number of books held by each box} = \frac{\text{mass of books held by each box}}{\text{mass of each book}}$$

Step 3: Divide the number of books by this conversion factor, and solve.

$$\text{number of boxes} = \frac{\text{number of books}}{\left(\frac{\text{mass of books held by each box}}{\text{mass of each book}} \right)}$$

$$\text{number of boxes} = \frac{755 \text{ books}}{\left(\frac{49 \text{ kg/box}}{3.5 \text{ kg/book}} \right)} = \frac{755 \text{ books}}{14 \text{ books/box}}$$

$$\text{number of boxes} = 54 \text{ boxes}$$

PRACTICE

13. Motion pictures are shown at a speed of 24 frames, or individual pictures, each second. If a standard frame is 1.9 cm long, how long will the strand of film be for a movie that lasts 1 hour and 45 minutes?

14. The Parthenon, in Athens, Greece, is one of the most recognized landmarks in the world. There are 46 Doric columns along the outer edge of the Parthenon. Each column has an average radius of 0.95 m and is 10.4 m tall. Assuming that the columns are cylindrical, what is the total volume of the columns? (Hint: The equation for the volume of a cylinder is $\pi r^2 h$, where r is the radius and h is the height.)