Academy of Greatness and Excellence

2021-2022

7th Grade Summer Math Assignment

Assalamu Alaikum WRWB Dear Students,

Congratulations on becoming a 7th grader. However, it is extremely important for you to practice and master Math Skills learned throughout the year in 6th grade to be ready for your 7th grade Math Class.

Student Expectations:

- ✓ The assignment must be completed, by showing your work and steps involved.
- ✓ If you don't know how to do any part of the assignment, then you must seek an additional help to learn these skills.
- ✓ Assignment must be submitted to your math teacher on the **first day of your school.**
- ✓ **Usage of calculator is not allowed.**

Practice, excel, and have a great summer!

NAME _____ DATE _____ PERIOD _____

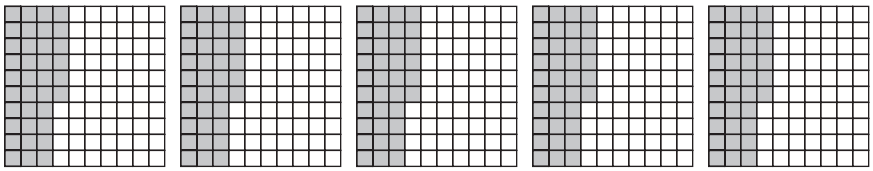
Reteach

Multiply Decimals by Whole Numbers

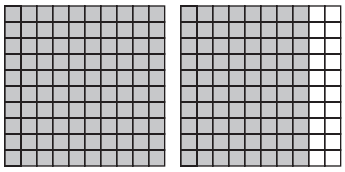
When you multiply a decimal by a whole number, you multiply the numbers as if you were multiplying all whole numbers. Then you use estimation or you count the number of decimal places to decide where to place the decimal point. If there are not enough decimal places in the product, annex zeros to the left.

Example 1 **Find 5×0.36 using models.**

Model 5 groups of 0.36 on a decimal model.



Rearrange the columns and small squares to fill as many whole grids as possible.



So, $5 \times 0.36 = 1.8$.

Example 2 **Find 6.25×5.**

Method 1 Use estimation.

Round 6.25 to 6.

$6.25 \times 5 \rightarrow 6 \times 5$ or 30

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ 6.25 \\ \times\ \ 5 \\ \hline 31.25 \end{array}$$

Since the estimate is 30, place the decimal point after 31.

Method 2 Count decimal places.

$$\begin{array}{r} 6.25 \\ \times\ \ 5 \\ \hline 31.25 \end{array}$$

There are two places to the right of the decimal point.

Count the same number of decimal places from right to left.

Example 3 **Find 3×0.0047.**

$$\begin{array}{r} {\scriptstyle 2} \\ 0.0047 \\ \times\ \ \ 3 \\ \hline 0.0141 \end{array}$$

There are four decimal places.

Annex a zero on the left of 141 to make four decimal places.

Exercises

Multiply.

1. 8.03×3 **2.** 6×12.6 **3.** 2×0.012 **4.** 0.0008×9

5. 2.32×5 **6.** 6.8×7 **7.** 5.2×4 **8.** 1.412×3

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Multiply Decimals by Decimals

When you multiply a decimal by a decimal, multiply the numbers as if you were multiplying all whole numbers. To decide where to place the decimal point, find the sum of the number of decimal places in each factor. The product has the same number of decimal places.

Example 1 **Find 5.2 × 6.13.**

Estimate: 5 × 6 or 30

$$\begin{array}{r} 5.2 \leftarrow \text{one decimal place} \\ \times\ 6.13 \leftarrow \text{two decimal places} \\ 156 \\ 52 \\ +312 \\ \hline 31.876 \leftarrow \text{three decimal places} \end{array}$$

The product is 31.876. Compared to the estimate, the product is reasonable.

Example 2 **Find 2.3 × 0.02.**

Estimate: 2 × 0.02 or 0.04

$$\begin{array}{r} 2.3 \leftarrow \text{one decimal places} \\ \times\ 0.02 \leftarrow \text{two decimal place} \\ \hline 0.046 \leftarrow \text{Annex a zero to make three decimal places.} \end{array}$$

The product is 0.046. Compared to the estimate, the product is reasonable.

Exercises

Multiply.

1. 7.2 × 2.1

2. 4.3 × 8.5

3. 2.64 × 1.4

4. 14.23 × 8.21

5. 5.01 × 11.6

6. 9.001 × 4.2

7. 3.24 × 0.008

8. 0.012 × 2.9

9. 0.9 × 11.2

10. 0.03 × 4.5

11. 27.8 × 0.023

12. 1.54 × 7.01

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Multiply by Powers of 10

- **When multiplying a decimal by a power of 10 greater than 1,** move the decimal point to the ***right*** the same number of places as the number of zeros in the power of 10.
- **When multiplying a decimal by a power of 10 less than 1,** move the decimal point to the ***left*** the same number of places as there are places after the decimal point in the power of 10.

Example 1 **Find $7.24 \times 1{,}000$.**

$7.24 \times 1{,}000 = \mathbf{7.240}$ — 1,000 has 3 zeros, so move the decimal point 3 places to the right. Annex zeros as needed.

$= 7{,}240$ — Remove the decimal point and add a comma.

Example 2 **Find 36.4×0.001.**

$36.4 \times 0.001 = \mathbf{036.4}$ — There are 3 places after the decimal point in 0.001, so move the decimal point 3 places to the left. Annex zeros as needed.

$= 0.0364$ — Annex a zero in front of the decimal point.

Exercises

Find each product.

1. 4.5×100

2. $0.298 \times 1{,}000$

3. 6.31×10

4. $0.34 \times 1{,}000$

5. $8.1 \times 10{,}000$

6. 44.73×10

7. 52.1×0.01

8. 12.21×0.001

9. 0.56×0.1

10. 12.8×0.001

11. 35.2×0.1

12. 0.7×0.01

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Divide by Powers of 10

- **When dividing a decimal by a power of 10 greater than 1,** move the decimal point to the ***left*** the same number of places as the number of zeros in the power of 10.
- **When dividing a decimal by a power of 10 less than 1,** move the decimal point to the ***right*** the same number of places as there are places after the decimal point in the power of 10.

Example 1 **Find 13.4 ÷ 100.**

$13.4 \div 100 = 13.4$ — 100 has two zeros, so move the decimal point 2 places to the left.

$= 0.134$ — Since all digits are decimal digits, insert a leading zero.

Example 2 **Find 0.67 ÷ 0.01.**

$0.67 \div 0.01 = 0.67$ — 0.01 has two places after the decimal point, so move the decimal point 2 places to the right.

$= 67$ — Remove the decimal point.

Exercises

Find each quotient.

1. $7.586 \div 1{,}000$

2. $243 \div 100$

3. $10.9 \div 10$

4. $16.82 \div 100$

5. $0.95 \div 1{,}000$

6. $1.536 \div 10$

7. $5.86 \div 0.01$

8. $37.21 \div 0.1$

9. $6.03 \div 0.001$

10. $0.284 \div 0.1$

11. $84 \div 0.001$

12. $41.4 \div 0.01$

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Divide Decimals by Decimals

When you divide a decimal by a decimal, multiply both the divisor and the dividend by the same power of ten. Then divide as with whole numbers.

Example 1 **Find 10.14 ÷ 5.2.**

Estimate: $10 \div 5 = 2$

Multiply by 10 to make a whole number.

$5.2\overline{)10.14}$ → $52\overline{)101.40}$

Multiply by the same number, 10.

$$\begin{array}{r} 1.95 \\ 52\overline{)101.40} \\ -\ 52 \\ \hline 494 \\ -\ 468 \\ \hline 260 \\ -\ 260 \\ \hline 0 \end{array}$$

Place the decimal point.
Divide as with whole numbers.
Annex a zero to continue.

10.14 divided by 5.2 is 1.95. Compare the quotient with the estimate.

Check $1.95 \times 5.2 = 10.14$ ✓

Example 2 **Find 4.09 ÷ 0.02.**

Multiply each by 100.

$0.02\overline{)4.09}$ → $2\overline{)409.0}$

$$\begin{array}{r} 204.5 \\ 2\overline{)409.0} \\ -\ 4 \\ \hline 00 \\ -\ 0 \\ \hline 09 \\ -\ 8 \\ \hline 10 \\ -\ 10 \\ \hline 0 \end{array}$$

Place the decimal point.
Divide.
Write a zero in the dividend and continue to divide.

4.09 divided by 0.02 is 204.5.

Check $204.5 \times 0.02 = 4.09$ ✓

Exercises

Divide.

1. $9.8 \div 1.4$ **2.** $4.41 \div 2.1$ **3.** $16.848 \div 0.72$

4. $8.652 \div 1.2$ **5.** $0.5 \div 0.001$ **6.** $9.594 \div 0.06$

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Exponents

A product of like factors can be written using a **base**, the number used as a factor, and an **exponent**, which tells how many times the base is used as a factor. Numbers expressed using exponents are called **powers**. For example, 100 and 1,000 are powers of 10 because they can be written as 10^2 and 10^3.

Example 1 **Write $4 \times 4 \times 4 \times 4 \times 4$ using an exponent.**

$4 \times 4 \times 4 \times 4 \times 4 = 4^5$ — 4 is used as a factor five times.

Example 2 **Write 3^4 as a product of the same factor. Then find the value.**

The base is 3. The exponent is 4. So, 3 is used as a factor four times.

$3^4 = 3 \times 3 \times 3 \times 3$ — Write 3^4 as a product.

$= 81$ — Multiply.

Exercises

Write each product using an exponent.

1. $4 \times 4 \times 4$

2. $7 \times 7 \times 7 \times 7 \times 7$

3. $9 \times 9 \times 9 \times 9$

4. $8 \times 8 \times 8 \times 8 \times 8 \times 8$

5. $1 \times 1 \times 1 \times 1$

6. $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

Write each power as a product of the same factor. Then find the value.

7. 5^3

8. 6^2

9. 2^8

10. 3^6

11. 1.1^4

12. 0.7^3

13. **MAMMALS** There are about 10^3 species of bats in the world. Write 10^3 as a product of the same factor. Then find the value.

14. **LANDSCAPE** The deepest point of the Grand Canyon in Arizona is a little over 18^3 feet deep. How deep is the canyon at this point?

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Multiply Fractions and Whole Numbers

You can multiply whole numbers and fractions by writing the whole number as a fraction. Then multiply the numerators and multiply the denominators.

Example 1

Find $6 \times \frac{3}{8}$.

Estimate $6 \times \frac{1}{2} = 3$.

$6 \times \frac{3}{8} = \frac{6}{1} \times \frac{3}{8}$ Write 6 as $\frac{6}{1}$.

$= \frac{6 \times 3}{1 \times 8}$ Multiply.

$= \frac{18}{8} = \frac{9}{4}$ or $2\frac{1}{4}$ Simplify. Compare to the estimate.

You can also multiply fractions by using a diagram.

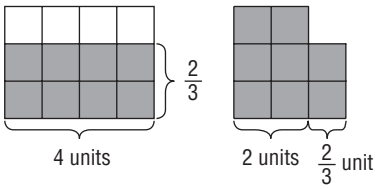
Example 2

Find $\frac{2}{3} \times 4$.

Draw 4 units. Then divide each unit into thirds.

Shade $\frac{2}{3}$ of each unit.

Rearrange to see that $2\frac{2}{3}$ units are shaded.



Exercises

Multiply. Write in simplest form.

1. $5 \times \frac{2}{3}$ **2.** $10 \times \frac{3}{5}$ **3.** $9 \times \frac{1}{3}$ **4.** $2 \times \frac{2}{5}$

5. $6 \times \frac{1}{4}$ **6.** $15 \times \frac{1}{8}$ **7.** $\frac{2}{3} \times 12$ **8.** $\frac{4}{5} \times 3$

9. $\frac{4}{5} \times 15$ **10.** $\frac{1}{6} \times 11$ **11.** $\frac{2}{7} \times 5$ **12.** $\frac{5}{6} \times 12$

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Multiply Mixed Numbers

To multiply mixed numbers, write the mixed numbers as improper fractions and then multiply as with fractions.

Example 1 **Find $\frac{1}{4} \times 1\frac{2}{3}$.** **Estimate. Use compatible numbers. $\frac{1}{2} \times 2 = 1$**

$\frac{1}{4} \times 1\frac{2}{3} = \frac{1}{4} \times \frac{5}{3}$ Write $1\frac{2}{3}$ as $\frac{5}{3}$.

$= \frac{1 \times 5}{4 \times 3}$ Multiply.

$= \frac{5}{12}$ Simplify. Compare to the estimate.

Example 2 **Find $1\frac{1}{3} \times 2\frac{1}{4}$.**

$1\frac{1}{3} \times 2\frac{1}{4} = \frac{4}{3} \times \frac{9}{4}$ Convert mixed numbers to improper fractions.

$= \frac{\overset{1}{\cancel{4}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{4}}}$ Divide the numerator and denominator by their common factors, 3 and 4.

$= \frac{3}{1}$ or 3 Simplify.

Exercises

Multiply. Write in simplest form.

1. $\frac{1}{3} \times 1\frac{1}{3}$ **2.** $1\frac{1}{5} \times \frac{3}{4}$ **3.** $\frac{2}{3} \times 1\frac{3}{5}$ **4.** $\frac{2}{3} \times 3\frac{1}{2}$

5. $\frac{2}{9} \times 1\frac{1}{6}$ **6.** $2\frac{4}{9} \times \frac{4}{11}$ **7.** $2\frac{1}{2} \times 1\frac{1}{3}$ **8.** $1\frac{1}{4} \times 3\frac{3}{5}$

9. $8\frac{1}{5} \times 1\frac{1}{4}$ **10.** $1\frac{3}{8} \times 2\frac{1}{2}$ **11.** $4\frac{2}{3} \times 1\frac{1}{8}$ **12.** $1\frac{1}{9} \times 3\frac{2}{5}$

13. Find the product of $\frac{1}{5}$ and $3\frac{1}{3}$.

14. Simplify $4\frac{2}{3} \times 1\frac{1}{4}$.

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Divide Whole Numbers by Fractions

When the product of two numbers is 1, the numbers are called reciprocals.

Example 1 **Find the reciprocal of $\frac{5}{9}$.**

Since $\frac{5}{9} \times \frac{9}{5} = 1$, the reciprocal of $\frac{5}{9}$ is $\frac{9}{5}$.

Example 2 **Find the reciprocal of 8.**

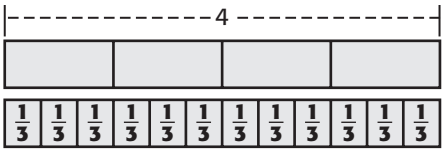
Since $8 \times \frac{1}{8} = 1$, the reciprocal of 8 is $\frac{1}{8}$.

You can use reciprocals to divide whole numbers by fractions. To divide by a fraction, multiply by its reciprocal.

Example 3 **Find $4 \div \frac{1}{3}$.**

$4 \div \frac{1}{3} = \frac{4}{1} \times \frac{3}{1}$ Multiply by the reciprocal, $\frac{3}{1}$.

$= \frac{12}{1}$ or 12 Simplify.



Exercises

Find the reciprocal of each number.

1. $\frac{1}{2}$ **2.** $\frac{1}{6}$ **3.** $\frac{4}{11}$ **4.** $\frac{3}{5}$

Divide. Write in simplest form.

5. $3 \div \frac{2}{5}$ **6.** $9 \div \frac{1}{2}$ **7.** $2 \div \frac{1}{4}$ **8.** $1 \div \frac{3}{4}$

9. $4 \div \frac{1}{2}$ **10.** $5 \div \frac{1}{10}$ **11.** $12 \div \frac{5}{6}$ **12.** $9 \div \frac{2}{3}$

13. $4 \div \frac{7}{12}$ **14.** $10 \div \frac{8}{9}$ **15.** $3 \div \frac{5}{8}$ **16.** $4 \div \frac{7}{9}$

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Divide Mixed Numbers

To divide mixed numbers, express each mixed number as an improper fraction. Then divide as with fractions.

Example 1 **Find $1\frac{2}{3} \div \frac{3}{4}$.**

$1\frac{2}{3} \div \frac{3}{4} = \frac{5}{3} \div \frac{3}{4}$ Write the mixed number as an improper fraction.

$= \frac{5}{3} \times \frac{4}{3}$ Multiply by the reciprocal.

$= \frac{20}{9}$ or $2\frac{2}{9}$ Simplify.

Example 2 **Find $2\frac{2}{3} \div 1\frac{1}{5}$.** **Estimate:** $3 \div 1 = 3$

$2\frac{2}{3} \div 1\frac{1}{5} = \frac{8}{3} \div \frac{6}{5}$ Write mixed numbers as improper fractions.

$= \frac{8}{3} \times \frac{5}{6}$ Multiply by the reciprocal, $\frac{5}{6}$.

$= \frac{\overset{4}{\cancel{8}} \times 5}{3 \times \underset{3}{\cancel{6}}}$ Divide 8 and 6 by the GCF, 2.

$= \frac{20}{9}$ or $2\frac{2}{9}$ Simplify. Compare to the estimate.

Exercises

Divide. Write in simplest form.

1. $2\frac{1}{2} \div \frac{4}{5}$ **2.** $9 \div 1\frac{1}{9}$ **3.** $5 \div 1\frac{3}{7}$ **4.** $2\frac{1}{3} \div \frac{7}{9}$

5. $5\frac{2}{5} \div \frac{9}{10}$ **6.** $2\frac{1}{4} \div \frac{2}{7}$ **7.** $2\frac{1}{2} \div 3\frac{1}{3}$ **8.** $7\frac{1}{2} \div 1\frac{2}{3}$

9. $1\frac{2}{3} \div 1\frac{1}{4}$ **10.** $4\frac{4}{5} \div 2\frac{6}{7}$ **11.** $5\frac{1}{10} \div 1\frac{8}{9}$ **12.** $2\frac{3}{8} \div 2\frac{1}{4}$

13. Simplify $6 \div 4\frac{3}{5}$.

14. Simplify $4\frac{2}{3} \div 1\frac{3}{4}$.

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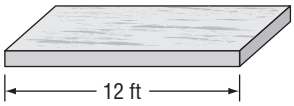
Problem-Solving Practice

Divide Whole Numbers by Fractions

1. SEWING Vanessa has 3 yards of cotton. She needs $\frac{3}{4}$ yard for each skirt she makes. How many skirts can she make?

2. CARPENTRY Laura wants to cut the board into equal pieces so that each piece is $\frac{5}{8}$ foot long. How many of these pieces can she make?



3. SERVINGS A bottle of juice states that a serving is $\frac{1}{2}$cup. How many servings are in a 2-pint container? (Hint: One pint equals 2 cups.)

4. CATS A cat eats $\frac{2}{3}$ cup of food each day. How many days will a bag containing 16 cups of food last?

5. GARDENING Talia has 80 pounds of soil. She wants to divide it into buckets so that each bucket weighs $\frac{4}{5}$ pound. How many buckets will she need?

6. PETS Errol uses $\frac{1}{3}$ can of wet dog food for his dog, Muddy, each day. How many servings will he get from 5 cans of dog food?

7. FOOD Launa has 30 cupcakes. How many pieces will she have if she divides them into fourths?

8. INTERNET At the library, there is a four-hour span of time to use a computer. The time slots are $\frac{1}{3}$ hour long. How many time slots are there?

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Ratio Tables

A **ratio table** organizes data into columns that are filled with pairs of numbers that have the same ratio, or are equivalent. **Equivalent ratios** express the same relationship between two quantities.

Example 1 **BAKING** **You need 1 cup of rolled oats to make 24 oatmeal cookies. Use the ratio table below to find how many oatmeal cookies you can make with 5 cups of rolled oats.**

Cups of Oats	1				5
Oatmeal Cookies	24				■

Find a pattern and extend it.

Cups of Oats	1	2	3	4	5
Oatmeal Cookies	24	48	72	96	120

+1 +1 +1 +1

+24 +24 +24 +24

So, 120 oatmeal cookies can be made with 5 cups of rolled oats.

Multiplying or dividing two related quanitities by the same number is called **scaling**. You may sometimes need to *scale back* and then *scale forward* or vice versa to find an equivalent ratio.

Example 2 **SHOPPING** **A department store has socks on sale for 4 pairs for $10. Use the ratio table at the right to find the cost of 6 pairs of socks.**

Pairs of Socks		4	6
Cost in Dollars		10	■

× 3

÷ 2

Pairs of Socks	2	4	6
Cost in Dollars	5	10	15

÷ 2

× 3

There is no whole number by which you can multiply 4 to get 6. Instead, scale back to 2 and then forward to 6.

So, the cost of 6 pairs of socks would be $15.

Exercises

For Exercises 1–2, use the ratio tables given to solve each problem.

1. **EXERCISE** Keewan bikes 6 miles in 30 minutes. At this rate, how long would it take him to bike 18 miles?

Distance Biked (mi)	6		18
Time (min)	30		■

2. **HOBBIES** Christine is making fleece blankets. 6 yards of fleece will make 2 blankets. How many blankets can she make with 9 yards of fleece?

Yards of Fleece		6	9
Number of Blankets		2	■

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Equivalent Ratios

Two ratios are said to be **equivalent ratios** if they have the same unit rate.

Example 1 **Determine if each pair of rates are equivalent. Explain your reasoning.**

$35 for 7 balls of yarn; $24 for 4 balls of yarn.

Write each rate as a fraction. Then find its unit rate.

$$\frac{\$35}{7 \text{ balls of yarn}} \overset{\div 7}{=} \frac{\$5}{1 \text{ ball of yarn}} \qquad \frac{\$24}{4 \text{ balls of yarn}} \overset{\div 4}{=} \frac{\$6}{1 \text{ ball of yarn}}$$

Since the rates do not share the same unit rate, they are not equivalent.

Example 2 **Determine if each pair of ratios are equivalent. Explain your reasoning.**

8 boys out of 24 students; 4 boys out of 12 students

Write each ratio as a fraction.

$$\frac{8 \text{ boys}}{24 \text{ students}} \overset{\div 2}{=} \frac{4 \text{ boys}}{12 \text{ students}}$$ ← The numerator and the denominator are divided by the same number.

Since the fractions are equivalent, the ratios are equivalent.

Exercises

Determine if each pair of ratios or rates are equivalent. Explain your reasoning.

1. $12 saved after 2 weeks; $36 saved after 6 weeks

2. $9 for 3 magazines; $20 for 5 magazines

3. 135 miles driven in 3 hours; 225 miles driven in 5 hours

4. 24 computers for 30 students; 48 computers for 70 students

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Compare and Order Fractions

To compare two fractions.

- Find the *least common denominator (LCD)* of the fractions; that is, find the least common multiple of the denominators.
- Write an equivalent fraction for each fraction using the LCD.
- Compare the numerators.

Example 1 **Replace ● with <, >, or = to make $\frac{1}{3}$ ● $\frac{5}{12}$ true.**

The LCM of 3 and 12 is 12. So, the LCD is 12.

Rewrite each fraction with a denominator of 12.

$\frac{1}{3} = \frac{\square}{12}$, so $\frac{1}{3} = \frac{4}{12}$. ×4, ×4 $\qquad \frac{5}{12} = \frac{5}{12}$

Now compare. Since $4 < 5$, $\frac{4}{12} < \frac{5}{12}$. So, $\frac{1}{3} < \frac{5}{12}$.

Example 2 **Order $\frac{1}{6}$, $\frac{2}{3}$, $\frac{1}{4}$, and $\frac{3}{8}$ from least to greatest.**

The LCD of the fractions is 24. So, rewrite each fraction with a denominator of 24.

$\frac{1}{6} = \frac{\square}{24}$, so $\frac{1}{6} = \frac{4}{24}$. ×4, ×4 $\qquad \frac{2}{3} = \frac{\square}{24}$, so $\frac{2}{3} = \frac{16}{24}$. ×8, ×8

$\frac{1}{4} = \frac{\square}{24}$, so $\frac{1}{4} = \frac{6}{24}$. ×6, ×6 $\qquad \frac{3}{8} = \frac{\square}{24}$, so $\frac{3}{8} = \frac{9}{24}$. ×3, ×3

The order of the fractions from least to greatest is $\frac{1}{6}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{2}{3}$.

Exercises

Replace each ● with <, >, or = to make a true statement.

1. $\frac{5}{12}$ ● $\frac{3}{8}$
2. $\frac{6}{8}$ ● $\frac{3}{4}$
3. $3\frac{2}{7}$ ● $3\frac{1}{6}$

Order the fractions from least to greatest.

4. $\frac{3}{4}, \frac{3}{8}, \frac{1}{2}, \frac{1}{4}$
5. $\frac{2}{3}, \frac{1}{6}, \frac{5}{18}, \frac{7}{9}$
6. $1\frac{1}{2}, 1\frac{5}{6}, 1\frac{5}{8}, 1\frac{5}{12}$

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Estimate with Percents

The table below shows some commonly used percents and their fraction equivalents.

Percent-Fraction Equivalents				
$20\% = \frac{1}{5}$	$50\% = \frac{1}{2}$	$80\% = \frac{4}{5}$	$25\% = \frac{1}{4}$	$33\frac{1}{3}\% = \frac{1}{3}$
$30\% = \frac{3}{10}$	$60\% = \frac{3}{5}$	$90\% = \frac{9}{10}$	$75\% = \frac{3}{4}$	$66\frac{2}{3}\% = \frac{2}{3}$
$40\% = \frac{2}{5}$	$70\% = \frac{7}{10}$	$100\% = 1$		

Examples **Estimate each percent.**

1. 20% of 58

   20% is $\frac{1}{5}$.

   Round 58 to 60 since it is divisible by 5.

   $\frac{1}{5}$ of 60 is 12.

   So, 20% of 58 is about 12.

2. 76% of 21.

   76% is close to 75% or $\frac{3}{4}$.

   Round 21 to 20 since it is divisible by 4.

   $\frac{1}{4}$ of 20 is 5.

   So, $\frac{3}{4}$ of 20 is 3×5 or 15.

   Thus, 76% of 21 is about 15.

Example 3 **Isabel is reading a book that has 218 pages. She wants to complete 25% of the book by Friday. About how many pages should she read by Friday?**

25% is $\frac{1}{4}$. Round 218 to 220.

$\frac{1}{4}$ of 220 is 55.

So, Isabel should read about 55 pages by Friday.

Exercises

Estimate each percent.

1. 49% of 8

2. 24% of 27

3. 19% of 46

4. 62% of 20

5. 40% of 51

6. 81% of 32

7. TIPS Jodha wants to tip the pizza delivery person 20%. If the cost of the pizzas is $15.99, what would be a reasonable amount to tip?

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Percent of a Number

Example 1 **Find 25% of 260.**

Method 1:

Write 25% as a fraction in simplest form.
Use the fraction in a multiplication problem.

$$25\% = \frac{25}{100} \text{ or } \frac{1}{4}$$

$$25\% \text{ of } 260 = \frac{1}{4} \times 260$$

$$= 65$$

So, 25% of 260 is 65.

Method 2:

Write 25% as a decimal.

Then write a multiplication problem.

$$25\% = 0.25$$

$$25\% \text{ of } 260 = 0.25 \times 260$$

$$= 65$$

Example 2 **Find 175% of 56.**

Method 1:

Write 175% as a fraction in simplest form.
Use the fraction in a multiplication problem.

$$175\% = \frac{175}{100} \text{ or } \frac{7}{4}$$

$$175\% \text{ of } 56 = \frac{7}{4} \times 56$$

$$= \frac{7}{\cancel{4}_{1}} \times \frac{\cancel{56}^{14}}{1}$$

$$= 98$$

So, 175% of 56 is 98.

Method 2:

Write 175% as a decimal.

Then write a multiplication problem.

$$175\% = 1.75$$

$$175\% \text{ of } 56 = 1.75 \times 56$$

$$= 98$$

Exercises

Find the percent of each number.

1. 48% of 50

2. 40% of 95

3. 75% of 116

4. 8% of 85

5. 98% of 30

6. 0.3% of 460

7. 15% of 342

8. 350% of 60

9. 0.25% of 500

10. 2.7% of 110

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Percents as Fractions

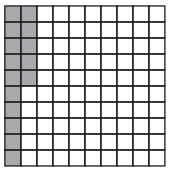
To write a percent as a fraction, write it as a fraction with a denominator of 100. Then simplify.

Example **Write 15% as a fraction in simplest form.**

15% means *15 out of 100*.

$15\% = \frac{15}{100}$ Definition of percent

$= \frac{\overset{3}{\cancel{15}}}{\underset{20}{\cancel{100}}}$ or $\frac{3}{20}$ Simplify. Divide the numerator and denominator by the GCF, 5.



Exercises

Write each percent as a fraction in simplest form.

1. 20%

2. 35%

3. 70%

4. 60%

5. 30%

6. 25%

7. 40%

8. 82%

9. 65%

10. 58%

11. 4%

12. 13%

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The Distributive Property

- To multiply a sum by a number, multiply each addend by the number outside the parentheses.
- $a(b + c) = ab + ac$
- $(b + c)a = ba + ca$

Example 1 **Find 6×38 mentally using the Distributive Property.**

$6 \times 38 = 6(30 + 8)$ Write 38 as 30 + 8.

$= 6(30) + 6(8)$ Distributive Property

$= 180 + 48$ Multiply mentally.

$= 228$ Add.

So, $6 \times 38 = 228$.

Example 2 **Use the Distributive Property to rewrite $4(x + 3)$.**

$4(x + 3) = 4(x) + 4(3)$ Distributive Property

$= 4x + 12$ Multiply.

So, $4(x + 3)$ can be rewritten as $4x + 12$.

Exercises

Find each product mentally. Show the steps you used.

1. 4×82

2. 9×26

3. 12×44

4. 8×5.7

Use the Distributive Property to rewrite each algebraic expression.

5. $5(y + 4)$

6. $(7 + r)3$

7. $12(x + 5)$

8. $(b + 2)9$

9. $4(4 + a)$

10. $9(7 + v)$

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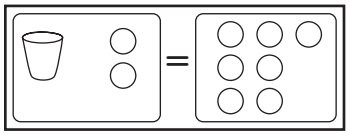
Solve and Write Addition Equations

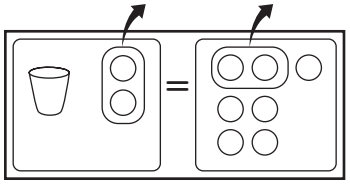
You can solve an equation by using inverse operations, which *undo* operations. To solve an addition equation, you would use subtraction.

Example 1 **Solve $x + 2 = 7$.**

Method 1: Use models.



$x + 2 = 7$



$x + 2 - 2 = 7 - 2$

Method 2: Use symbols.

$x + 2 = 7$	Write the equation.
$-2 \quad -2$	Subtract 2 from each side to undo the addition of 2 on the left.
$x = 5$	Simplify. The solution is 5.

Check

$x + 2 = 7$	Write the equation.
$5 + 2 \stackrel{?}{=} 7$	Replace x with 5.
$7 = 7$	The sentence is true. ✓

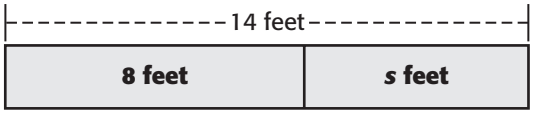
Subtraction Property of Equality If you subtract the same number from each side of an equation, the two sides remain equal.

Example 2 **While at an aquarium, Alec saw sharks swimming together. He noticed the 8-foot blacktip shark and a spinner shark together were the length of the 14-foot hammerhead shark. What was the length of the spinner shark?**

Words Blacktip length and spinner length is hammerhead length.

Variable Let s represent the spinner length.

Model



Equation $8 + s = 14$

$8 + s = 14$	Write the equation.
$-8 \quad -8$	Subtract 8 from both sides.
$s = 6$	$14 - 8 = 6$ So, the length of the spinner shark is 6 feet.

Exercises

Solve each equation. Check your solution.

1. $a + 1 = 7$ **2.** $3 + b = 8$ **3.** $c + 3 = 10$

4. $9 = x + 4$ **5.** $10 = x + 6$ **6.** $11 = 2 + j$

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Numerical Expressions

Order of Operations

1. Simplify the expressions inside grouping symbols, like parentheses.
2. Find the value of all powers.
3. Multiply and divide in order from left to right.
4. Add and subtract in order from left to right.

Example 1 **Find the value of $48 \div (3 + 3) - 2^2$.**

$48 \div (3 + 3) - 2^2 = 48 \div 6 - 2^2$ Simplify the expression inside the parentheses.
$= 48 \div 6 - 4$ Find 2^2.
$= 8 - 4$ Divide 48 by 6.
$= 4$ Subtract 4 from 8.

Example 2 **Write and solve an expression to find the total cost of planting flowers in the garden.**

Item	Cost per Item	Number of Items Needed
Pack of flowers	\$4	5
Bag of dirt	\$3	1
Bottle of fertilizer	\$4	1

Words	cost of 5 flower packs	plus	cost of dirt	plus	cost of fertilizer
Expression	$5 \times \$4$	$+$	\$3	$+$	\$4

$5 \times \$4 + \$3 + \$4 = \$20 + \$3 + \$4$ Multiply 5 by \$4.
$= \$23 + \$4$ Add \$20 and \$3.
$= \$27$ Add \$23 and \$4.

The total cost of planting flowers in the garden is \$27.

Exercises

Find the value of each expression.

1. $7 + 2 \times 3$

2. $12 \div 3 + 5$

3. $16 - (4 + 5)$

4. $8 \times 8 \div 4$

5. $10 + 14 \div 2$

6. $3 \times 3 + 2 \times 4$

7. $25 \div 5 + 6 \times (12 - 4)$

8. $80 - 8 \times 3^2$

9. $11 \times (9 - 2^2)$

10. GARDENING Refer to Example 2 above. Suppose that the gardener did not buy enough flowers and goes back to the store to purchase four more packs. She also purchases a shovel for \$16. Write an expression that shows the total amount she spent to plant flowers in her garden.

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Algebra: Variables and Expressions

- **A variable** is a symbol, usually a letter, used to represent a number.
- In addition to the symbol $\times$, the other ways to show multiplication are $2 \cdot 3$, $5t$, and st.
- **Algebraic expressions** contain at least one variable and at least one operation.

Example 1 **Evaluate $35 + x$ if $x = 6$.**

$35 + x = 35 + 6$ Replace x with 6.
$= 41$ Add 35 and 6.

Example 2 **Evaluate $y + x$ if $x = 21$ and $y = 35$.**

$y + x = 35 + 21$ Replace x with 21 and y with 35.
$= 56$ Add 35 and 21.

Example 3 **Evaluate $4n + 3$ if $n = 2$.**

$4n + 3 = 4 \cdot 2 + 3$ Replace n with 2.
$= 8 + 3$ Find the product of 4 and 2.
$= 11$ Add 8 and 3.

Example 4 **Evaluate $4n - 2$ if $n = 5$.**

$4n - 2 = 4 \cdot 5 - 2$ Replace n with 5.
$= 20 - 2$ Find the product of 4 and 5.
$= 18$ Subtract 2 from 20.

Exercises

Evaluate each expression if $y = 4$.

1. $3 + y$ **2.** $y + 8$ **3.** $4 \cdot y$

4. $9y$ **5.** $15y$ **6.** $300y$

7. y^2 **8.** $y^2 + 18$ **9.** $y^2 + 3 \cdot 7$

Evaluate each expression if $m = 3$ and $k = 10$.

10. $16 + m$ **11.** $4k$ **12.** $m \cdot k$

13. $m + k$ **14.** $7m + k$ **15.** $6k + m$

16. $3k - 4m$ **17.** $2mk$ **18.** $5k - 6m$

19. $20m \div k$ **20.** $m^3 + 2k^2$ **21.** $k^2 \div (2 + m)$

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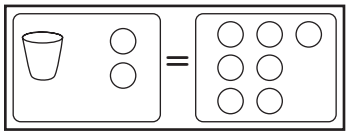
Solve and Write Addition Equations

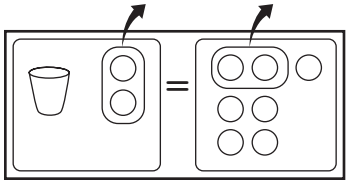
You can solve an equation by using inverse operations, which *undo* operations. To solve an addition equation, you would use subtraction.

Example 1 **Solve $x + 2 = 7$.**

Method 1: Use models.



$x + 2 = 7$



$x + 2 - 2 = 7 - 2$

Method 2: Use symbols.

$x + 2 = 7$	Write the equation.
$-2 \quad -2$	Subtract 2 from each side to undo the addition of 2 on the left.
$x = 5$	Simplify. The solution is 5.

Check

$x + 2 = 7$	Write the equation.
$5 + 2 \stackrel{?}{=} 7$	Replace x with 5.
$7 = 7$	The sentence is true. ✓

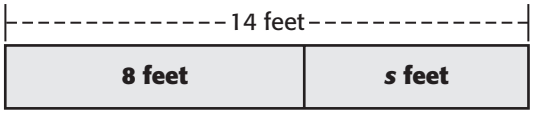
Subtraction Property of Equality If you subtract the same number from each side of an equation, the two sides remain equal.

Example 2 **While at an aquarium, Alec saw sharks swimming together. He noticed the 8-foot blacktip shark and a spinner shark together were the length of the 14-foot hammerhead shark. What was the length of the spinner shark?**

Words Blacktip length and spinner length is hammerhead length.

Variable Let s represent the spinner length.

Model



Equation $8 + s = 14$

$8 + s = 14$	Write the equation.
$-8 \quad -8$	Subtract 8 from both sides.
$s = 6$	$14 - 8 = 6$ So, the length of the spinner shark is 6 feet.

Exercises

Solve each equation. Check your solution.

1. $a + 1 = 7$ **2.** $3 + b = 8$ **3.** $c + 3 = 10$

4. $9 = x + 4$ **5.** $10 = x + 6$ **6.** $11 = 2 + j$

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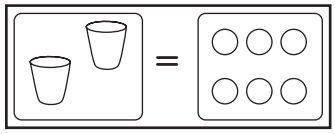
Solve and Write Multiplication Equations

The number by which a variable is multiplied is called the **coefficient**. For example, in the expression $5x$, the coefficient of x is 5. Because multiplication and division undo each other, use division to solve a multiplication equation.

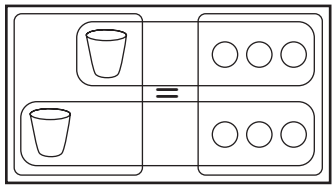
Example 1 **Solve $2x = 6$.**

Method 1: Use models.



$2x = 6$

Model the equation.



$x = 3$

Divide the counters equally into two groups.

The solution is 3.

Method 2: Use symbols.

$2x = 6$	Write the equation.
$\frac{2x}{2} = \frac{6}{2}$	Divide each side by 2 to undo the multiplication on the left.
$x = 3$	Simplify.
Check $2x = 6$	Write the original equation.
$2(3) \stackrel{?}{=} 6$	Replace x with 3.
$6 = 6$	The sentence is true. ✓

Example 2 **A category 5 hurricane can have a storm surge of 20 feet. This is about 5 times greater than the storm surge of a category 1 hurricane. What is the storm surge of a category 1 hurricane?**

Words	5 times category 1 surge is category 5 surge.
Variable	Let c = category 1 storm surge.
Equation	$5c = 20$

$5c = 20$	Write the equation.
$\frac{5c}{5} = \frac{20}{5}$	Divide both sides by 5.
$c = 4$	Simplify.

The storm surge of a category 1 hurricane is about 4 feet.

Exercises

Solve each equation. Check your solution.

1. $5a = 25$ **2.** $7c = 49$ **3.** $3u = 27$

4. $24 = 6d$ **5.** $18 = 3z$ **6.** $56 = 7v$

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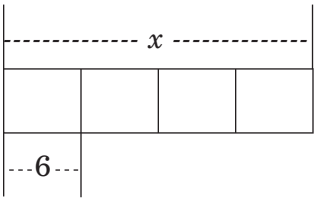
Solve and Write Division Equations

Use multiplication to solve division equations.

Example 1 **Solve $\frac{x}{4} = 6$.**

Method 1: Use models.

Model the equation.



There are four equal groups of 6. Multiply.

$6 \times 4 = 24$

The solution is 24.

Method 2: Use symbols.

$\frac{x}{4} = 6$	Write the equation.
$\frac{x}{4}(4) = 6(4)$	Multiply each side by 4 to undo the division on the left.
$x = 24$	Simplify.

Check $\frac{x}{4} = 6$	Write the original equation.
$\frac{24}{4} \stackrel{?}{=} 6$	Replace x with 24.
$6 = 6$	The sentence is true. ✓

Example 2 **The Yungs are making 6 payments of $200 on their new television set. What was the cost of the television set?**

Words: Total cost divided by 6 is $200.

$\frac{c}{6} = 200$	Write the equation.
$\frac{c}{6}(6) = 200(6)$	Multiply both sides by 6.
$c = 1{,}200$	Simplify.

The total cost of the television was $1,200.

Exercises

Solve each equation. Check your solution.

1. $\frac{a}{2} = 4$

2. $\frac{c}{3} = 6$

3. $\frac{g}{5} = 10$

4. $6 = \frac{d}{4}$

5. $9 = \frac{t}{3}$

6. $11 = \frac{w}{6}$

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Equations

An **equation** is a mathematical sentence showing two expressions are equal. An equation contains an **equals sign**, =. Some equations contain variables. When you replace a variable with a value that results in a true sentence, you **solve** the equation. The value for the variable is the **solution** of the equation.

Example 1 **Solve $14 - p = 6$ using guess, check, and revise.**

Guess the value of p, then check it.

Try 7.	Try 6.	Try 8.
$14 - p = 6$	$14 - p = 6$	$14 - p = 6$
$14 - 7 \neq 6$	$14 - 6 \neq 6$	$14 - 8 = 6$
revise	revise	yes

The solution is 8 because replacing p with 8 results in a true sentence.

Example 2 **Solve $15 \div m = 5$ mentally.**

$15 \div m = 5$ **Think** 15 divided by what number is 5?

$15 \div 3 = 5$ You know that $15 \div 3 = 5$.

$5 = 5$

The solution is 3.

Exercises

Identify the solution of each equation from the list given.

1. $h + 19 = 56$; 36, 37, 38

2. $31 + x = 42$; 9, 10, 11

3. $k - 4 = 13$; 16, 17, 18

4. $34 - b = 17$; 16, 17, 18

5. $5w = 30$; 5, 6, 7

6. $63 = 7k$; 7, 8, 9

7. $36 \div s = 9$; 4, 5, 6

8. $x \div 3 = 8$; 23, 24, 25

Solve each equation mentally.

9. $j + 3 = 9$

10. $14 + n = 19$

11. $23 + x = 29$

12. $31 - h = 24$

13. $m - 5 = 11$

14. $3m = 27$

15. $56 = 7b$

16. $14 \div f = 2$

17. $j \div 8 = 4$

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Function Rules

A **sequence** is a list of numbers in a specific order. Each number in the sequence is called a **term**. An **arithmetic sequence** is a sequence in which each term is found by adding the same number to the previous term.

Example **Use words and symbols to describe the value of each term as a function of its position. Then find the value of the tenth term in the sequence.**

Position	1	2	3	4	n
Value of Term	4	8	12	16	

Study the relationship between each position and the value of its term.

Notice that the value of each term is 4 times its position number. So, the value of the term in position n is $4n$.

To find the value of the tenth term, replace n with 10 in the algebraic expression $4n$. Since $4 \times 10 = 40$, the value of the tenth term in the sequence is 40.

Position		**Value of term**
1	$\times 4 =$	4
2	$\times 4 =$	8
3	$\times 4 =$	12
4	$\times 4 =$	16
n	$\times 4 =$	$4n$

Exercises

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the tenth term in the sequence.

1.

Position	3	4	5	6	n
Value of Term	1	2	3	4	

2.

Position	1	2	3	4	n
Value of Term	5	10	15	20	

3.

Position	4	5	6	7	n
Value of Term	11	12	13	14	

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Function Tables

A **function rule** describes the relationship between the input and output of a **function**. The inputs and outputs can be organized in a **function table**.

Example 1 **Complete the function table.**

Input (x)	$x - 3$	Output (y)
9	$9 - 3$	
8	$8 - 3$	
6	$6 - 3$	

The function rule is $x - 3$. Subtract 3 from each input.

Input		Output
9	$- 3 \rightarrow$	6
8	$- 3 \rightarrow$	5
6	$- 3 \rightarrow$	3

$\rightarrow$

Input (x)	$x - 3$	Output (y)
9	$9 - 3$	6
8	$8 - 3$	5
6	$6 - 3$	3

Example 2 **Find the input for the function table.**

Input (x)	$4x$	Output (y)
		0
		4
		8

Work backward to find the input. Since the rule is $4x$, divide each output by 4.

The inputs are 0, 1, and 2.

Exercises

Complete each function table.

1.

Input (x)	$2x$	Output (y)
0		
2		
4		

2.

Input (x)	$4 + x$	Output (y)
0		
1		
4		

Find the input for each function table.

3.

Input (x)	$x + 2$	Output (y)
	$1 + 2$	3
	$2 + 2$	4
	$5 + 2$	7

4.

Input (x)	$x \div 2$	Output (y)
	$2 \div 2$	1
	$6 \div 2$	3
	$10 \div 2$	5

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Functions and Equations

A **function table** displays **input** and **output** values that represent a function. The function displayed in a function table can be represented with an **equation**.

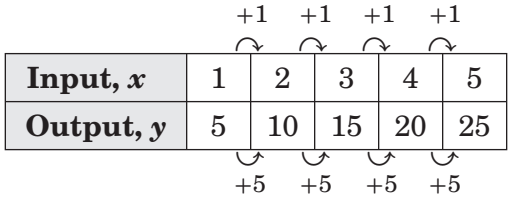
Example 1 **Write an equation to represent the function.**

Examine how the value of each input and output changes.

Input, x	1	2	3	4	5
Output, y	5	10	15	20	25

Each output y is equal to 5 times the input x.

So, the equation that represents the function is $y = 5x$.

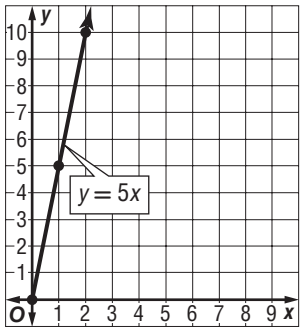


Example 2 **Graph the equation $y = 5x$.**

Select any three values for the input x, for example, 0, 1, and 2. Substitute these values for x to find the output y.

x	$5x$	y	(x, y)
0	5(0)	0	(0, 0)
1	5(1)	5	(1, 5)
2	5(2)	10	(2, 10)

The ordered pairs (0, 0), (1, 5), and (2, 10) represent the function. They are solutions of the equation.



Exercises

Write an equation to represent each function.

1.

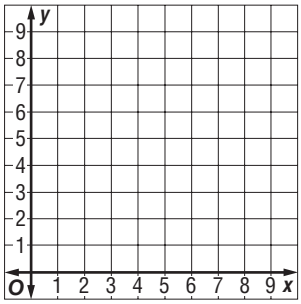
Input, x	1	2	3	4
Output, y	2	4	6	8

2.

Input, x	0	1	2	3
Output, y	0	6	12	18

In Exercise 3, graph the equation you got as an answer in Exercise 1.
In Exercise 4, graph the equation you got in Exercise 2.

3.



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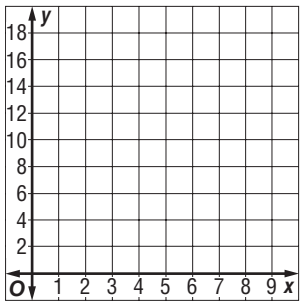

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Angle Relationships

Vertical angles are the opposite angles formed by intersecting lines. Vertical angles are **congruent angles**, or angles with the same measures.

Example 1 **Find the value of x in the figure at the right.**

The angle labeled $x°$ and the angle labeled 40° are vertical angles. Therefore, they are congruent.

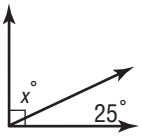
So, the value of x is 40.

Two angles are **complementary** if the sum of their measures is 90°.
Two angles are **supplementary** if the sum of their measures is 180°

Example 2 **Classify the pair of angles at the right as *complementary*, *supplementary*, or *neither*.**

$130° + 50° = 180°$
The angles are supplementary.

Example 3 **Find the value of x in the figure at the right.**



Since the angles form a right angle, they are complementary.

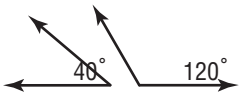
$x° + 25° =$	$90°$	Definition of complementary angles
$- 25° =$	$-25°$	Subtract 25 from each side.
$x° =$	$65°$	Simplify.

So, the value of x is 65.

Exercises

Classify each pair of angles as *complementary*, *supplementary*, or *neither*.

1.



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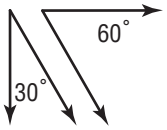

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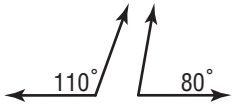
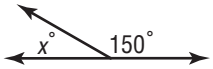


Find the value of x in each figure.

4.



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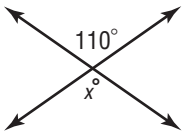

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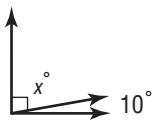

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Properties of Quadrilaterals

A **rectangle** has opposite sides congruent and parallel, and all right angles.

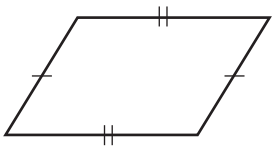
A **square** has all sides congruent, opposite sides parallel, and all right angles.

A **parallelogram** has opposite sides congruent and parallel, and opposite angles congruent.

A **rhombus** has all sides congruent, opposite sides parallel, and opposite angles congruent.

A **trapezoid** has exactly one pair of opposite sides parallel.

Example 1 **Classify the quadrilateral at the right.**

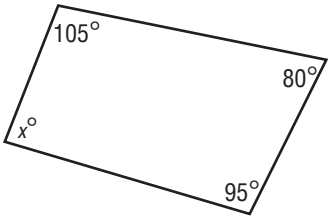


The figure has opposite sides congruent and parallel.

So, the figure is a parallelogram.

Quadrilaterals have four sides and four angles. The sum of the measures of the angles is 360°.

Example 2 **Find the value of x in the quadrilateral at the right.**



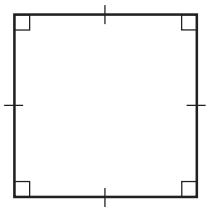
$x + 105 + 80 + 95 =$	360	Write the equation.
$x + 280 =$	360	Simplify: 105 + 80 + 95.
$- 280 =$	-280	Subtract 280 from each side.
$x =$	80	Simplify.

So, the value of x is 80.

Exercises

Classify each quadrilateral.

1.



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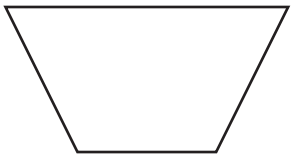
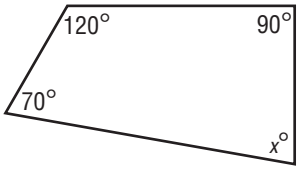


Find the value of x in each quadrilateral.

4.



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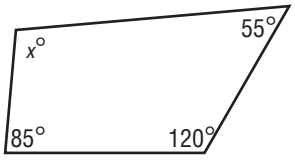

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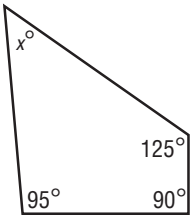

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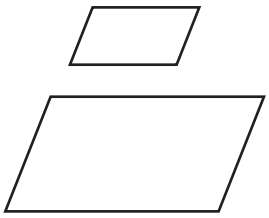
Similar and Congruent Figures

Figures that have the same size and shape are **congruent figures**.

Figures that have the same shape but not necessarily the same size are **similar figures**.

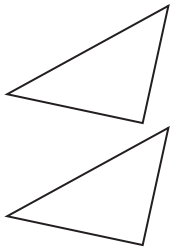
Examples **Tell whether each pair of figures is *similar*, *congruent*, or *neither*.**

1



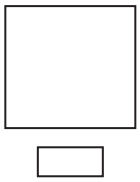
The parallelograms have the same shape but not the same size, so they are similar.

2



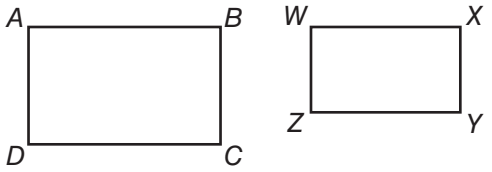
The triangles have the same shape and size, so they are congruent.

3



The rectangles are neither the same size nor the same shape, so they are neither congruent nor similar.

Example 4 **The rectangles at the right are similar. What side of rectangle *ABCD* corresponds to side $\overline{ZY}$?**

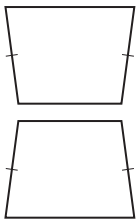


Corresponding sides represent the same side of similar figures. So, side $\overline{DC}$ corresponds to side $\overline{ZY}$.

Exercises

Tell whether each pair of figures is *congruent*, *similar*, or *neither*.

1.



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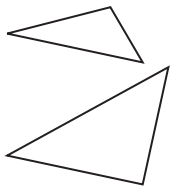

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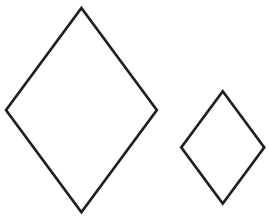
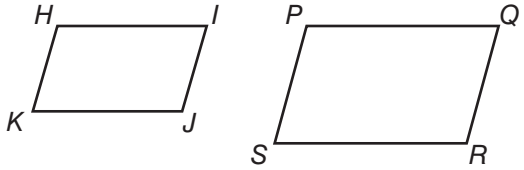


For Exercises 4 and 5, refer to the similar parallelograms at the right.



4. What side of parallelogram HIJK corresponds to side $\overline{QR}$?

5. What side or parallelogram PQRS corresponds to side $\overline{HK}$?

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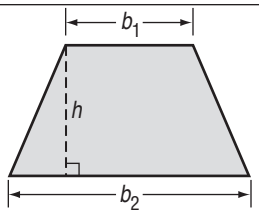
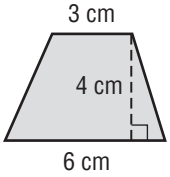
Area of Trapezoids

A trapezoid has two bases, b_1 and b_2. The height of a trapezoid is the distance between the two bases. The area A of a trapezoid equals half the product of the height h and the sum of the bases b_1 and b_2.

$$A = \frac{1}{2}h(b_1 + b_2)$$



Example **Find the area of the trapezoid.**



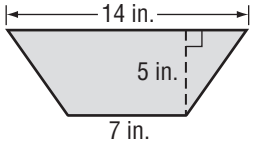
$A = \frac{1}{2}h(b_1 + b_2)$	Area of a trapezoid
$A = \frac{1}{2}(4)(3 + 6)$	Replace h with 4, b_1 with 3, and b_2 with 6.
$A = \frac{1}{2}(4)(9)$	Add 3 and 6.
$A = 18$	Simplify.

The area of the trapezoid is 18 square centimeters.

Exercises

Find the area of each figure. Round to the nearest tenth if necessary.

1.



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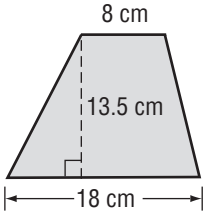

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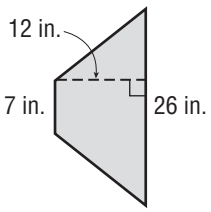

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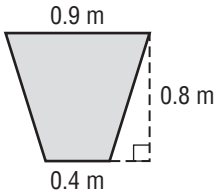

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Median, Mode, and Range

The **median** is the middle number of the data put in order, or the mean of the middle two numbers.
The **mode** is the number or numbers that occur most often.

Example 1 **The table shows the costs of seven different books. Find the mean, median, and mode of the data.**

Book Costs ($)			
22	13	11	16
14	13	16	

mean: $\frac{22 + 13 + 11 + 16 + 14 + 13 + 16}{7} = \frac{105}{7}$ or 15

To find the median, write the data in order from least to greatest.
median: 11, 13, 13, (14), 16, 16, 22

To find the mode, find the number or numbers that occur most often.
mode: 11, (13, 13,) 14, (16, 16,) 22

The mean is \$15. The median is \$14. There are two modes, \$13 and \$16.

The **range** of a set of data describes how the data vary.

Example 2 **Find the range of the data in the table. Then write a sentence describing how the data vary.**

Temperatures		
32°	40°	50°
55°	60°	63°

The greatest value is 63. The least value is 32. So, the range is 63° − 32° or 31°. The range is large. It tells us that the data vary greatly in value.

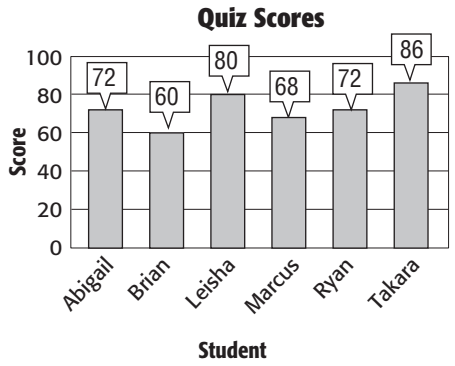
Exercises

Find the mean, median, mode, and range of each set of data.

1. hours worked: 14, 13, 14, 16, 8

2. points scored by a football team: 29, 31, 14, 21, 31, 22, 20

3.



4.

Snowfall (in.)					
0	2	2	3	3	3
5	5	6	7	8	

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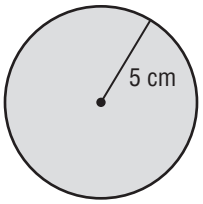
Area of Circles

The area A of a circle equals the product of pi (π) and the square of its radius r.

$$A = \pi r^2$$

Example 1 **Find the area of the circle. Use 3.14 for π.**



$A = \pi r^2$	Area of circle
$A \approx 3.14 \cdot 5^2$	Replace π with 3.14 and r with 5.
$A \approx 3.14 \cdot 25$	$5^2 = 5 \cdot 5 = 25$
$A \approx 78.5$	

The area of the circle is approximately 78.5 square centimeters.

Example 2 **Find the area of a circle that has a diameter of 9.4 millimeters. Use 3.14 for π. Round to the nearest tenth.**

$A = \pi r^2$	Area of circle
$A \approx 3.14 \cdot 4.7^2$	Replace π with 3.14 and r with 9.4 ÷ 2 or 4.7.
$A \approx 69.4$	Multiply.

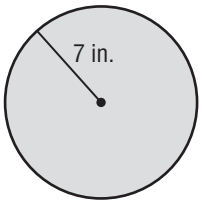
The area of the circle is approximately 69.4 square millimeters.

The formula for the area of a semicircle, or half a circle, is $A = \frac{1}{2}\pi r^2$.

Exercises

Find the area of each circle. Use 3.14 or $\frac{22}{7}$ for π. Round to the nearest tenth.

1.



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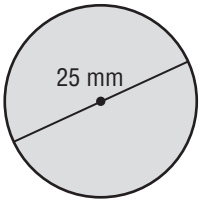

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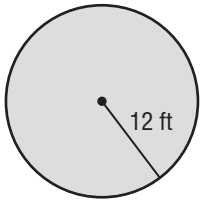
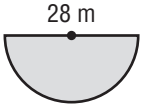


Approximate the area of each semicircle.

4.



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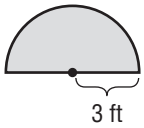

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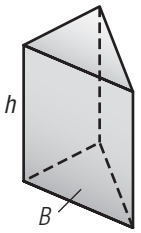
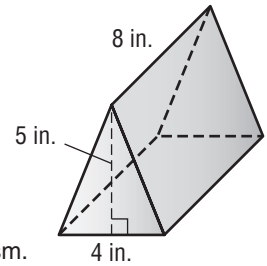
Volume of Triangular Prisms

Volume of a Triangular Prism	
Words The volume V of a triangular prism is the area of the base B times the height h.	**Model** 
Symbols $V = Bh$, where $B = \frac{1}{2}bh$	

Example 1 **Find the volume of the triangular prism.**



The area of the triangle is $\frac{1}{2} \cdot 4 \cdot 5$, so replace B with $\frac{1}{2} \cdot 4 \cdot 5$.

$V = Bh$ Volume of a prism

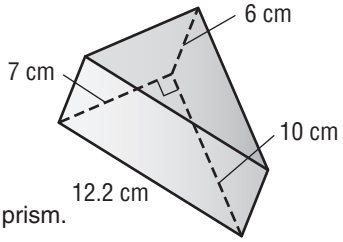
$V = \left(\frac{1}{2} \cdot 4 \cdot 5\right)(h)$ Replace B with $\frac{1}{2} \cdot 4 \cdot 5$.

$V = \left(\frac{1}{2} \cdot 4 \cdot 5\right)(8)$ Replace h with 8, the height of the prism.

$V = 80$ Multiply.

The volume is 80 cubic inches or 80 in^3.

Example 2 **Find the volume of the triangular prism.**



$V = Bh$ Volume of a prism

$V = \left(\frac{1}{2} \cdot 7 \cdot 10\right)(h)$ Replace B with $\frac{1}{2} \cdot 7 \cdot 10$.

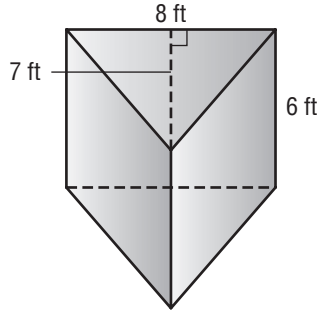
$V = \left(\frac{1}{2} \cdot 7 \cdot 10\right)(6)$ Replace h with 6, the height of the prism.

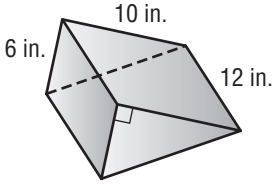
$V = 210$ Multiply.

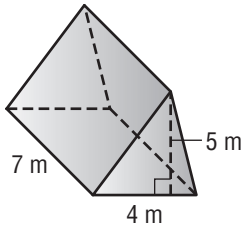
The volume is 210 cubic centimeters or 210 cm^3.

Exercises

Find the volume of each prism. Round to the nearest tenth if necessary.

1. 

2. 

3. 

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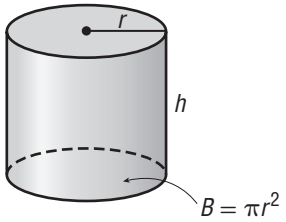
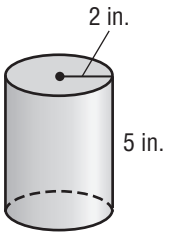
Volume of Cylinders

As with prisms, the area of the base of a **cylinder** tells the number of cubic units in one layer. The height tells how many layers there are in the cylinder. The volume V of a cylinder with radius r is the area of the base B times the height h.

$V = Bh$ or $V = \pi r^2 h$, where $B = \pi r^2$



Example **Find the volume of the cylinder. Use 3.14 for π. Round to the nearest tenth.**



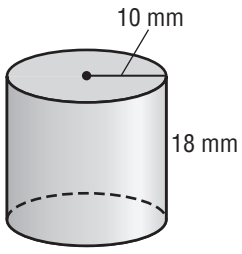
$V = \pi r^2 h$	Volume of a cylinder
$V \approx 3.14(2)^2(5)$	Replace π with 3.14, r with 2, and h with 5.
$V \approx 62.8$	Multiply.

The volume is about 62.8 cubic inches.

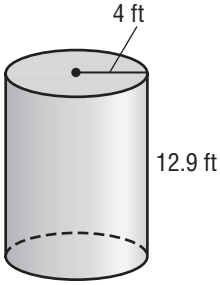
Exercises

Find the volume of each cylinder. Use 3.14 for π. Round to the nearest tenth.

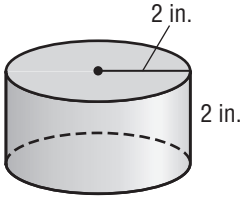
1.



2.



3.



4. radius = 9.5 yd
height = 2.2 yd

5. diameter = 6 cm
height = 11 cm

6. diameter = 3 m
height = 1 m

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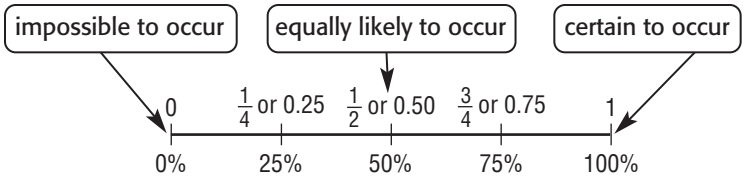
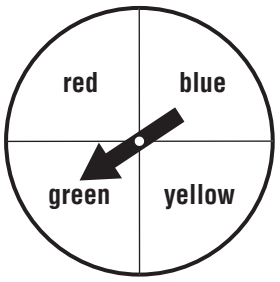
Probability of Simple Events

When tossing a coin, there are two possible **outcomes**, heads and tails. Suppose you are looking for heads. If the coin lands on heads, this would be a favorable outcome. The chance that some event will happen (in this case, getting heads) is called **probability**. You can use a ratio to find probability. The probability of an event is a number from 0 to 1, including 0 and 1. The closer a probability is to 1, the more likely it is to happen.



Example 1 **There are four equally likely outcomes on the spinner. Find the probability of spinning green or blue.**



$$P(\text{green or blue}) = \frac{\text{number of favorable outcomes}}{\text{number of total outcomes}}$$

$$= \frac{2}{4} \text{ or } \frac{1}{2}$$

The probability of landing on green or blue is $\frac{1}{2}$, 0.50, or 50%.

Complementary events are two events in which either one or the other must happen, but both cannot happen at the same time. The sum of the probabilities of complementary events is 1.

Example 2 **There is a 25% chance that Sam will win a prize. What is the probability that Sam will not win a prize?**

$$\begin{aligned} P(\text{win}) + P(\text{not win}) &= 1 \\ 0.25 + P(\text{not win}) &= 1 \\ -0.25 \qquad\qquad &= -0.25 \\ \hline P(\text{not win}) &= 0.75 \end{aligned}$$

So, the probability that Sam won't win a prize is 0.75, 75%, or $\frac{3}{4}$.

Exercises

1. There is a 90% chance that it will rain. What is the probability that it will not rain?

One pen is chosen without looking from a bag that has 3 blue pens, 6 red, and 3 green. Find the probability of each event. Write each answer as a fraction, a decimal, and a percent.

2. P(green)

3. P(blue or red)

4. P(*not* red)

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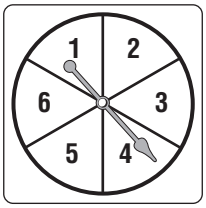
Probability of Independent Events

Compound events in which the outcome of one event does not affect the outcome of the other event are **independent events**. The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event. Therefore, $P(A \text{ and } B) = P(A) \times P(B)$.

Example 1 **A coin is tossed and the spinner is spun. Find the probability of tossing tails and spinning a number greater than 2.**



First, find the probability of each event.

$P(\text{tails}) = \frac{1}{2}$ ← $\frac{\text{number of ways to toss tails}}{\text{number of possible outcomes}}$

$P(\text{greater than } 2) = \frac{4}{6}$ ← $\frac{\text{numbers greater than 2}}{\text{number of possible outcomes}}$

Then find the probability of both events occurring.

$P(\text{tails and greater than } 2) = \frac{1}{2} \times \frac{4}{6}$ $P(\text{tails}) \times P(\text{greater than 2})$

$= \frac{4}{12} = \frac{1}{3}$ Multiply and simplify.

The probability of tossing tails and spinning greater than two is $\frac{1}{3}$.

Example 2 **Sara has 4 DVDs and 12 CDs in a box. She chose 1 item without looking, replaced it, and then chose a second item from the box. What is the probability that each item selected was a DVD?**

Find the probability that the first item selected is a DVD.

$P(\text{DVD}) = \frac{4}{16}$ or $\frac{1}{4}$

Since Sara replaces the item back into the box after the first trial, the probability that the second item selected is a DVD is also $\frac{4}{16}$ or $\frac{1}{4}$.

$P(\text{DVD and DVD}) = \frac{1}{4} \times \frac{1}{4}$ $P(\text{DVD}) \times P(\text{DVD})$

$= \frac{1}{16}$ Multiply.

So, the probability of selecting a DVD and a DVD is $\frac{1}{16}$.

Exercises

For Exercises 1–3, refer to the spinner from Example 1. Find each probability.

1. $P(\text{odd and even})$ **2.** $P(3 \text{ and } 5)$ **3.** $P(1 \text{ and greater than } 1)$

4. Kaden has 2 pieces of gum, 3 mints, and 5 hard candies in a jar. He pulls out one item, then replaces it and pulls out another item. What is the probability that each item is a piece of gum? Write your answer as a fraction, decimal, and percent.

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The Fundamental Counting Principle

The **Fundamental Counting Principle** states that if there are m outcomes for a first choice and n outcomes for a second choice, then the total number of possible outcomes can be found by multiplying $m \times n$.

Example 1 **A spinner with three equal sections marked A, B, and C is spun and a letter is randomly chosen from the word *flower*. Find the total number of possible outcomes.**

spinner choices		letter choices		total number of outcomes	
3	×	6	=	18	Fundamental Counting Principle

There are 18 possible outcomes.

Example 2 **A local deli offers customers a choice of three different kinds of soups, four different kinds of sandwiches, and two different beverages. How many meals consisting of one soup, one sandwich, and one beverage are possible?**

soup choices		sandwich choices		beverage choices		total number of outcomes	
3	×	4	×	2	=	24	Fundamental Counting Principle

There are 24 possible meals.

Exercises

Use the Fundamental Counting Principle to find the total number of possible outcomes in each situation.

1. selecting one letter from the word *tiger* and one month of the year
2. tossing a coin and rolling a number cube
3. selecting either Joseph or Yolanda to be president and either Beckie, Antwon, or Guido to be vice-president
4. selecting one entrée from chicken, beef, or fish and one side dish from salad, soup, or potato
5. spinning a spinner with eight equal sections twice
6. choosing a color from ten colors and a number from 1 to 5
7. Michelle has four pairs of pants and seven shirts. Assuming she can wear any of the shirts with each pair of pants, how many outfits are possible?
8. A spinner with five equal sections marked A, B, C, D, and E is spun twice. What is the probability that the spinner will land on A after the first spin and on C after the second spin?

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