

Interpreting Word Problems

Say Thanks to the Authors

Click <http://www.ck12.org/saythanks>

(No sign in required)



To access a customizable version of this book, as well as other interactive content, visit www.ck12.org

CK-12 Foundation is a non-profit organization with a mission to reduce the cost of textbook materials for the K-12 market both in the U.S. and worldwide. Using an open-content, web-based collaborative model termed the **FlexBook®**, CK-12 intends to pioneer the generation and distribution of high-quality educational content that will serve both as core text as well as provide an adaptive environment for learning, powered through the **FlexBook Platform®**.

Copyright © 2013 CK-12 Foundation, www.ck12.org

The names “CK-12” and “CK12” and associated logos and the terms “**FlexBook®**” and “**FlexBook Platform®**” (collectively “CK-12 Marks”) are trademarks and service marks of CK-12 Foundation and are protected by federal, state, and international laws.

Any form of reproduction of this book in any format or medium, in whole or in sections must include the referral attribution link <http://www.ck12.org/saythanks> (placed in a visible location) in addition to the following terms.

Except as otherwise noted, all CK-12 Content (including CK-12 Curriculum Material) is made available to Users in accordance with the Creative Commons Attribution/Non-Commercial/Share Alike 3.0 Unported (CC BY-NC-SA) License (<http://creativecommons.org/licenses/by-nc-sa/3.0/>), as amended and updated by Creative Commons from time to time (the “CC License”), which is incorporated herein by this reference.

Complete terms can be found at <http://www.ck12.org/terms>.

Printed: September 1, 2013

flexbook
next generation textbooks



CONCEPT 1 Interpreting Word Problems

Objective

To learn how to write a word problem as a mathematical equation.

Review Queue

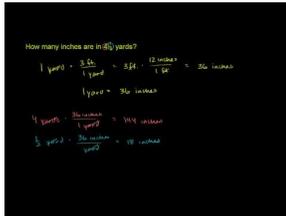
1. Solve $3(4x - 7) + 18 = 5x + 53$.
2. How many feet are in a yard? A mile?
3. List 3 words that mean “add.”
4. List 3 words that mean “subtract.”

Unit Conversion

Objective

To convert units of measure into a different unit.

Watch This



MEDIA

Click image to the left for more content.

[KhanAcademy: Unit Conversion with Fractions](#)

Guidance

One part of word problems is the unit of measure. It can be confusing when we don't know what the problem is asking for. For example, how many feet are in a mile? How many cups are in a gallon? Here are a few conversions between different units of measure.

TABLE 1.1:

2 cups (c)	1 pint
2 pints (pt)	1 quart
4 quarts (qt)	1 gallon (gal)
12 inches (in)	1 foot
3 feet (ft)	1 yard
1760 yards (yd)	1 mile (mi)
8 ounces (oz)	1 pound (lb)
2000 lbs	1 ton
100 centimeters (cm)	1 meter (m)
1000 meters	1 kilometer (km)
2.2 cm	1 inch

Example A

How many cups are in a gallon?

Solution: There are 2 cups in a pint, 2 pints in a quart and 4 quarts in a gallon.

$\frac{2c}{1pt} \cdot \frac{2pt}{1qt} \cdot \frac{4qt}{1gal}$ Cancel out the like terms and multiply across.

$\frac{2c}{\cancel{1pt}} \cdot \frac{2\cancel{pt}}{\cancel{1qt}} \cdot \frac{4\cancel{qt}}{1gal} = \frac{16c}{1gal}$ There are 16 cups in one gallon.

Make sure to always cancel any units that are in the numerator and denominator of these fractions. Fractions like these are called **unit rates** because the base is one unit. We write out the unit conversion problems in this way so that we ensure that all of the correct units are canceled out.

Example B

How many feet are in 16 yards?

Solution: This problem is not a conversion problem, but asking to extend your knowledge of how many feet are in a yard. We know that there are 3 feet in a yard; therefore there will be $3 \cdot 16 = 48$ feet in 16 yards.

Another way to solve this problem is in a ratio, below:

$$\frac{3ft}{1yd} = \frac{xft}{16yd} \text{ To solve a ratio, we cross-multiply.}$$

$$3ft \cdot 16yd = 1yd \cdot xft$$

$$\frac{48ft \cdot \cancel{yd}}{1\cancel{yd}} = xft \text{ Here, } x = 48 \text{ feet and we show that the appropriate units cancel.}$$

Guided Practice

1. How many centimeters are in a foot?
2. How many ounces are in 3.5 pounds?

Answers

1. This problem is just like Example A. Set up the conversion.

$$\frac{2.2cm}{1in} \cdot \frac{12in}{1ft} \text{ Cancel out the inches and multiply.}$$

$$\frac{2.2cm}{1\cancel{in}} \cdot \frac{12\cancel{in}}{1ft} = \frac{26.4cm}{1ft}$$

2. This problem is just like Example B. If there are 8 ounces in a pound, then there will be $8 \cdot 3.5 = 28$ ounces in 3.5 pounds.

Problem Set

For questions 1-6, set up a unit conversion to find:

1. Feet in a mile?
2. Cups in a quart?
3. Centimeters in a kilometer?
4. Pints in a gallon?
5. Centimeters in a mile?
6. Gallons in a quart?

7. How many inches are in 5.25 yards?
8. How many pints are in 7.5 gallons?
9. How many pounds are in 2.6 tons?
10. How many centimeters are in 4.75 meters?
11. Claire is making chocolate chip cookies. If the recipe calls for 3.5 cups of flour, how many cups will Claire need to use if she triples the recipe?
12. The recipe above calls for 8 oz. of chocolate chips. Claire wants to make the cookies with three-quarters bittersweet chips and one-quarter semi-sweet chips. Again, tripling the recipe, how many ounces of each type of chocolate chip will she need?

Using Algebraic Models

Objective

To write and solve an algebraic equation from a word problem.

Guidance

Word problems are some of the hardest types of problems for students to grasp. There are a few steps to solving any word problem:

1. Read the problem at least twice.
2. Cross out any unnecessary words, circle any numbers or words that represent mathematical operators, or translate words into mathematical expressions.
3. Write an equation and solve.

To help you with steps 2 and 3, generate a list of words that represent: add, subtract, multiply, divide, equal, etc. Here are a few to get you started.

TABLE 1.2:

Operation	Alternate Terms
add	sum ; plus ; and ; increase ; more (than)
multiply	times ; of ; product ; double (x2) ; triple (x3)
subtract	difference ; minus ; decrease ; less (than)
equal	is ; total ; to ; made/make ; spend/spent
divide	quotient ; half ($\div 2$) ; third ($\div 3$)
variable	how many ___ ; how much ___ ; what amount (of) ___

See if you can add anything to these lists. Then, use this chart to help you with decoding word problems.

Example A

Two consecutive numbers add up to 55. What are the two numbers?

Solution: First, translate the statement. “Consecutive” means numbers that are one after the other. So if the first number is x , then the second number will be $x + 1$. And, they add up to 55. The equation is: $x + (x + 1) = 55$

We put $x + 1$ in parenthesis to show that it is a separate number. Solve the equation.

$$x + x + 1 = 55$$

$$2x + 1 = 55$$

$$2x = 54$$

$$x = 27$$

The smaller number is 27, and the larger number will be 28. $27 + 28 = 55$

Sometime you may encounter problems with “consecutive even numbers” or “consecutive odd numbers.” All even numbers are divisible by 2, so the smallest should be $2x$, then the next even number would be $2x + 2$. For consecutive odd numbers, they will always be an even number plus 1, 3, 5, etc. So, the smaller odd number would be $2x + 1$ and the larger odd number would be $2x + 3$.

Example B

Over the Winter Break, you worked at a clothing store and made \$9.00 an hour. For the two weeks you worked 65 hours of regular pay and 10 hours of overtime (time and a half). How much money did you make?

Solution: First, we need to figure out how much you make for overtime. Time and a half would be $\$9.00 + \$4.50 = \$13.50$ an hour. So, you made:

$$\$9.00(65) + \$13.50(10) = \$585.00 + \$135.00 = \$720.00$$

Guided Practice

1. Elise is taking piano lessons. The first lesson is twice as expensive as each additional lesson. Her mom spends \$270 for 8 lessons. How much was the first lesson?
2. Javier needs to get a tank of gas. Gas costs \$3.79 per gallon. How much money does Javier need to fill up his 16 gallon tank?

Answers

1. Translate each statement.

first lesson is twice as expensive as each additional lesson: call the regularly priced lessons l . Then, the first lesson will be $2l$.

mom spends \$270 for 8 lessons: first lesson, $2l + 7l = \$270$

Solve:

$$2l + 7l = 270$$

$$9l = 270$$

$$l = 30$$

The regularly priced lessons are \$30. The first lesson will be \$60.

2. This problem wants to know how much money Javier needs to fill up his gas tank. Gas costs \$3.79 per gallon and he needs 16 gallons of gas. It will cost $\$3.79 \cdot 16 = \60.64 to fill up his tank.

Problem Set

Answer each question to the best of your ability.

1. The average speed on highway 101 is 65 miles per hour (mph). Assuming you drive the speed limit, how long will it take you to drive 350 miles? Use the formula $distance = rate \cdot time$. Round your answer to two decimal places.
2. Using the information in #1, how many miles did you drive on highway 101 if you drove for 2.5 hours?
3. The sum of two consecutive numbers is 79. Find the two numbers.
4. The sum of two consecutive odd numbers is 44. Find the two odd numbers.
5. You borrowed \$350 from your parents for a new Wii and games. They are not going to charge you interest, but you need to pay them back as quickly as possible. If you pay them \$15 per week, how long will it take you to pay them back?
6. George is building a rectangular, fenced-in dog run. He has 120 feet of fencing and wants the length to be 20 feet greater than the width. If you use all the fencing, find the length and width of the dog run.
7. Cynthia is selling chocolate bars for a fundraiser for school. Each bar costs \$1.50. If she needs to raise \$225, how many chocolate bars does she need to sell?
8. Harriet bakes and sells cookies to local stores. Her cost for one dozen cookies is \$2.75 and she sells them to stores for \$7.00 (per dozen). How many dozen cookies does she need to make to earn \$500? Round to the nearest dozen.
9. A football field is a rectangle where the length is 100 yards. If the total perimeter is 1040 feet, what is the width of a football field? Leave your answer in feet.
10. **Challenge** The sum of *three* consecutive even numbers is 138. What are the three numbers?