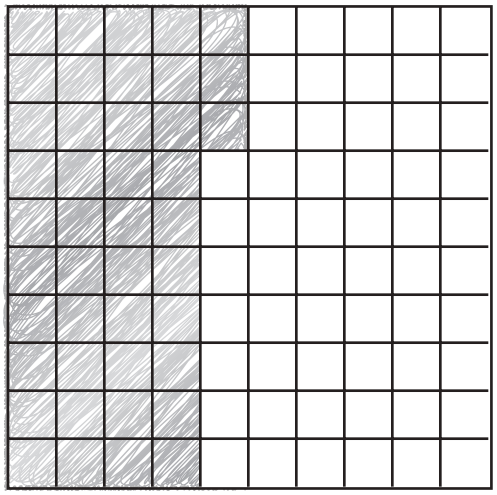
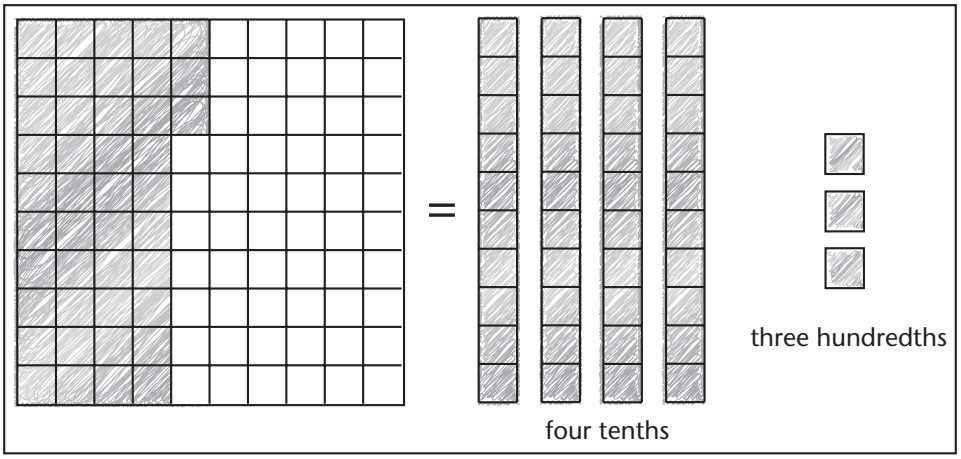
Let's look at an example.



We can see that 43 pieces are shaded; this means we have $\frac{43}{100}$ or 43% shaded. But we can also see that there are 4 tenths and 3 hundredths:



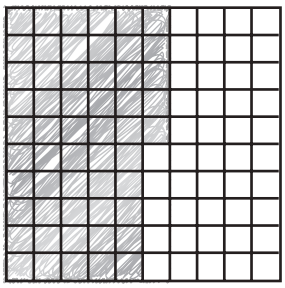
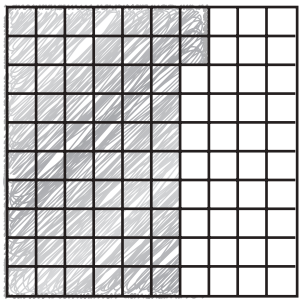
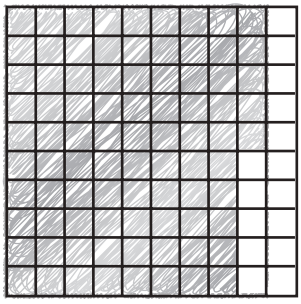
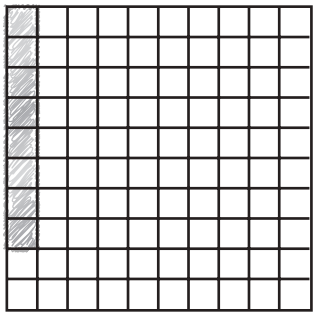
This shows us we have 0.43.

So $\frac{43}{100} = 43\% = 0.43$

Thinking Space

Practice 2

Write the amount shaded in the 10 by 10 grid as a fraction (in lowest terms), percent, and decimal

10 by 10 grid Tenths and hundredths	Fraction (in lowest terms)	Percent	Decimal
1. 			
2. 			
3. 			
4. 			

Turn to the Answer Key at the end of the Module and mark your answers.

Explore

Thinking Space

Drawing a picture can be helpful, but it's not always the fastest method. What other methods have you used in the past?

Let's look at some other ways to make these conversions.

In Section 2.2, you became an expert at converting between fractions and decimals! Let's review with some examples.

Fraction to decimal:

$$\frac{7}{20} = 7 \div 20 = 0.35 \quad \text{OR} \quad \frac{7}{20} = \frac{7 \times 5}{20 \times 5} = \frac{35}{100} = 0.35$$

Decimal to fraction:

$$0.35 = \frac{35}{100} = \frac{35 \div 5}{100 \div 5} = \frac{7}{20}$$

Practice 3

1. Josephine is a baseball player. She hit the ball 8 out of the last 10 times she was at bat. What is her batting average? *Note:* batting average is written as a decimal.

2. Miranda's batting average is 0.7. How many times would she probably hit the ball if she was at bat 20 times?

Turn to the Answer Key at the end of the Module and mark your answers.

Explore

Thinking Space

Percent to Fraction

Let's look at how to change from percents to fractions. Remember, a percent means over 100. So all we need to do is remove the % sign and make it over 100. Remember to simplify.

For example: $35\% = \frac{35}{100} = \frac{35 \div 5}{100 \div 5} = \frac{7}{20}$

Fraction to Percent

To change from a fraction to a percent, find an equivalent fraction with a denominator of 100. Then multiply by 100 to find the percent.

% Remember: when you put the % symbol at the end, you're actually saying "out of 100", so you don't need the 100 as a denominator anymore.

For example: $\frac{7}{20} = \frac{7 \times 5}{7 \times 5} = \frac{35}{100} = 35\%$

Practice 4

1. Samuel received 75% on his last test. What fraction of the test did he get right?

2. Norio received a quiz back. He received a mark of 3/5. What percent did he get on the quiz?

Turn to the Answer Key at the end of the Module and mark your answers.

Explore

Thinking Space

Decimal to Percent

To change a percent to a decimal, divide by 100%. This means we need to move the decimal twice to the left and remove the percent sign.

For example: 35% = 0.35

Percent to Decimal

To change a decimal to a percent, multiply by 100%. This means we need to move the decimal twice to the right and add a percent sign.

For example: 0.35 = 35%

Practice 5

1. Jessica chose a page out of the newspaper and saw that ads took up one quarter of the page. What percent of the page is covered in ads?

2. Pierre chose a page out of the newspaper and saw that ads took up two thirds of the page. How can this be written as a decimal?

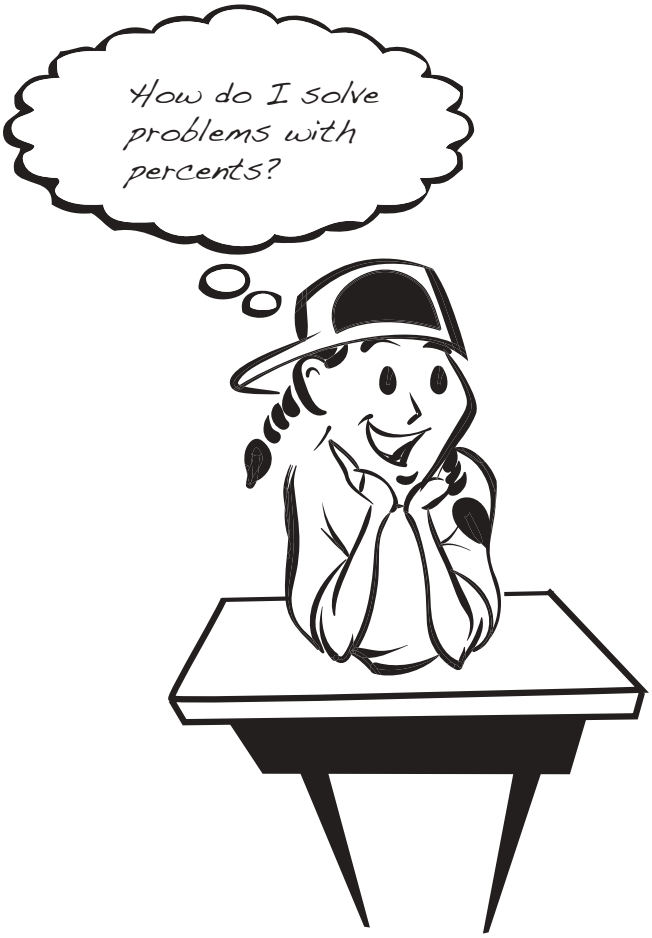
3. Fill in the chart below. The first one is done for you.

Fraction (in lowest terms)	Decimal	Percent
$\frac{1}{4}$	0.25	25%
a. $\frac{19}{20}$		
b. $\frac{43}{50}$		
c.	0.32	
d.	0.74	
e.		92%
f.		8%

Turn to the Answer Key at the end of the Module and mark your answers.

Lesson 2.3B: Problem Solving with Percent

Student Inquiry



This activity will help you get ready for, learn, and review the information in the upcoming lesson.

When you turn this page over, you will find a chart containing the inquiry outcomes for this lesson. You may be able to answer some of these questions already! Start by writing down your thoughts before the lesson.

When you finish the lesson, answer each question and give an example.

Student Inquiries	BEFORE THE LESSON	AFTER THE LESSON
	What I already know about this question:	What I thought at the end: My final answer, and examples:
How do I solve problems with percents?		answer
		example
When should I round an answer for a percent problem?		answer
		example

Lesson 2.3B: Problem Solving with Percent

Thinking Space

Introduction

We know how percents, decimals, and fractions are related. We have also worked closely with fractions and decimals.

What about percents?

We need to know how to work with percents to answer questions like "what percent did I get on that last test?" and "how much is that sweater going to cost with the discount?" You will be able to answer questions just like these once we go through the steps to solve problems with percents.

Warm-up

Let's have a look at some problems involving percents:

1. Richard has 50 songs on his iPod. Twelve of these songs are rock songs. What percent of his songs are rock songs?

2. Barbara has a collection of 20 DVDs. She has not seen 3 of the DVDs yet. What percent of the DVDs has Barbara not seen?

3. Caroline's team won 19 of the last 25 basketball games. What percent of the games has Caroline's team won?

Let's also review how to multiply decimals.

When multiplying decimals:

	Example
1. Multiply the numbers as if they were both whole numbers.	0.5×60.2 Ignoring the decimals we have $5 \times 602 = 3010$
2. Count how many digits are to the right of the decimal in the original numbers.	0.5 has one digit and 60.2 has one digit to the right of the decimal. We have a total of 2 digits to the right of the decimal.
3. Place the decimal in your answer so it has the same number of digits to the right of the decimal as you found in step 2.	From step 2 we know we need two digits after the decimal. 3010 becomes 30.10. So $0.5 \times 60.2 = 30.10$, which equals 30.1.

Here's another example: 0.25×40

Let's follow the steps above to solve:

1. $25 \times 40 = 1000$
2. 0.25 has 2 decimal places, 40 has none.
3. 1000 with 2 decimal places is 10.00 = 10.

So $0.25 \times 40 = 10$

4. Use the above steps to find the following products:

   a. $0.75 \times 80 =$

   b. $0.8 \times 50 =$

c. $0.35 \times 200 =$

d. $0.9 \times 1.5 =$

e. $0.63 \times 5.5 =$

Turn to the Answer Key at the end of the Module and mark your answers.

Explore

All of the word problems we are going to work with use the following equation:

(percent)	×	(original number)	=	(amount)
P	×	**O**	=	A

Here's what you need to know to use this equation:

Percent (P) = the percent in DECIMAL form

Original number (**O**) = the number after the word "of"

Amount (A) = percent of a number

50% of 20 is 10, so let's see what this will look like in the equation:

(percent)	×	(original number)	=	(amount)
(0.5)	×	(20)	=	(10)

We will be looking at problems where the percent, original number (of number), or the amount is missing.

Let's take a closer look at the equation: $P \times \mathbf{O} = A$

This equation is solved for A. But what if we want to find P?

You will learn more about ways to solve equations like this later in Math 7. For now, here is a short explanation.

To have P on its own, we need to move the **O**. Since the P and **O** are being multiplied we need to "un-multiply" them. Un-multiplying is the same dividing. We "un-multiply" by dividing both sides by **O**.

$$\frac{P \times \mathbf{O}}{\mathbf{O}} = \frac{A}{\mathbf{O}} \rightarrow P = \frac{A}{\mathbf{O}}$$

We can use the same "un-multiply" method to solve for **O**. We can isolate **O** by dividing both sides by P. $O = \frac{A}{P}$.

Thinking Space

You can think of the *O* as the "of number" or the "big number."

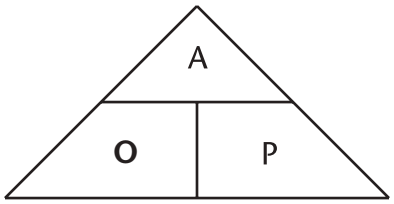
You can think of this as the "little number."

Notice that the word "of" means multiply.

"un-multiply" isn't a real math word, but it helps us understand what's happening.

It is important to understand how to isolate variables. But in case you have trouble understanding this right away, you can use a handy trick. Rewrite the equation in a triangle.

Thinking Space



A = amount

O = original number (of number)

P = percent in decimal form

Now we will see how to use this triangle by going through examples.

Example 1

20% of 40 is what number?

We know:

The percent is 20% = 0.20 and the number after "of" is 40 so this is our original number (of number).

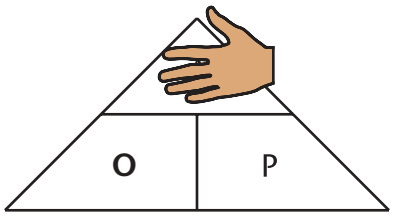
P = 0.20

O = 40

A = ?

To find the amount, we cover the A in the triangle and see what we have:

We always cover the letter that we're trying to find.



Since the **O** and the P are next to each other, we multiply them.

Thinking Space

This is the same as our original equation:

(percent) × (original number) = (amount)

A = **O** × P

A = 0.20 × 40 = 8

So we know the amount is 8.

Example 2

What percent of 45 is 27?

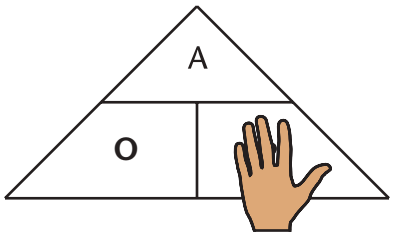
We do not know the percent. The number after "of" is 45, so this is our original number (of number) and our amount is 27.

P = ?

O = 45

A = 27

We do not know P, so let's cover the P in our triangle to see what we need to do:



Since the A is over the **O**, we know $P = \frac{A}{O}$. This is the same equation we found earlier.

$$P = \frac{A}{O}$$

$$P = \frac{27}{45} = 0.6 = 60\%$$

Example 3

80% of what number is 29.6?

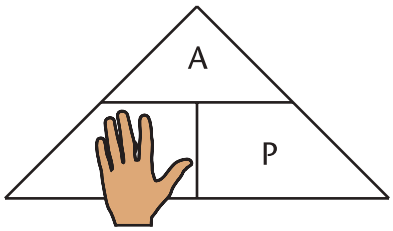
The percent is 80% = 0.80, we do not know the original number (of number), and our amount is 29.6.

P = 0.80

O = ?

A = 29.6

We do not know *O*, so let's cover the *O* in our triangle to see what we need to do:



A is over the P so we need to divide.

$$O = \frac{A}{P}$$

$$O = \frac{29.6}{0.80} = 37$$

Our original number is 37.

Thinking Space

Explore

Some simple steps can make problem solving easier. In this lesson we'll focus on the following:

1. What is the question asking for?	Read through the problem and identify what you are trying to find. Knowing what sort of answer you're looking for can help you solve the problem.
2. Estimate an answer.	If you have an estimate, then you'll know if your answer is reasonable.
3. Find an answer.	Do the appropriate calculations, and come up with an answer.
4. Make sure the answer is reasonable.	This is a good way to check your work and can help you identify if you've made an error. Compare your answer with your estimate. Is it close? Why or why not? Remember that just because your answer isn't the same as your estimate, doesn't make it wrong. Look carefully at how you rounded the numbers to make your estimate. Stop to think about how your answer compares to your estimate, and decide if your solution is reasonable.

Thinking Space

Think about the steps you used to solve problems in Module 1.

The table shown here simplifies those steps.

Here's an example problem. We'll use the steps outlined above to solve it.

Scott just ate dinner at a restaurant. His bill came to $23.54. He wants to leave his waiter a 15% tip. How much money should Scott leave for the tip?

Let's follow the four steps:

1. Write what this question is asking (e.g. find 15% of $23.54).
2. Estimate an answer.
3. Find an answer.
4. Make sure the answer is reasonable.

1. What is the question asking for?	What is 15% of $23.54?
2. Estimate an answer.	The bill is about $24. 10% of $24 is $2.40. 15% is 1½ times as much as a 10%. So, $2.40 + $1.20 = $3.60.
3. Find an answer.	The percent is 15% = 0.15, the original number (of number) is 23.54, and we want to find the amount. P = 0.15 **O** = 23.54 A = ? A = **O** × P A = 23.54 × 0.15 = 3.531 = $3.53 The tip should be $3.53.
4. Make sure the answer is reasonable. If not then check over your work.	$3.53 is very close to our estimate, so our answer is reasonable.

Thinking Space

How do you like these simplified steps?

Do you think most people tip exactly 15%? Or are most people more likely to round off the tip?

Don't forget to answer the question in a sentence.

Scott should leave $3.53 for a tip.

Here are some definitions you may need to review:

Discount = how much money is taken off the original price?

Example: A jacket is originally $100. It is on sale at 25% off.

The discount = 100 × 0.25 = $25

Sales Price = original price – discount.

Example: A jacket is originally $100 and the discount is $25.

The sale price = $100 – $25 = $75

Practice

Answer the following questions by following four steps.

1. Write what this question is asking.
2. Estimate an answer. (To estimate, round off the numbers. Then use these rounded numbers to find an estimated answer.)
3. Find an answer.
4. Make sure the answer is reasonable. (Make sure your answer in step 3 is close to your estimate in step 2.)

A chart is provided to guide you for the first few questions. Remember to round to 2 decimal places when working with money.

1. A shirt is regularly priced at $37.49. It is discounted at 30% off. How much is the discount?

1. What is the question asking for?	
2. Estimate an answer.	
3. Find an answer.	
4. Make sure the answer is reasonable. If not then check over your work.	

2. Bruce just received a mark of 59 out of 70 on his math test. What percent score did he get on the test?

1. What is the question asking for?	
2. Estimate an answer.	
3. Find an answer.	
4. Make sure the answer is reasonable. If not then check over your work.	

3. William bought a shirt 30% off. It was discounted at $11.27 less than the original price. What was the original price?

1. What is the question asking for?	
2. Estimate an answer.	

3. Find an answer.	
4. Make sure the answer is reasonable. If not then check over your work.	

4. Terri wants to buy cereal with the highest percent of iron. The amount of daily required iron in one serving of each type of cereal is:

Crunchy Cereal

Nutrition Facts
Per 125 mL (87 g)

Amount	% DV*
Calories 80	
Fat 0.5 g	**1** %
Saturated 0 g + Trans 0 g	**0** %
Cholesterol 0 mg	
Sodium 0 mg	**0** %
Carbohydrate 18 g	**6** %
Fibre 2 g	**8** %
Sugars 2 g	
Protein 3 g	
Vitamin A	2 %
Vitamin C	10 %
Calcium	0 %
Iron	25 %

* DV = Daily Value

Original Oats

Nutrition Facts
Per 125 mL (87 g)

Amount	% DV*
Calories 80	
Fat 0.5 g	**1** %
Saturated 0 g + Trans 0 g	**0** %
Cholesterol 0 mg	
Sodium 0 mg	**0** %
Carbohydrate 18 g	**6** %
Fibre 2 g	**8** %
Sugars 2 g	
Protein 3 g	
Vitamin A	2
Vitamin C	10
Calcium	0
Iron	0.3

* DV = Daily Value

Green Flake

Nutrition Facts
Per 125 mL (87 g)

Amount	% DV*
Calories 80	
Fat 0.5 g	**1** %
Saturated 0 g + Trans 0 g	**0** %
Cholesterol 0 mg	
Sodium 0 mg	**0** %
Carbohydrate 18 g	**6** %
Fibre 2 g	**8** %
Sugars 2 g	
Protein 3 g	
Vitamin A	2
Vitamin C	10
Calcium	0
Iron	1/5

* DV = Daily Value

Which cereal should Terri buy?

5. Two years ago Bert was 120 cm tall. He has grown 20% since then. What is Bert's current height?

Turn to the Answer Key at the end of the Module and mark your answers.

Section Summary

Here is a quick review of what we have learned in this section:

1. A percent can be written as a fraction or a decimal.

$$50\% = \frac{50}{100} = \frac{1}{2}$$
$$50\% = 0.50 = 0.5$$

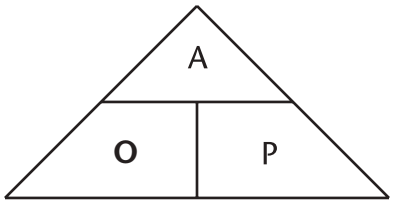
2. We can solve problems with percents by using this equation.

(percent)	×	(original number)	=	(amount)
P	×	**O**	=	A

This equation can be rearranged to solve for P and *O*:

$$P = \frac{A}{O} \text{ and } O = \frac{A}{P}$$

This equation can also be rewritten in a triangle:



Example

What percent of 50 is 10?

P = ?

O = 50

A = 10

$$P = \frac{A}{\mathbf{O}}$$
$$= \frac{10}{50} = \frac{20}{100} = 20\%$$

Section Challenge

Moira received $\frac{7}{10}$ on her integer quiz. She divided 7 by 10 and got 0.7, but does not know what that means. Can you help Moira find what the 0.7 means on her integer quiz?

On the fraction quiz, she earned 80%. She received a 24, but cannot remember how many total marks were on that quiz. Can you help her find out what her fraction quiz was out of?

If you've already solved the problem, then you should solve the problem now.

Turn to the Answer Key at the end of the Module and mark your answers.