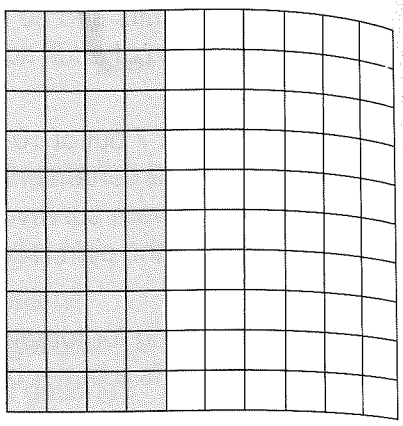
UNDERSTANDING PERCENTS

A **percent** represents the number of parts out of 100 parts.



In the box at the right, 40 of the 100 squares are shaded. Therefore, 40% of the squares are shaded and 60% are unshaded.

If all of the squares were shaded, then 100% would be shaded.

100% represents the *whole amount.* (100% = 1)

Percents can be added or subtracted as long as they represent parts of the same whole.

Example 1 If 40 of the 100 squares are shaded, then what percent of the squares are unshaded?

You can figure the percent of unshaded squares by subtracting the percent of shaded squares (40%) from 100%.

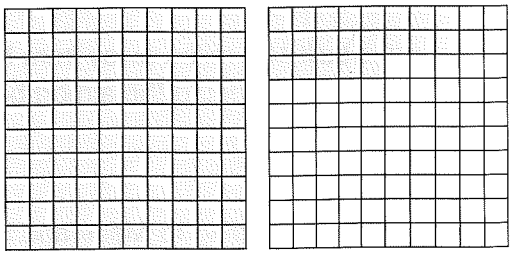
100% – 40% = **60%**

Example 2 If 40 of the 100 squares are shaded, and you shade 10 more, what percent of the squares will be shaded?

If 40% of the squares are shaded and you shade 10 more, then you have shaded another 10% of the squares. Add the percents together to find the total percent shaded.

40% + 10% = **50%**

Since 100% stands for the whole amount, a percent less than 100% represents a part of the whole amount. A percent more than 100% represents more than the whole.



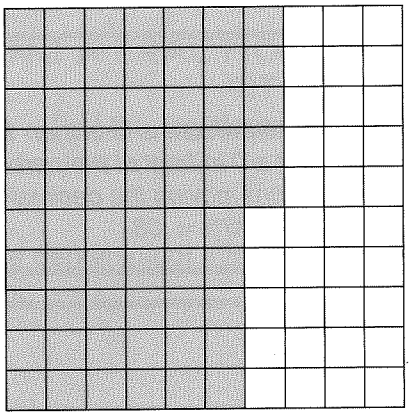
Example 3 How much does 125% represent?

You can rewrite 125% as 100% + 25%.
Since 100% is the same as the whole amount, 125% represents the **whole amount plus 25% more.**

Find the missing percents in each problem. Use a total of 100%.

1.	30% shaded ? % unshaded	67% broken ? % unbroken	4% fat ? % not fat	50% in favor of ? % against
2.	89% women ? % men	30% children ? % adults	16% alcohol ? % not alcohol	20% discount ? % not discounted

Use the diagram to solve problems 3–6.



3. If 65 of the 100 squares are shaded, what percent of the squares are shaded?

4. What percent of the squares are unshaded?

5. If you shade 10 more squares, what percent of the squares would be shaded?

6. If you erased the shading from 20 of the 65 shaded squares, what percent would be shaded?

Use the chart to solve problems 7–10. Some will take more than one step to solve.

7. What percent of the coins are dimes?

8. What percent of the coins are *not* quarters?

9. What percent of the coins are either pennies or half-dollars?

10. What percent of the coins are *not* quarters or nickels?

Coin Type	Amount
pennies	28
nickels	31
dimes	16
quarters	22
half-dollars	3
Total	**100**

Answers start on page 192.

DECIMALS, FRACTIONS, AND PERCENTS

Decimals, fractions, and percents are all ways to express numbers as amounts other than whole numbers. Decimals use digits to the right of the decimal point to write tenths, hundredths, thousandths, and so on. In fractions, the numerator expresses the number of parts and the denominator expresses the whole. A percent indicates the number of parts out of 100.

WRITING A PERCENT AS A DECIMAL

Example Write 80% as a decimal.

Step 1
Drop the percent sign and move the decimal point two places *to the left.*

80% = .80
(*Note:* 80% = 80.%)

Step 2
Drop any unnecessary zeros.

.80 = **.8**

TIP

If the percent is less than 10%, add a 0 in front of the percent before moving the decimal point.
8% = 08% = .08

WRITING A DECIMAL AS A PERCENT

Example What is .3 expressed as a percent?

Step 1
Move the decimal point two places to the right, adding any necessary zeros.

.30.

Step 2
Add a percent sign.

.30 = **30%**

Change the percents below into decimals or whole numbers.

1.	16%	300%	50%	97.8%
2.	3%	8.2%	7%	1,259%

Change the following decimals to percents.

3.	.67	.01	.40	3.4
4.	5.06	4.19	.082	23.8

WRITING A PERCENT AS A FRACTION

Example Emily finished 25% of her paperwork. What fraction of her paperwork did she finish?

Step 1
Drop the percent sign and write the number with a denominator of 100.

$25\% = \frac{25}{100}$

Step 2
Simplify the fraction if necessary.

$\frac{25}{100} \div \frac{25}{25} = \frac{1}{4}$

Emily finished $\frac{1}{4}$ of her paperwork.

WRITING A FRACTION AS A PERCENT

Example $\frac{4}{5}$ of the registered voters of Barden voted in the mayoral election. What percent of the registered voters voted?

Step 1
Divide the denominator into the numerator.

$$5\overline{)4.0} \quad .8$$

Using a calculator:
4 ÷ 5 [enter] 4÷5 0.8

Step 2
Change the decimal answer into a percent by moving the decimal point two places *to the right.*

.80.

Step 3
Add a percent sign.

.80 = 80%

80% of the registered voters of Barden voted in the election.

Change the following percents into fractions and fractions into percents.

5.	75%	10%	50%	12%
6.	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{5}$	$\frac{2}{3}$

Solve the following problems. Change fractions to percents and percents to fractions as requested.

7. The Tanakas planted corn on $\frac{5}{8}$ of the acreage on their farm. What percent of the land was planted with corn?

8. $\frac{1}{5}$ of the class received an A on the spelling test. What percent of the class received an A on the test?

9. Xu Ping scored on 60% of her shots in the recent basketball game. What fraction of her shots were successful?

10. Chart Create a chart that lists the percent and decimal equivalents for each of the following fractions that are smaller than 1: halves, thirds, quarters, fifths, and tenths. Use only simplified fractions. Round decimals to the nearest hundredth where needed.

Answers start on page 192.

THE PERCENT EQUATION

A **percent statement** has three parts: the percent, the whole, and the part. In a percent statement, you express the part as a percent of the whole.

Percent statement: percent of whole equals part
30% of 120 is 36.

A percent statement can easily be changed into a **percent equation** by replacing the word *of* with a × sign and the word *is* with an = sign. If you use a variable in a percent equation, you can answer one of the following:

- The part is what percent of the whole?
- How much is the whole?
- How much is the part?

CHANGING A PERCENT STATEMENT TO AN EQUATION

Write a percent equation for each of these examples:

Example 1 80% of 90 is _____.

Step 1	**Step 2**	**Step 3**
Represent the unknown part with a variable.	Change the percent, if there is one, to a decimal.	Replace the word *of* with a × sign and the word *is* with an equal sign.
80% of 90 is *p*.	80% = .80	.80 of 90 is *p*. **.80 × 90 = *p***

Example 2 Caitlin made a 20% down payment on a dress. She paid $16. How much was the dress?
Percent statement: 20% of _____ is $16.

Step 1	**Step 2**	**Step 3**
Represent the unknown whole with a variable.	Change the percent, if there is one, to a decimal.	Replace the word *of* with a × sign and the word *is* with an equal sign.
20% of *w* is $16.	.2 of *w* is $16.	.2 × w = $16

Example 3 Ramón completed 16 out of 43 forms for the proposed bid. What percent of the forms has Ramón completed?
Percent statement: _____ of 43 is 16.

Step 1	**Step 2**	**Step 3**
Represent the unknown percent with a variable.	Change the percent, if there is one, to a decimal.	Replace the word of with a × sign and the word *is* with an equal sign.
n% of 43 is 16.	*n*% of 43 is 16.	*n*% × 43 = 16

Change the following percent statements into equations. Use p to represent the part, w to represent the whole, and n% to represent the percent.

1. 45% of 62 is _____. 23% of 134 is _____. 89% of 1,530 is _____. 9% of 431 is _____.
2. 75% of _____ is 65. 6% of _____ is 128. 100% of _____ is 40. 18% of _____ is 850.
3. _____ of 35 is 20. _____ of 174 is 9. _____ of 521 is 502. _____ of 67 is 13.

For each problem below, write a percent statement. Then write a percent equation.

4. Maria spends 38% of her salary on rent. If she earns $2,500 per month, how much is her rent?

   _____ of _____ is _____.

   Equation: _____

5. Ken stopped for gas after driving 65% of the way to his grandparents' house. If he had driven 262 miles, how far is it to his grandparents' house?

   _____ of _____ is _____.

   Equation: _____

6. In a recent survey, 34 people said they would vote for Sánchez. If 87 people were questioned, what percent intend to vote for Sánchez?

   _____ of _____ is _____.

   Equation: _____

7. Damon scored 29% of his team's runs. If the team scored 734 runs, how many runs did Damon score?

   _____ of _____ is _____.

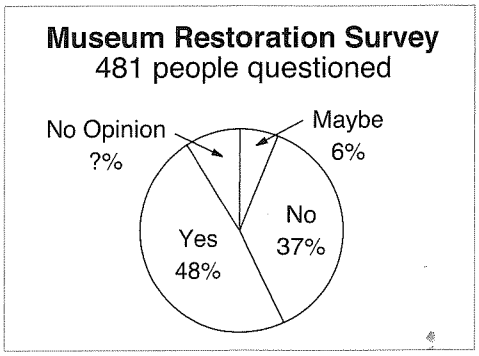
   Equation: _____

For another look at decimals and percents, turn to page 205.

CORE CONNECTIONS: Circle Graphs

Circle graphs show a whole, or 100% (circle), and its parts (each wedge).

Example: A recent survey questioned residents of Parkville on whether or not to raise money to restore the local art museum. The results of the survey are given in the circle graph to the right.



1. What percent of the residents had no opinion?
2. Write a percent statement and equation for the number of people who said yes.

Answers start on page 192.

Write and solve percent equations for each statement below.

1. 80% of _____ is 1,200. _____ % of 55 is 11. 35% of 60 is _____. 15% of _____ is 6.

2. _____% of 18 is 9. 90% of 80 is _____. 24% of _____ is 1,647. _____% of 748 is 561.

3. 62% of 114 is _____. 25% of _____ is 2,498. _____% of 180 is 120. 7% of 584 is _____.

For another look at decimals and percents, turn to page 205.

Solve the following percent problems.

4. Eugenia has 17% of her paycheck deducted in taxes. If the amount of the taxes deducted is $67, what was her paycheck before the deduction? Round to the nearest cent.

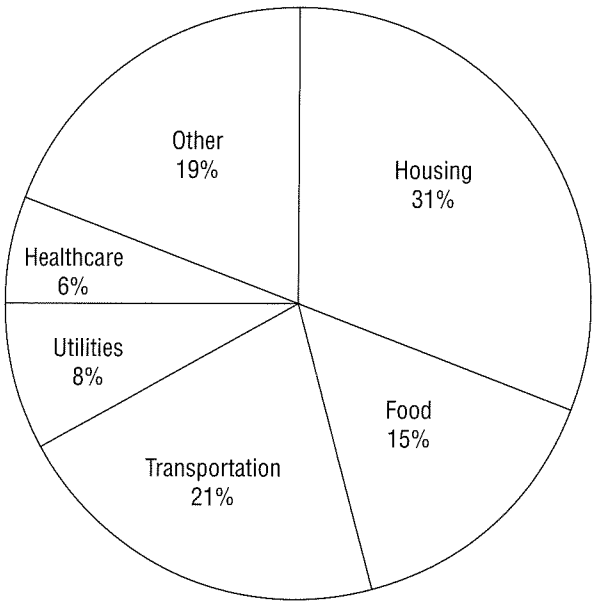
5. Velma is responsible for signing the restaurant bill for her company's annual dinner. The food bill came to $839. If she leaves a 15% tip, how much was the tip?

6. Kim Manufacturing Company had 1,165 employees last year. This year it hired 128 more workers. By what percent did the company grow? Round to the nearest percent.

7. 90% of Kennedy Middle School students were present on Friday. If 1,350 students were present, what is the total number of students in the school?

Use the circle graph to solve problems 8–10.

Rosale's Family Monthly Budget
Based on $4,200 take-home pay



8. How much does the Rosales family spend on housing each month?

9. If the Rosales family's housing expenses change to $1,344, what percent of the monthly budget will the housing be?

10. If the family's food expense increases to 16% of take-home pay per month, how much more will they spend on food than they do now?

11. Draw Create a circle graph of your own monthly expenses. Think of four to six categories for your expenses. One category should be "other" for minor expenses. Try to estimate your expenses to the nearest half, quarter, or sixth.

Answers start on page 193.

PERCENT OF INCREASE/ DECREASE

So far, you have learned how to do problems that ask you to find the percent. Another common type of percent problem asks you to find the percent by which a number has changed.

A percent of increase problem asks for the percent by which a number has *increased,* or gone up.

A percent of decrease problem asks for the percent by which a number has *decreased,* or gone down.

If a problem asks for a percent of increase or decrease, remember that:

- the *part* is the *change* in value
- the *whole* is the *original* value

FINDING PERCENT OF INCREASE

Example The price of a pair of soccer cleats increased from $55 to $66. By what percent was the price raised?

Step 1	**Step 2**	**Step 3**
Find the change in value by subtracting.	Write a percent equation. Use the change in value as the part and the original value as the whole.	**Solve.**
$66 – $55 = $11	n% of $55 is $11 n% × 55 = 11	n% × 55 = 11 n% = 11 ÷ 55 n% = .2 = **20%**

The price of a pair of soccer cleats increased **20%.**

FINDING PERCENT OF DECREASE

Example The price of a pre-owned truck was lowered from $3,600 to $3,000. By what percent was the price decreased?

Step 1	**Step 2**	**Step 3**
Find the change in value by subtracting.	Write a percent equation. Use the change in value as the part and the original value as the whole.	**Solve.**
$3,600 – $3,000 = $600	n% of $3,600 is $600 n% × 3,600 = 600	n% × 3,600 = 600 n% = 600 ÷ 3,600 n% ≈ .1667 = $16\frac{2}{3}$%

The price of the truck decreased by **$16\frac{2}{3}$%.**

For each problem below, find the change in value *(part)* and the original amount *(whole)*. Then solve using either the percent equation or proportion. Round your answer to the nearest tenth.

1. Danielle's hourly wage went up from $12.80 to $13.82. By what percent did her hourly wage go up?

Change: _____

Original amount: _____

Percent of increase: _____

2. A stock began the day with a price of $21.60 per share. It finished the day with a price of $19.10 per share. By what percent did the stock's price decrease?

Change: _____

Original amount: _____

Percent of decrease: _____

3. A salon increased the price of a permanent from $110 to $115. By what percent did the price go up?

Change: _____

Original amount: _____

Percent of increase: _____

4. In a biology class, 84 students passed the midterm, but only 50 students passed the final. What was the percent of decrease?

Change: _____

Original amount: _____

Percent of decrease: _____

Solve the following problems.

5. After following energy savings tips, the Morales family decreased their energy bill from $2,200 to $1,650. By what percent did the family's energy bill decrease?

6. Last year, Mitchell Milk had 520 customers on its morning route. This year, the number of customers went down to 494. By what percent did Mitchell Milk customers decrease?

7. After advertising its business, the number of students at a martial arts studio increased from 17 to 34. What is the percent increase?

8. The population of Lakewood increased from 52,200 to 56,376. By what percent did the population increase?

9. A department store buys a kind of perfume for $41.40 and sells it for $113.85. What is the markup (percent of increase) on the perfume?

10. A school had 1,800 students at the start of the school year. At the start of the following year, 1,926 students enrolled. By what percent did enrollment increase?

11. A pet carrier was marked down from $24.00 to $20.40. By what percent did the price decrease?

12. Over a two-year period, average consumer spending on Black Friday decreased from $422.50 to $405.60. By what percent did spending decrease?

Answers start on page 195.

USE FRACTIONS TO SOLVE PERCENT PROBLEMS

It's common to convert the percent to a decimal when solving percent problems. However, some problems can be answered more quickly by converting the percent to a fraction. Good test takers learn common fraction-percent equivalencies and know when to use them to save time.

Example At the Hamburger Hut, about 20% of customers order the signature burger. If the restaurant has 500 customers in a day, about how many customers order the signature burger?

Here's how you would solve the problem with the percent equation:

20% of 500 is *p*.
.2 × 500 = *p*
p = 100 customers

Here's how you could solve the problem using fractions:

20% is equal to $\frac{1}{5}$. Multiplying by $\frac{1}{5}$ is the same as dividing by 5.
500 ÷ 5 = 100 customers

Either way, about **100 customers** ordered the signature burger.

Which method seemed best to you?

The fraction method is often useful with the most common fraction–percent equivalencies. The common equivalencies can be found in the toolkit on page 205.

Fractions can also help you eliminate answer choices.

Example In Jinglu's diet, about 35% of her calories come from fat. If she eats about 1,800 calories a day, how many calories are from fat?

A. 51
B. 515
C. 630
D. 1,170

Think: 35% is close to $33\frac{1}{3}$%, or $\frac{1}{3}$. $\frac{1}{3}$ of 1,800 is 600. The answer should be close to 600. The correct answer is probably **C.**

Solve the problem:

35% of 1,800 is *p*.
.35 × 1,800 = *p*
p = 630

Choice **C** is correct. Your knowledge of fractions can help you estimate an answer or even help you choose the right answer without working the problem.

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Solve the following problems.

1. Only 20% of a company's 355 employees will be sent to a training conference. How many employees will the company send?
   A. 71
   B. 105
   C. 212
   D. 284

2. The average person uses about 750 pounds of paper in a year. About $33\frac{1}{3}$% does not get recycled. About how many pounds of paper does the average person not recycle?
   A. 175
   B. 250
   C. 500
   D. 700

3. In a class of 30 students, 10% were absent on Tuesday. How many students were absent?
   A. 3
   B. 6
   C. 9
   D. 27

4. In the month of May, 50% of a dress shop's 60 customers purchased a size 12. How many customers purchased a size 12?
   A. 3
   B. 10
   C. 30
   D. 48

5. Out of 812 vehicles, 25% of a car dealer's inventory is pickup trucks. How many pickup trucks are part of the inventory?
   A. 203
   B. 250
   C. 406
   D. 609

6. Jewelry that is 14-karat gold is 58% pure gold. If a 14-karat gold necklace weighs 15 grams, how many grams of pure gold are in the necklace?
   A. 3.0
   B. 4.7
   C. 6.3
   D. 8.7

Use the chart to answer problems 7 and 8.

Stuart made the following chart to show how he spends his workday.

Task	Percent of Workday
Working the register	45%
Stocking shelves	25%
Helping customers	15%
Lunch break	12.5%
Miscellaneous	2.5%

7. In an 8-hour workday, how many hours is Stuart's lunch break?
   A. 0.5
   B. 0.12
   C. 1
   D. 1.2

8. How many hours does Stuart spend on tasks other than stocking shelves?
   A. 1.2
   B. 2
   C. 3.6
   D. 6

Answers start on page 195.