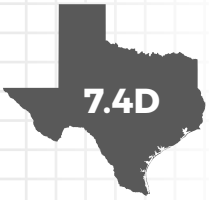
SOLVING PROBLEMS WITH PERCENTS



The student is expected to solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems.

TELL ME MORE...

A **percent** is a ratio that is expressed as a value out of 100. To find a *percent* when the *part* and the *whole* are known, use a part-to-whole ratio to represent the situation. Then, determine an equivalent ratio out of 100, since 100 is the whole for the percent amount.

$$\frac{\textbf{part}}{\textbf{whole}} = \frac{\textbf{percent}}{\textbf{100}}$$

Allison saved $30 of her $200 paycheck. What percent of her paycheck did she save?

The whole is 200 and the part saved is 30. The ratio of savings to earnings is $\frac{30}{200}$.

$\frac{30}{200} = \frac{15}{100}$

Allison saved 15% of her paycheck.

When the *percent value* and the *whole* are known, but the *part* is not, use the percent ratio out of 100 to find the equivalent ratio to represent the part out of the given whole.

Allison decided to save 15% of her paycheck. If she earned $200, how much did she save?

The whole is 200 and the part saved is 15. The percent of savings is $\frac{15}{100}$.

$\frac{15}{100} = \frac{n}{200}$

The part is 30 of a whole of 200.

When the *percent value* and the *whole* are known, but the *part* is not, use the percent ratio out of 100 to find the equivalent ratio to represent the part out of the given whole.

Allison decided to save 15% of her paycheck. If she saved $30, how much did she earn?

The part is 30 and the part percent is 15. The percent of savings $\frac{15}{100}$.

$\frac{15}{100} = \frac{30}{n}$

The whole is 200.

A special percent relationship is **percent of increase** or **percent of decrease** (sometimes called percent of change). To calculate a percent of increase or decrease:

$$\frac{\textbf{final value – starting value}}{\textbf{starting value}} = \frac{\textbf{percent of change}}{\textbf{100}}$$

- Find the difference between the values.
- Create a ratio of the difference to the original value.
- Find an equivalent ratio out of 100.

Allison earned $200 the first month she worked and $250 the second month she worked. By what percent did her salary increase?

The difference in the values is 50. The ratio of the difference to the original value is $\frac{50}{200}$.

$\frac{50}{200} = \frac{n}{100}$

The percent of increase is 25%.

EXAMPLES

EXAMPLE 1: There are 900 students in an elementary school. On Friday, 36 students were absent. What percent of the students was absent on Friday?

STEP 1 Determine the known information and the information needed for the solution.

- The *whole* is the total number of students in the elementary school.
- The *part* is the number of students that were absent on Friday.
- The *percent* is unknown.

The part and whole are known. The percent is unknown.

STEP 2 Write equivalent ratios as a proportion to solve.

- The part-to-whole ratio in the problem is $\frac{\text{36 students absent}}{\text{900 total students}}$.
- Since the percent is the unknown, $n\% = \frac{n}{100}$.

$$\frac{\textbf{36}}{\textbf{900}} = \frac{\boldsymbol{n}}{\textbf{100}}$$

STEP 3 Solve the proportion.

- $\frac{36}{900} = \frac{n}{100}$
- Since 900 ÷ 100 = 9, divide 36 by 9 to determine n, the percent of students that was absent on Friday.

The percent of students that was absent on Friday is 4%.

YOU TRY IT!

56 is what percent of 70?

- Set up a proportion: $\frac{\text{part}}{\text{whole}} = \frac{\%}{100}$ ___ = $\frac{}{100}$
- Solve the proportion: _____

20% of 55 is what number?

- Set up a proportion: $\frac{\text{part}}{\text{whole}} = \frac{\%}{100}$ ___ = $\frac{}{100}$
- Solve the proportion: _____

60% of what number is 72?

- Set up a proportion: $\frac{\text{part}}{\text{whole}} = \frac{\%}{100}$ ___ = $\frac{}{100}$
- Solve the proportion: _____

EXAMPLE 2: In a recent survey, 230 people, or 40% of the people surveyed, said that hamburgers were their favorite fast food to eat. How many people were surveyed? Record your answer and fill in the bubbles. Be sure to use the correct place value.

STEP 1 Determine the known information and the information needed for the solution.

- The *part* of the people surveyed is known.
- The *percent* of the people surveyed is known.
- The *whole* of the people surveyed is unknown.

The part and percent are known. The whole is unknown.

STEP 2 Write a percent ratio and simplify to lowest terms.

- $\frac{40}{100} = \frac{2}{5}$

$\frac{2}{5}$ of the people surveyed said hamburgers were their favorite.

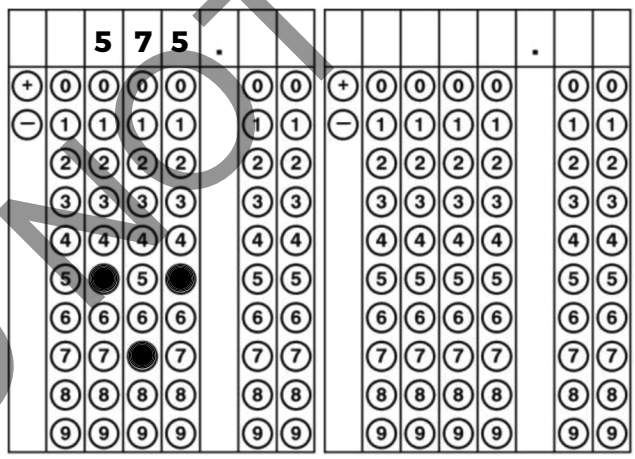
STEP 3 Write and solve a proportion using the percent ratio and the part to whole ratio.

- $\frac{2}{5} = \frac{230}{n}$
- $\frac{2 \times 115}{5 \times 115} = \frac{230}{575}$

575 people were surveyed.

STEP 4 Since the question is a gridded response question, enter your response on the grid provided. Practice using the grid with the instructions.

1. Record a 5 in the hundreds column.
   Record a 7 in the tens column.
   Record a 5 in the ones column.
   Ignore the sign since the answer is a positive number.
2. Bubble **5** beneath the numeral 5.
   Bubble **7** beneath the numeral 7.
   Bubble **5** beneath the numeral 5.



EXAMPLE 3: At the local farmer's market, strawberries are normally \$5, but this week they are on sale for \$4. What is the percent decrease in price?

STEP 1 Determine the difference between the prices.

- $5 - 4 = 1$

The difference between the prices is \$1.

YOU TRY IT!

Last year the 8th grade had 550 students. This year there are 605 students. What is the percent increase in the number of 8th graders from last year to this year?

Difference in the numbers _____

$\frac{\text{difference in the numbers}}{\text{original number}}$ _____

$\frac{\text{difference in the numbers}}{\text{original number}} = \frac{n}{100} =$ _____

STEP 2 Create a ratio of the difference in the prices to the original price.

- $\frac{\text{difference in the prices}}{\text{original price}} = \frac{\$1}{\$5}$

The ratio of the differences in the prices to the original price is $\frac{1}{5}$.

STEP 3 Find an equivalent ratio out of 100.

- $\frac{1}{5} = \frac{n}{100}$
- $\frac{1 \times 20}{5 \times 20} = \frac{20}{100}$
- The price decreased, so the percent change is a percent decrease.

The percent of decrease is 20%.

PRACTICE

1. An organization sent out 780 invitations to a fundraiser. Of those, invited 507 attended. What percent of the people invited attended the fundraiser?

2. Shaunda answered 86% of the questions on her test correctly. If there were 50 questions on the test, how many did she NOT answer correctly?

3. An energy drink contains 55% of the recommended daily amount of carbohydrates. The energy drink contains 165 grams of carbohydrates. What is the recommended daily amount of carbohydrates?

4. A local car dealer has 250 cars on the lot. 30% of the cars are SUVs. How many of the cars are NOT SUVs?

5. The bill at a restaurant for a family of 6 was $150 before the tip. The restaurant automatically added the tip for groups of 5 or more. If the restaurant added an additional $30 as a tip, what percent of the bill was added as the tip?

6. Jose was playing a basketball shooting game in the arcade. He made 15 shots and missed 25 shots. What is the percentage of shots Jose made in the basketball game?

7. Lance purchased four tires for $94.50 each. The store charged 7.5% sales tax. What was the amount of sales tax that Lance paid for the four tires?

8. Kristi had $3,250 in her bank account. Currently, she has $2,730 in her account. What is the approximate percent of decrease in her account?

9. A baby elephant was born last month at the city zoo. When the baby elephant was born he weighed 260 pounds. At the end of the first month the baby weighed 338 pounds. What is the percent of increase in the baby's weight?

10. A football team won 16 games last year. This year the team won 20 games. What is the percent increase in the number of games the team won from last year to this year?

A 20%
B 25%
C 80%
D 125%

11. At a local grocery store, hamburger meat is normally $3.50 per pound, but this week hamburger meat is on sale for $2.10 per pound. What is the percent decrease in the price?

F 14%
G 34%
H 60%
J 40%

12. Mrs. Hill said that 30% of her students made an A on the test last week. If 33 students made an A on the test, how many total students does Mrs. Hill have? Record your answer and fill in the bubbles. Be sure to use the correct place value.