Many percent problems can be solved using a proportion. In order to use this method, you should be familiar with the following ideas about percent:

1. Percent is a part out of 100.

   Examples: $35\% = \frac{35}{100}$ $2.5\% = \frac{2.5}{100}$

   $123\% = \frac{123}{100}$ $x\% = \frac{x}{100}$

2. In solving percent problems with a proportion, use the following pattern:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

Note: If the ideas above are not familiar to you, see the Learning Lab Handout:
Arithmetic 10 - PERCENT PROBLEMS

EXAMPLES: **Finding Percent when the Part and the Whole are given.**

1. Mr Brown sold his house through real estate agent to whom he paid a commission of 7% of the sale price. If the sale price of the house was \$90,500, how much commission did Mr. Brown pay?

   Given: The Percent = 7%
   The Whole = \$90,500

   Find: The Part Let x = The Part

   Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{7}{100} = \frac{x}{90{,}500}$$

   Solve the proportion:

$$100x = (7)(90{,}500)$$

$$\frac{100x}{100} = \frac{633500}{100}$$

$$x = 6335$$

   Therefore: Mr. Brown paid a commission of \$6,335.

Note: If the process of solving a proportion is unfamiliar to you, see the following Learning Lab Handout: **Arithmetic 7**

2. The monthly finance charge on a credit card is 1.5% of the previous month's outstanding balance. If Sue had an outstanding balance of \$300 last month, what was the finance charge for the month?

Given: The Percent = 1.5%
The Whole = \$300

Find: The Part Let $x =$ The Part

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{1.5}{100} = \frac{x}{300}$$

Solve the proportion:

$$100x = (1.5)(300)$$

$$\frac{100x}{100} = 450$$

$$x = 4.5$$

Therefore: The finance charge for the month was \$4.50.

EXAMPLES: **Finding the Whole when the Part and the Percent are given.**

3. If 252 represents 45% of a number, what is the number?

Given: The Part = 252
The Percent = 45%

Find: The Whole Let $x =$ The Whole

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{45}{100} = \frac{252}{x}$$

Solve the proportion:

$$45x = (100)(252)$$

$$x = 560$$

Therefore: 252 represents 45% of 560.

Note: The quantity that is mentioned after the words "percent of " is usually the quantity representing the whole.

4. A local university had a total of 6,600 students enrolled in math courses. If the number enrolled in math courses represents 55% of the total student body, how many students are enrolled at the university?

Given: The Part = 6,600 students
The Percent = 55%

Find The Whole which is the number of students enrolled at the university.

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{55}{100} = \frac{6600}{x}$$

Solve the proportion:

$$55x = (100)(6600)$$
$$x = 12000$$

Therefore: 12,000 students are enrolled at the university.

5. A real estate agent received a commission of $9375 on the sale of a home. If the commission represents $7\frac{1}{2}\%$ of the selling price, how much did the house sell for?

Given: The Part = $9375

The Percent = $7\frac{1}{2}\% = 7.5\%$

Find: The Whole which is the selling price of the house.
Let $x =$ The Whole

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{7.5}{100} = \frac{9375}{x}$$

Solve the proportion:

$$7.5x = (100)(9375)$$
$$x = 125000$$

Therefore: The selling price of the house was $125,000.

EXAMPLES: **Finding the Percent when the Part and the Whole are given.**

6. The number 8 is what percent of 40?

Given: The Part = 8
The Whole = 40

Find: The Percent Let x = The Percent

Set up the proportion:
$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$
$$\frac{x}{100} = \frac{8}{40}$$

Solve the proportion:
$$40x = (8)(100)$$
$$x = 20$$

Therefore: The number 8 is 20% of 40.

7. If Tim has read 455 pages of a 520 page book, he has read what percent of the book?

Given: The Part = 455 pages
The Whole = 520 pages (The words "the book" come after the words "percent of", and since the book is 520 pages long, 520 is the whole.)

Find: The Percent Let x = The Percent

Set up the proportion:
$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$
$$\frac{x}{100} = \frac{455}{520}$$

Solve the proportion:
$$520x = (100)(455)$$
$$x = 87.5$$

Therefore: Tim has read 87.5% of the book.

8. Dave's weekly salary is $450. His deductions are $49.50 per week.
   a. His deductions are what percent of his salary?
   b. His take-home pay is what percent of his salary?

a. **Given:** The Part = $49.50 (The deductions are the Part.)
The Whole = $450 The words "his salary" come after the words "percent of," and since his salary is $450, then $450 is the whole.)

Find: The Percent Let x = The Percent

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{x}{100} = \frac{49.50}{450}$$

Solve the proportion: $x = 11$

Therefore: Dave's deductions are 11% of his salary.

b. The take-home pay is the Part. Take-home pay = weekly salary − deductions
= $450 − $49.50
= $400.50

Given: The Part = $400.50
The Whole = $450

Find: The Percent Let x = The Percent

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{x}{100} = \frac{400.50}{450}$$

Solve the proportion: $x = 89$

Therefore: Dave's take-home pay is 89% of his salary.

Note: Another way to find the answer to part "b" of this problem is to realize that:

Percent of take-home pay = 100% − percent of deductions
= 100% − 11%
= 89%

9. A hockey player set a personal target of scoring 20 goals for the season. He scored 26 goals that season. What percent of his personal target did he reach?

Given: The Part = 26 goals
The Whole = 20 goals (The words "his personal target" come after the words "percent of," and since his personal target is 20 goals, 20 is the Whole)

Find: The Percent Let x = The Percent

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Part}}{\text{The Whole}}$$

$$\frac{x}{100} = \frac{26}{20}$$

Solve the proportion: $x = 130$

Therefore: The hockey player reached 130% of his personal target.

Note: This answer should make sense because the player scored more goals than his target and 130% is more than 100%.

PERCENT OF INCREASE (or DECREASE)

In a problem that asks for a percent of increase (or decrease):

The Part = the amount of increase (or decrease)

The Whole = the original amount

So the proportion that is needed to find an answer to a percent increase (or decrease) problem follows the pattern:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Amount of Increase}}{\text{The Original Amount}}$$

OR

$$\frac{\text{The Percent}}{100} = \frac{\text{The Amount of Decrease}}{\text{The Original Amount}}$$

10. The rent in an apartment building was increased from \$425 to \$450.50. What was the percent of increase?

Note: The Amount of Increase isn't given directly, but can be found using the following idea:

$$\begin{aligned}\text{The Amount of Increase} &= \text{the new rent} - \text{the original rent}\\ &= \$450.50 - \$425\\ &= \$25.50\end{aligned}$$

Given: The Amount of Increase = \$25.50
The Original Amount = \$425

Find: The Percent Let x = The Percent

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Amount of Increase}}{\text{The Original Amount}}$$

$$\frac{x}{100} = \frac{25.50}{425}$$

Solve the proportion: $x = 6$

Therefore: The percent of increase in rent is 6%.

11. A DVD player at Adray's was on sale for \$245. The original price was \$350. What was the percent of decrease in price?

Given: The Amount of Decrease = the original price − the sale price
= \$350 − \$245
= \$105
The Original Amount = \$350

Find: The Percent Let x = The Percent

Set up the proportion:

$$\frac{\text{The Percent}}{100} = \frac{\text{The Amount of Decrease}}{\text{The Original Amount}}$$

$$\frac{x}{100} = \frac{105}{350}$$

Solve the proportion: $x = 30$

Therefore: The sale price was a 30% decrease in price.

SIMPLE INTEREST

Remember: The formula for finding simple interest is: $I = Prt$ where

I = interest
P = principal or amount invested
r = rate in decimal form
t = time in years

Remember: To change a percent to a decimal, move the decimal point 2 places to the left.

Examples: 35% = 0.35 0.3% = 0.003

1.25% = 0.0125 130% = 1.3

To Find Simple Interest:

1. Identify the values for $P, r,$ and t.
2. Replace $P, r,$ and t in $I = Prt$ with these values.
3. Multiply to find simple interest.

12. What is the simple interest on $4000 invested at 9% for 1 year?

Given: $P = \$4000$
$r = 9\% = .09$
$t = 1$ year

Replace $P, r,$ and t in $I = Prt$:

$$I = (4000)(.09)(1)$$

Multiply: $I = 360$

Therefore: The simple interest on $4000 invested at 9% for 1 year is $360.

13. Find the simple interest on a principal of $7500 invested at 6.5% for 9 months.

Given: $P = \$7500$
$r = 6.5\% = .065$
$t = 9$ months (Since time must be in years, we must change 9 months to years.)

$$= 9 \text{ months} \times \frac{1 \text{ year}}{12 \text{ months}} = \frac{3}{4} \text{ year}$$

Replace: P, r, and t in $I = Prt$:

$$I = (7500)(.065)\left(\frac{3}{4}\right)$$

Multiply: $I = \$365.63$ rounded to the nearest cent.

Therefore: The simple interest on a principal of $7500 invested at 6.5% is $365.63.

14. Determine the simple interest at a rate of 12% on a principal of $10,000 for 60 days.

Given: $P = \$10{,}000$
$r = 12\% = .12$

$$t = 60 \text{ days} \times \frac{1 \text{ year}}{360 \text{ days}} = \frac{1}{6} \text{ year}$$

Note: 360 days (not 365) is the number of days in a "banker's year."

Replace: P, r, and t in $I = Prt$:

$$I = (10{,}000)(12)\left(\frac{1}{6}\right)$$

Multiply: $I = 200$

Therefore: The simple interest on $10,000 at a rate of 12% for 60 days is $200.

EXERCISES

1. A sign at Adray's said "30% Discount". If the price tag of a TV read $750, how much will the discount be?

2. A student needs a grade of 75% on a final exam to pass the course. If there are 120 problems of equal value on the test, how many of the problems must he answer correctly to pass the course?

3. 40% of many breakfast cereals are sugar. How much sugar is there in a box of cereal which contains 420 grams?

4. Bob's salary last year was $18,500. This year his salary increased 6%.
   a) How much more money will he make this year?
   b) What will his new salary be?

5. In a class of 50 students, 38 of the students received a grade of C or better. What percent of the students received a grade of C or better?

6. There are 48 grams of sulfuric acid in 600 grams of solution. Find the percent of acid in the solution.

7. Jim's weekly salary is $450. If his deductions amount to $117, what percent of his salary are deductions?

8. Last year the Jones Family paid $900 for property taxes. This year they will pay $1,080. What was the percent of increase?

9. Enrollment in English classes decreased from 12,000 students to 11,580 students. What was the percent of decrease?

10. If 117 represents 18% of a number, what is the number?

11. A soccer team won 36 games. This is 80% of the games played. How many games were played?

12. A family in the 28% tax bracket paid $9,660 in taxes last year. Find their total income.

13. A customer paid $234.50 for a VCR marked 33% off. What was the original price of the VCR?

14. Phil paid $384 on his VISA bill. If this represents 30% of his total bill, what is his total bill?

15. Find the simple interest on $8,000 invested at 8.5% for 6 months.

16. How much interest would be earned on an investment of $3,500 at $4\frac{1}{2}$ % for 2 years?

17. Determine the simple interest at a rate of 6% on a principal of $1,120 for 3 months.

18. What is the interest on a loan of $650 at $7\frac{1}{4}\%$ for 240 days? (Round answer to the nearest cent.)

19. Five percent of the students attending Peterson Community College were denied some financial aid. If 122 students were denied some financial aid,
   a) how many students attend Peterson Community College?
   b) how many students received financial aid?

20. A sweatshirt with a price tag of $32.95 is on sale for 20% off.
   a) What is the amount of the discount?
   b) What is the sale price of the sweatshirt?

21. Sue receives a commission rate of 9% on her weekly sales. How much does she have to sell to earn a commission of $153?

22. On monthly sales of $25,500, Dick received a commission of $3,825. What commission rate does Dick receive?

Solutions to odd and answers to even numbered problems.

1. **Given:** The Percent = 30%
The Whole = $750

Find: The Part Let x = The Part

Set up the proportion: $\frac{30}{100} = \frac{x}{750}$

Solve the proportion: $100x = (30)(750)$
$x = 225$

Therefore: The discount will be $225.

2. He must answer 90 problems correctly to pass the course.

3. **Given:** The Percent = 40%
The Whole = 420 grams

Find: The Part Let x = The Part

Set up the proportion: $\frac{40}{100} = \frac{x}{420}$

Solve the proportion: $100x = (40)(420)$
$x = 168$

Therefore: 168 grams of sugar are in a box of cereal which contains 420 grams.

4. a) Bob will make $1,110 more this year.
b) His new salary will be $19,610.

5. **Given:** The Part = 38 students
The Whole = 50 students

Find: The Percent Let x = The Percent

Set up the proportion: $\frac{x}{100} = \frac{38}{50}$

Solve the proportion: $50x = (100)(38)$
$x = 76$

Therefore: 76% of the students received a grade of C or better.

6. The percent of acid in the solution is 8%.

7. **Given:** The Whole = \$450
The Part = \$117

Find: The Percent Let x = The Percent

Set up the proportion: $\frac{x}{100} = \frac{117}{450}$

Solve the proportion: $450x = (100)(117)$
$x = 26$

Therefore: 26% of Jim's salary are deductions.

8. The percent of increase was 20%.

9. **Given:** The amount of decrease = $12{,}000 - 11{,}580 = 420$
The original amount = 12,000

Find: The Percent Let x = The Percent

Set up the proportion: $\frac{x}{100} = \frac{420}{12000}$

Solve the proportion: $12000x = (100)(420)$
$x = 3.5$

Therefore: The percent of decrease was 3.5%.

10. The number is 650.

11. **Given:** The Part = 36 grams
The Percent = 80%

Find: The Whole Let x = The Whole

Set up the proportion: $\frac{80}{100} = \frac{36}{x}$

Solve the proportion: $80x = (100)(36)$

$x = 45$

Therefore: The soccer team played 45 games.

12. Their total income was $34,500.

13. **Given:** The Part = $234.50 (This is the sale price)
The Percent = 67% (Note: 33% represents the discount. Since 100% - 33% = 67%, $234.50 represents 67% of the selling price.)

Find: The Whole Let x = The Whole

Set up the proportion: $\frac{67}{100} = \frac{234.50}{x}$

Solve the proportion: $67x = (100)(234.50)$

$x = 350$

Therefore: The original price of the VCR was $350.

14. His total bill was $1,280.

15. **Given:** $P = \$8{,}000$

$r = 8.5\% = .085$

$t = 6 \text{ months} \times \frac{1 \text{ year}}{12 \text{ months}} = \frac{1}{2} \text{ year}$

Replace: P, r, and t in $I = Prt$:

$I = (8000)(.085)\left(\frac{1}{2}\right)$

Multiply: $I = 340$

Therefore: The simple interest on $8,000 invested at 8.5% for 6 months is $340.

16. $315 would be earned on an investment of $3,500 at 4 ½ % for 2 years.

17. **Given:** $P = \$1120$
$r = 6\% = .06$

$$t = 3 \text{ months} \times \frac{1 \text{ year}}{12 \text{ months}} = \frac{1}{4} \text{ year}$$

Replace: P, r, and t in $I = Prt$:

$$I = (1120)(.06)\left(\frac{1}{4}\right)$$

Multiply: $I = 16.8$

Therefore: The simple interest on \$1120 invested at 6% for 3 months is \$16.80.

18. The interest on a loan of \$650 at 7 1/4 % for 240 days is \$31.42.

19. a) **Given:** The Part = 122 students
The Percent = 5%

Find: The Whole Let x = The Whole

Set up the proportion: $\frac{5}{100} = \frac{122}{x}$

Solve the proportion: $5x = (100)(122)$
$x = 2440$

Therefore: 2,440 students attend Peterson Community College.

b) 2440 - 122 = 2318 students received financial aid.

20. a) The amount of the discount is \$6.59.

b) The sale price of the sweatshirt is \$26.36.

21. **Given:** The Percent = 9%
The Part = $153

Find: The Whole Let x = The Whole

Set up the proportion: $\frac{9}{100} = \frac{153}{x}$

Solve the proportion: $9x = (100)(153)$
$x = 1700$

Therefore: Sue has to sell $1,700 each week to get a commission of $153.

22. Dick receives a commission of 15%.