Name:

4.4 Percent Problems

Translating statements into mathematical equations is an important part of solving percent problems. There are key words in percent problems that, if directly replaced with mathematical symbols, produce equations that can be solved using algebra.

Word(s)	Replace with
what value, what number, what percent	x (or some other variable for the unknown value)
is	= (Equals)
of	× (Multiply)
percent	decimal or fraction notation

When replacing key words from percent problems with mathematical symbols and notation, the resulting equations can take the form: **Amount = Percent × Base**. The base can be considered the whole object in the problem, and the amount is a portion or part of the whole object.

Example 1   What is 20% of 80?

▶ *Solution*:   Amount = Percent × Base → $x = 0.20 \times 80$ or   What is 20% of 80
$$= 16$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$x \quad = \quad 0.20 \quad \times \quad 80$$
$$= 16$$

Therefore, 20% of 80 is 16.

Example 2   30 is 40% of what number?

▶ *Solution*:   Amount = Percent × Base → $30 = 0.40 \times a$ or   30 is 40% of what number
$$a = \frac{30}{0.40}$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$a = 75$$
$$30 = 0.40 \times \quad a$$
$$a = \frac{30}{0.40}$$

Therefore, 30 is 40% of 75.
$$a = 75$$

Example 3   50 is what percent of 80?

▶ *Solution*:   Amount = Percent × Base → $50 = b \times 80$ or   50 is what percent of 80
$$b = \frac{50}{80}$$
$$\downarrow \quad \downarrow \quad \quad \downarrow \quad \quad \downarrow \quad \downarrow$$
$$b = 0.625$$
$$50 = \quad b \quad \times 80$$
$$= 62.5\%$$
$$b = \frac{50}{80}$$

Therefore, 50 is 62.5% of 80.
$$b = 0.625$$

Solving Problems Using an Equation

Percent problems can also be translated into a proportion equation.

An equivalent form of the equation Amount $=$ Percent $\times$ Base is: $\dfrac{\text{Amount}}{\text{Base}} = \dfrac{\text{Percent}}{100}$

Example 4   What is 20% of 80?

▶ *Solution:*   "of 80" $\rightarrow$ Base $=$ 80

$$\frac{\text{Amount}}{\text{Base}} = \frac{\text{Percent}}{100} \;\rightarrow\; \frac{a}{80} = \frac{20}{100}$$

$$100 \cdot a = 20 \cdot 80$$

$$a = \frac{1600}{100}$$

$$a = 16$$

Therefore, 20% of 80 is 16.

Example 5   30 is 40% of what number?

▶ *Solution:*   "of what number" $\rightarrow$ Base $=$ b

$$\frac{\text{Amount}}{\text{Base}} = \frac{\text{Percent}}{100} \;\rightarrow\; \frac{30}{b} = \frac{40}{100}$$

$$40 \cdot b = 30 \cdot 100$$

$$b = \frac{3000}{40}$$

$$b = 75$$

Therefore 30 is 40% of 75.

Example 6   50 is what percent of 80?

▶ *Solution:*   "of 80" $\rightarrow$ Base $=$ 80

$$\frac{\text{Amount}}{\text{Base}} = \frac{\text{Percent}}{100} \;\rightarrow\; \frac{50}{80} = \frac{c}{100}$$

$$80 \cdot c = 50 \cdot 100$$

$$c = \frac{5000}{80}$$

$$c = 62.5\%$$

Therefore 50 is 62.5% of 80.

4.4 Exercise Set

Fill in the blanks with the appropriate word.

a) When translating a mathematical statement, the word _____ is replaced with a multiplication symbol.

b) The _____ can be considered the whole object.

c) The _____ is a portion of the whole object.

d) The _____ of the base is the amount.

2. Identify the percent, base and amount in each statement.

a) 28% of 300 is 84.

c) What is 12% of 360?

e) 18% of what number is 72?

g) What percent of 40 is 120?

3. Translate into an equation.

a) What is 36% of 80?

c) 92 is what percent of 80?

e) 18 is 30% of what?

4. Translate into a proportion equation.

a) What is 64% of 80?

c) 10.4 is what percent of 16.3?

e) 16 is 30% of what?

5. Translate into an equation, then solve.

a) What is 65% of 80?

b) 20% of 300 is what number?

e) What is 40% of 200?

f) What percent of 80 is 4?

i) 160 is what percent of 50?

j) 100% of 15 is what number?

m) 92 is 8% of what number?

n) 6% of what number is 42?

q) 62.5 is 175% of what number?

r) 90 is what percent of 16?

Translate into a proportion equation, then solve.

a) What is 38% of 80?

b) What is 64% of 140?

e) 120 is what percent of 100?

f) $60 is 30% of what?

i) 36 is $16\frac{2}{3}$% of what number?

j) 60 is what percent of 50?

m) What percent of 32 is 30?

n) What percent of 33 is 22?

q) 46.81 is 62% of what number?

r) 43.29 is 37% of what number?

7. A team won 60% of its games. If it won 48 games, how many games did it play?

8. On a math test, Anna answered 32 questions correctly and scored 64%. How many questions were on the test?

9. In a class of 35 students, 5 students failed the exam. What percent of students failed the exam?

10. A student had 18 correct, and 6 incorrect answers on a quiz. What percent of the quiz did the student answer correctly?

11. The population of a town is 24 000. If the population decreases by 4%, what is the new population?

12. Cindy's weekly pay, after deductions of 32%, was $595. What was her pay before the deductions?

13. Kate's weekly pay went from $850 to $918. What percent increase in pay did she receive?

14. The price of a movie increased by 20% to $12.50. What was the old price of seeing a movie?

16. A coat cost $100.24 after adding 12% tax to the cost. What was the price of the coat before taxes?