Write as a fraction or as a mixed number.

3. 6%  
4. 8%  
5. 33%  
6. 47%  
7. 55%

8. 35%  
9. 75%  
10. 25%  
11. 20%  
12. 40%

\[
8\% = 0.08 = \frac{8}{100} = \frac{2}{25}
\]

\[
54\% = 0.54 = \frac{54}{100} = \frac{27}{50}
\]

\[
235\% = 2.35 = \frac{235}{100} = \frac{27}{10}
\]

\[
0.26\% = 0.00026 = \frac{26}{100,000} = \frac{13}{50,000}
\]

\[
2 \frac{7}{9} = \frac{25}{9} \times \frac{1}{4} = \frac{25}{36}
\]

\[
0.02777 = 0.0278
\]

Round to Ten Thousandths
\[
\frac{3}{4} = .75 = 75\% \\
3 ÷ 4 =
\]

\[
\frac{7}{8} = .875 = 87.5\% \\
7 ÷ 8 =
\]

\[
\frac{3}{1000} = .003 = 0.3\% \\
\text{Round up to 4 places}
\]

\[
\frac{1}{7} = .1428571 ≈ 0.1429 \approx 14.29\% \\
\text{Decimal}
\]

\[
3 \frac{2}{5} = 3.4 = 340\% \\
2 ÷ 5 = .4
\]

\[
1 \frac{1}{4} = 1.25 = 125\% \\
1 ÷ 4 = .25
\]
\[ 0.67 = 67\% = \frac{67}{100} \]

\[ 0.37 = 3.7\% = \frac{37}{1000} \]

\[ 0.017 = 0.17\% = \frac{17}{10,000} \]

\[ 2.35\% = 0.0235 = \frac{235}{10,000} \approx \frac{47}{2000} \]

\[ 4.7 = 470\% = \frac{470}{10} \]

\[ 5.13 = 513\% = \frac{513}{100} \]
5.3A Solving Percent Problems Using Equations

1 Translating a Percent Problem into an Equation

In word problems like the ones in this section, we can translate from words to mathematical symbols and back again. After we have the mathematical symbols arranged in an equation, we solve the equation. When we find the values that make the equation true, we have also found the answer to our word problem.

To solve a percent problem, we express it as an equation with an unknown quantity. We use the letter \( n \) to represent the number we do not know. The following table is helpful when translating from a percent problem to an equation.

<table>
<thead>
<tr>
<th>Word</th>
<th>Mathematical Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>of</td>
<td>Any multiplication symbol: ( \times ) or ( ) or ( \cdot )</td>
</tr>
<tr>
<td>is</td>
<td>=</td>
</tr>
<tr>
<td>what</td>
<td>Any letter; for example, ( n )</td>
</tr>
<tr>
<td>find</td>
<td>( n = )</td>
</tr>
</tbody>
</table>

In Examples 1–5 we show how to translate words into an equation. Please do not solve the problem. Translate into an equation only.

\[
\text{Amount} = 10\% \text{ of } 3000
\]

\[
.\text{Amount} = \text{Percent} \times \text{Base}
\]

\[
A = P \times B
\]
EXAMPLE 1  Translate into an equation.

What is 5% of 19.00?

\[ n = 5\% \times 19.00 \]

Solution

Practice Problem 1  Translate into an equation. What is 26% of 35?

\[ n = 26\% \times 35 \]

\[ A = 0.26 \times 35 \quad \text{Multiply} \]

\[ A = 9.1 \]

Amount = Percent \times Base

\[ A \]

\[ P \]

\[ B \]
Practice Problem 2: Translate into an equation. Find 0.08% of 350.

\[
\frac{A}{\frac{b}{100}} \quad \text{Multiply}
\]

Find 0.08% of 350

\[
\begin{align*}
\text{b} & = 0.08\% \times 350 \\
\text{D} & = 350 \\
A & = 0.0008 \times 350 \\
A & = 0.28
\end{align*}
\]
EXAMPLE 3  Translate into an equation.

(a) 35% of what is 60?  
\[ 35\% \times n = 60 \]

(b) 7.2 is 120% of what?  
\[ 7.2 = 120\% \times n \]

Solution

(a) 35% of what is 60?  
\[ 35\% \times n = 60 \]

(b) 7.2 is 120% of what?  
\[ 7.2 = 120\% \times n \]

Practice Problem 3  Translate into an equation.

(a) 58% of what is 400?  
\[ 58\% \times n = 400 \]
\[ 58\% \times B = 400 \]
\[ 0.58 \times B = 400 \]
\[ B = \frac{400}{0.58} \]
\[ B = 689.6551 \]
\[ B \approx 689.66 \]

(b) 9.1 is 135% of what?  
\[ 9.1 = 135\% \times n \]
\[ 9.1 = 1.35 \times B \]
\[ B = \frac{9.1}{1.35} \]
\[ B \approx 6.74 \]
**Example 4** Translate into an equation.

What percent of 50 is 10?

\[ \frac{n}{50} = 10 \]

**Solution**
We see here that the words *what percent* are represented by the letter \( n \).

**Practice Problem 4** Translate into an equation. What percent of 250 is 36?

\[ \frac{n}{250} = 36 \]

\[ p \times 250 = 36 \]

\[ p = \frac{36}{250} = 0.144 \text{ Decimal} \]

\[ \text{Percent } 14.4\% \]
EXAMPLE 5  Translate into an equation.

(a) 30 is what percent of 16?  

Solution

(a) 30 is what percent of 16?

\[ \frac{30}{n} \times 16 \]

(b) What percent of 3000 is 2.6?

\[ \frac{n}{3000} = 2.6 \]

A = \( \frac{A}{B} \)

Practice Problem 5  Translate into an equation.

(a) 50 is what percent of 20?

\[ \frac{50}{20} \times 20 \]

(b) What percent of 2000 is 4.5?

\[ \frac{4.5}{2000} \]

\[ \rho = 0.225 \% \]

\[ \rho = 0.00225 \]

\[ \rho = 250 \% \]
Solving a Percent Problem by Solving an Equation

The percent problems we have translated are of three types. Consider the equation $60 = 20\% \times 300$. This problem has the form

\[ \text{amount} = \text{percent} \times \text{base} \]

Any one of these quantities—amount, percent, or base—may be unknown.

1. When *we do not know the amount*, we have an equation like
   \[ A = 20\% \times 300. \]

2. When *we do not know the base*, we have an equation like
   \[ 60 = 20\% \times B. \]

3. When *we do not know the percent*, we have an equation like
   \[ 60 = P \times 300. \]
EXAMPLE 6

What is 45% of 590?

\[ n = 45\% \times 590 \]
\[ n = (0.45)(590) \]
\[ n = 265.5 \]

Translate into an equation.
Change the percent to decimal form.
Multiply 0.45 \times 590.

Practice Problem 6

What is 82% of 350?

\[ n = 0.82 \times 350 \]
\[ A = 0.82 \times 350 \]
\[ A = 287 \]
### Example 7
Find 160% of 500.

Find 160% of 500.

\[ n = 160\% \times 500 \]

\[ n = (1.60)(500) \]

\[ n = 800 \]

When you translate, remember that the word *find* is equivalent to *what is*.

Change the percent to decimal form.

Multiply 1.6 by 500.

### Practice Problem 7
Find 230% of 400.

\[ A = 2.30 \times 400 \]

\[ A = 920 \]
**EXAMPLE 8** When Rick bought a new Toyota Yaris, he had to pay a sales tax of 5% on the cost of the car, which was $12,000. What was the sales tax?

**Solution** This problem is asking

What is 5% of $12,000?

\[
\text{n} = 5\% \times 12,000
\]

\[
\text{n} = 0.05 \times 12,000
\]

\[
\text{n} = 600
\]

The sales tax was $600.

**Practice Problem 8** When Oprah bought an airplane ticket, she had to pay a tax of 8% on the cost of the ticket, which was $350. What was the tax?

\[
\text{Tax} = \text{Percent} \times \text{Price}
\]

\[
A = P \times B
\]

\[
A = 0.08 \times 350
\]

\[
A = 28
\]
Solving Percent Problems When the Base Is Unknown  If a number is multiplied by the letter $n$, this can be indicated by a multiplication sign, parentheses, a dot, or placing the number in front of the letter. Thus $3 \times n = 3(n) = 3 \cdot n = 3n$.

In this section we use equations like $3n = 9$ and $0.5n = 20$. To solve these equations we use the procedures developed in Chapter 4. We divide each side by the number multiplied by $n$. 
EXAMPLE 9

12 is 0.6% of what?

\[
\begin{align*}
12 &= 0.6\% \times n \\
12 &= 0.006n \\
\frac{12}{0.006} &= \frac{0.006n}{0.006} \\
2000 &= n
\end{align*}
\]

Solution

Translate into an equation.

Change 0.6% to a decimal.

Divide each side of the equation by 0.006.

Divide 12 ÷ 0.006.

Practice Problem 9

32 is 0.4% of what?

\[
\begin{align*}
32 &= .004 \times n \\
32 &= .004 \times B \\
B &= \frac{32}{.004} = 8000
\end{align*}
\]
EXAMPLE 10  Dave and Elsie went out to dinner. They gave the waiter a tip that was 15% of the total bill. The tip the waiter received was $6. What was the total bill (not including the tip)?

**Solution**  This problem is asking

\[ 15\% \times n = 6 \]

\[ 0.15n = 6 \]

\[ n = \frac{6}{0.15} = 40 \]

The total bill for the meal (not including the tip) was $40.

Practice Problem 10  The coach of the university baseball team said that 30% of the players on his team are left-handed. Six people on the team are left-handed. How many people are on the team?

30% of players on team are left handed

\[ 0.30 \times n = 6 \]

\[ 0.30 \times 20 = 6 \]

\[ n = \frac{6}{0.30} = 20 \]
Solving Percent Problems When the Percent Is Unknown  In solving these problems, we notice that there is no \% symbol in the problem. The percent is what we are trying to find. Therefore, our answer for this type of problem will always have a percent symbol.

**Example 11**

What percent of 5000 is 3.8?

\[
\frac{\text{What percent}}{n} \times 5000 = 3.8 \quad \text{Translate into an equation.}
\]

\[
5000n = 3.8
\]

Multiplication is commutative.
\[
n \times 5000 = 5000 \times n.
\]

\[
\frac{5000n}{5000} = \frac{3.8}{5000}
\]

Divide each side by 5000.
\[
\frac{n}{5000} = 0.00076
\]

Divide 3.8 by 5000.
\[
n = 0.076\%
\]

Express the decimal as a percent.

**Practice Problem 11**

What percent of 9000 is 4.5?

\[
\frac{\text{What percent}}{p} \times 9000 = 4.5
\]

\[
p = \frac{4.5}{9000} = 0.0005
\]

Decimal
\[
p = 0.05\%
\]
EXAMPLE 12

90 is what percent of 20?

Solution

\[ 90 = \frac{20n}{n} \times 20 \]

Translate into an equation.

\[ 90 = 20n \quad \text{Multiplication is commutative.} \quad n \times 20 = 20 \times n. \]

\[ \frac{90}{20} = \frac{20n}{20} \quad \text{Divide each side by 20.} \]

\[ 4.5 = n \quad \text{Divide 90 by 20.} \]

\[ 450\% = n \quad \text{Express the decimal as a percent.} \]

Practice Problem 12

198 is what percent of 33?

\[ \frac{198}{33} = p \]

Decimal 6 = p

600% = p
**Example 13**  In a recent basketball game for the New York Knicks, Jamal Crawford made 10 of his 24 shots. What percent of his shots did he make? (Round to the nearest tenth of a percent.)

**Solution**  This is equivalent to

\[
10 \text{ is what percent of 24?}
\]

\[
10 = \frac{24n}{n} \times 24
\]

\[
10 = 24n
\]

\[
10 = \frac{24n}{24}
\]

\[
0.4166 \ldots = n
\]

To the nearest tenth of a percent we have

\[
n = 41.7\%
\]

Jamal Crawford made 41.7% of his shots in this game.

**Practice Problem 13**  In a basketball game for the Los Angeles Lakers, Kobe Bryant made 5 of his 16 shots. What percent of his shots did he make? (Round to the nearest tenth of a percent.)
8. What is 9% of 65?

10. 65% of what is 28?

12. 24 is what percent of 144?

14. What is 30% of 210?

16. Find 60% of 210.
18. **Coin-Counting Service** At the local bank coins can be placed into a machine to be counted. You can then receive bills for the amount the coins are worth. However, the bank charges a fee that is 8% of the coins' value. How much would the service fee be if someone put $215 worth of coins into the machine?
24. **Opinion Poll** A newspaper states that 522 of its residents are in favor of building a new high school. This is 12% of the town's population. What is the population of the town?
30. *Car Repairs* Randy's bill for car repairs was $140. Of this amount, $28 was charged for labor and $112 was charged for parts. What percent of the bill was for labor?
42. 10 is 25% of what?

46. What is 17.5% of 260?

36. 72 is what percent of 900?