Percents, Decimals, and Fractions

Introduction...
The size of categories in the pie chart below are given as percents. The whole pie chart is represented by 100%. In general, 100% of something is the whole thing.

Factors producing more traffic today

Increase in population
13%

Increase in trip lengths
35%

Fewer occupants traveling in vehicles
17%

Switch to driving from other modes of transportation
17%

Increase in trips taken
18%

In this section we will look at the meaning of percent. To begin, we learn to change decimals to percents and percents to decimals.

The Meaning of Percent
Percent means “per hundred.” Writing a number as a percent is a way of comparing the number with 100. For example, the number 42% (the % symbol is read “percent”) is the same as 42 one-hundredths. That is:

\[ 42\% = \frac{42}{100} \]

Percents are really fractions (or ratios) with denominator 100.
Here are some examples that show the meaning of percent.

**EXAMPLE 1**
50% = \( \frac{50}{100} \)

**EXAMPLE 2**
75% = \( \frac{75}{100} \)

**EXAMPLE 3**
25% = \( \frac{25}{100} \)

**EXAMPLE 4**
33% = \( \frac{33}{100} \)

**EXAMPLE 5**
6% = \( \frac{6}{100} \)

**EXAMPLE 6**
160% = \( \frac{160}{100} \)

Practice Problems
Write each number as an equivalent fraction without the % symbol.

1. 40% 
2. 80% 
3. 15% 
4. 37% 
5. 8% 
6. 150%

Answers
1. \( \frac{40}{100} \) 
2. \( \frac{80}{100} \) 
3. \( \frac{15}{100} \) 
4. \( \frac{37}{100} \) 
5. \( \frac{8}{100} \) 
6. \( \frac{150}{100} \)
Changing Percents to Decimals

To change a percent to a decimal number, we simply use the meaning of percent.

**EXAMPLE 7** Change 35.2% to a decimal.

**SOLUTION** We drop the % symbol and write 35.2 over 100.

\[
35.2\% = \frac{35.2}{100} \quad \text{Use the meaning of \% to convert to a fraction with denominator 100}
\]

\[
= 0.352 \quad \text{Divide 35.2 by 100}
\]

We see from Example 7 that 35.2\% is the same as the decimal 0.352. The result is that the % symbol has been dropped and the decimal point has been moved two places to the left. Because % always means “per hundred,” we will always end up moving the decimal point two places to the left when we change percents to decimals. Because of this, we can write the following rule.

**RULE**

To change a percent to a decimal, drop the % symbol and move the decimal point two places to the left.

Here are some examples to illustrate how to use this rule.

<table>
<thead>
<tr>
<th>EXAMPLE 8</th>
<th>25% = 0.25</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXAMPLE 9</td>
<td>75% = 0.75  Notice that the results in Examples 8, 9, and 10 are consistent with the results in Examples 1, 2, and 3</td>
</tr>
<tr>
<td>EXAMPLE 10</td>
<td>50% = 0.50</td>
</tr>
<tr>
<td>EXAMPLE 11</td>
<td>6.8% = 0.068 Notice here that we put a 0 in front of the 6 so we can move the decimal point two places to the left</td>
</tr>
<tr>
<td>EXAMPLE 12</td>
<td>3.62% = 0.0362</td>
</tr>
<tr>
<td>EXAMPLE 13</td>
<td>0.4% = 0.004 This time we put two 0’s in front of the 4 in order to be able to move the decimal point two places to the left</td>
</tr>
<tr>
<td>EXAMPLE 14</td>
<td>The cortisone cream shown here is 0.5% hydrocortisone. Writing this number as a decimal we have 0.5% = 0.005</td>
</tr>
</tbody>
</table>

Answers
7. 0.252  8. 0.40  9. 0.80  
10. 0.15  11. 0.056  12. 0.0486  
13. 0.006  14. 0.0058
Changing Decimals to Percents

Now we want to do the opposite of what we just did in Examples 7–14. We want to change decimals to percents. We know that 42% written as a decimal is 0.42, which means that in order to change 0.42 back to a percent, we must move the decimal point two places to the right and use the % symbol:

0.42 = 42% Notice that we don’t show the new decimal point if it is at the end of the number

**RULE**

To change a decimal to a percent, we move the decimal point two places to the right and use the % symbol.

Examples 15–20 show how we use this rule.

<table>
<thead>
<tr>
<th>Example</th>
<th>Decimal</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0.27</td>
<td>27%</td>
</tr>
<tr>
<td>16</td>
<td>4.89</td>
<td>489%</td>
</tr>
<tr>
<td>17</td>
<td>0.2 = 0.20 = 20%</td>
<td>Notice here that we put a 0 after the 2 so we can move the decimal point two places to the right</td>
</tr>
<tr>
<td>18</td>
<td>0.09 = 09% = 9%</td>
<td>Notice that we can drop the 0 at the left without changing the value of the number</td>
</tr>
<tr>
<td>19</td>
<td>25 = 25.00 = 2,500%</td>
<td>Here, we put two 0’s after the 5 so we can move the decimal point two places to the right</td>
</tr>
<tr>
<td>20</td>
<td>A softball player has a batting average of 0.650. As a percent, this number is 0.650 = 65.0%</td>
<td></td>
</tr>
</tbody>
</table>

As you can see from the examples above, percent is just a way of comparing numbers to 100. To multiply decimals by 100, we move the decimal point two places to the right. To divide by 100, we move the decimal point two places to the left. Because of this, it is a fairly simple procedure to change percents to decimals and decimals to percents.

**Answers**

15. 35%  
16. 577%  
17. 40%  
18. 3%  
19. 4.500%  
20. 69%
Changing Fractions to Percents

To change a fraction to a percent, we can change the fraction to a decimal and then change the decimal to a percent.

**EXAMPLE 24** Suppose the price your bookstore pays for your textbook is $\frac{7}{10}$ of the price you pay for your textbook. Write $\frac{7}{10}$ as a percent.

**SOLUTION** We can change $\frac{7}{10}$ to a decimal by dividing 7 by 10:

\[
\begin{array}{c}
\text{7} \\
\hline
\text{10} \\
\text{7} \\
\hline
\text{0}
\end{array}
\]

We then change the decimal 0.7 to a percent by moving the decimal point two places to the right and using the % symbol:

\[
0.7 = 70\%
\]

You may have noticed that we could have saved some time by simply writing $\frac{7}{10}$ as an equivalent fraction with denominator 100. That is:

\[
\frac{7}{10} = \frac{7 \cdot 10}{10 \cdot 10} = \frac{70}{100} = 70\%
\]

This is a good way to convert fractions like $\frac{7}{10}$ to percents. It works well for fractions with denominators of 2, 4, 5, 10, 20, 25, and 50, because they are easy to change to fractions with denominators of 100.

**EXAMPLE 25** Change $\frac{3}{8}$ to a percent.

**SOLUTION** We write $\frac{3}{8}$ as a decimal by dividing 3 by 8. We then change the decimal to a percent by moving the decimal point two places to the right and using the % symbol.

\[
\begin{array}{c}
\text{3} \\
\hline
\text{8} \\
\text{2} \text{ R } 4 \\
\text{60} \\
\text{56} \\
\text{40} \\
\text{40} \\
\text{0}
\end{array}
\]

\[
\frac{3}{8} = 0.375 = 37.5\%
\]

**EXAMPLE 26** Change $\frac{5}{12}$ to a percent.

**SOLUTION** We begin by dividing 5 by 12:

\[
\begin{array}{c}
\text{5} \\
\hline
\text{12} \text{ R } 4 \\
\text{8} \\
\text{20} \\
\text{12} \\
\text{80} \\
\text{72} \\
\text{80} \\
\text{72}
\end{array}
\]

\[
\frac{5}{12} = 0.4166 = 41.66\%
\]

24. Change $\frac{9}{10}$ to a percent.

25. Change $\frac{5}{8}$ to a percent.

26. Change $\frac{7}{12}$ to a percent.

Answers

24. 90% 25. 62.5%
In Class Work

P432
45) Write the percent for the statements:
    Out of 100 eligible people, 53 voted.

46) A dealer sold 9 out of 20 cars available.

P444

418) Change 0.095 to percent
(Decimal)

Instructor's Made up Problem
Change $\frac{15}{8}$ to a percent

→ Doing Division for the Fraction to change it to Decimal