GOALS
Students will write given fractions as percents, where the given fraction has a denominator that divides evenly into 100.

PRIOR KNOWLEDGE REQUIRED
Equivalent fractions
Reducing fractions to lowest terms

VOCABULARY
percent

Ask students what the word “per” means in these sentences:

Rita can type 60 words per minute.
Anna scores 3 goals per game.
John makes $10 per hour.
The car travels at a speed of up to 140 kilometres per hour.

Then write the word “percent” on the board. ASK: Has anyone seen the word “cent” before? What does it mean? Does anyone know a French word that is spelled the same way? What does that word mean? Explain that “percent” means “for every 100” or “out of 100.” For example, a score of 84% on a test would mean that you got 84 out of every 100 marks or points. Another example: if a survey reports that 72% of people read the newspaper every day, that means 72 out of every 100 people read the newspaper daily.

ASK: Sally got 84% on a test where there were 200 possible points. How many points did she get? Then rephrase the question: A test has 200 possible points. Sally got 84 points for every 100 possible points. How many points did she get?

\[
\frac{84 \text{ points}}{100 \text{ possible points}} = \frac{\text{____}}{200 \text{ possible points}}
\]

Explain to your students that a percent is a ratio that compares a number to 100.

Have students rephrase the percents in these statements using the phrases “for every 100 ___________” or “out of 100 ___________.”

a) 52% of students in the school are girls (For every 100 students, 52 are girls OR 52 out of every 100 students in the school are girls.)

b) 40% of tickets sold were on sale (For every 100 tickets sold, 40 were on sale OR 40 out of every 100 tickets were on sale.)

c) Alejandra scored 95% on the test (For every 100 possible points, Alejandra scored 95 points on the test OR Alejandra got 95 out of every 100 points on the test.)

d) About 60% of your body weight is water (For every 100 kg of body weight, about 60 kg is water OR 60 kg out of every 100 kg of body weight is made up of water.)

Explain to students that a percent is just a short way of writing a fraction with denominator 100. Have students write each fraction as a percent:

\[
a) \frac{28}{100} \quad b) \frac{9}{100} \quad c) \frac{34}{100} \quad d) \frac{67}{100} \quad e) \frac{81}{100} \quad f) \frac{3}{100}
\]

Then have students write each percent as a fraction:

a) 6%  b) 19%  c) 8%  d) 54%  e) 79%  f) 97%
Now have students write each decimal as a percent by first changing the decimal into a fraction with denominator 100.

a) 0.74  

b) 0.03  

c) 0.12  

d) 0.83  

e) 0.91  

f) 0.09

Write the fraction \(\frac{3}{5}\) on the board and have a volunteer find an equivalent fraction with denominator 100. **ASk:** If 3 out of every 5 students at a school are girls, how many out of every 100 students are girls? (\(\frac{60}{100}\)) What percent of the students are girls? (60%) Write on the board: \(\frac{3}{5} = \frac{60}{100} = 60\%\). Then have volunteers find the equivalent fraction with denominator 100 and then the equivalent percent for more fractions with denominator 5.

**EXAMPLES:** \(\frac{2}{5}, \frac{4}{5}\) and \(\frac{1}{5}\)

Repeat for fractions with various denominators.

**EXAMPLES:** \(\frac{4}{10}, \frac{9}{20}, \frac{3}{4}, \frac{1}{2}, \frac{29}{50}, \frac{21}{25}, \frac{17}{5}\)

**Bonus**

Use the equivalent percents to put the above fractions in order from least to greatest.

Then have students write various decimal tenths as percents by first changing the decimal to a fraction with denominator 100.

**EXAMPLES:** 0.2 = \(\frac{2}{10} = \frac{20}{100} = 20\%\)  
0.3  
0.9  
0.7  
0.5

Explain to students that they can find a percent of a figure just as they can find a fraction of a figure. Ask students to decide first what fraction and then what percent of each figure is shaded:

Now show students a fraction not in lowest terms, whose denominator does not divide evenly into 100 unless the fraction is reduced.

**EXAMPLE:** \(\frac{9}{15}\)

Tell your students that you want to find an equivalent fraction with denominator 100. **Ask:** How is this fraction different from previous fractions you have changed to percents? (The denominator does not divide evenly into 100.) Is there any way to find an equivalent fraction whose denominator does divide evenly into 100? (Reduce the fraction by dividing both the numerator and the denominator by 3.) Write on the board:

\(\frac{9}{15} = \frac{3}{5} = \frac{60}{100} = 60\%\)

Summarize the 3 steps for finding the equivalent percent of a fraction.

1. Reduce the fraction so that the denominator is divisible by 100.
2. Find an equivalent fraction with denominator 100.
3. Write the fraction with denominator 100 as a percent.

Have students write various fractions as percents:

a) \(\frac{3}{12}\)  

b) \(\frac{6}{30}\)  

c) \(\frac{24}{30}\)  

d) \(\frac{3}{75}\)  

e) \(\frac{6}{15}\)  

f) \(\frac{36}{48}\)  

g) \(\frac{60}{75}\)
Extension

**ASK:** How many degrees are in a circle? If I rotate an object 90° counter-clockwise, what fraction and what percent of a complete 360-degree turn has the object made? \( \frac{90}{360} = \frac{1}{4} = \frac{25}{100} = 25\% \)

Repeat for various degrees: 180°, 18°, 126°, 270°, 72°, 216°.

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**NS6-102**

**Visual Representations of Percents**

**GOALS**
Students will visualize various percentages of different shapes, including rectangles, squares, triangles, and lines.

**PRIOR KNOWLEDGE REQUIRED**
Equivalent fractions
The relationship between decimals with up to 2 decimal places and fractions with denominator 100

**VOCABULARY**
percent

Draw a hundreds block on the board and have students write what part of the block is shaded in three different ways:

**EXAMPLE:**

\[ \left( \frac{39}{100}, 0.39, 39\% \right) \]

Have students find 25% of each shape in various ways:

Then draw shapes on the board and divide them into equal pieces, the number of which divide evenly into 100:

**ASK:** What fraction of each shape is shaded? Have students change each fraction to an equivalent fraction with denominator 100, and then to a decimal and a percent.
Show students a double number line with fractions on top and percents on the bottom.

```
<table>
<thead>
<tr>
<th>0</th>
<th>1/10</th>
<th>2/10</th>
<th>3/10</th>
<th>4/10</th>
<th>5/10</th>
<th>6/10</th>
<th>7/10</th>
<th>8/10</th>
<th>9/10</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>
```

Then have volunteers add fractions and percents to each number line below:

```
0 1 0 1
```

```
0 1/2 0 1/3
```

Draw lines of varying lengths and have students mark a different percent on each one.

**EXAMPLES:**

- 50% ———————————————————— ANSWER: ———————————————————— 50%
- 20% ————————————————————
- 75% ————————————————————
- 80% ————————————————————
- 60% ————————————————————

Then have students draw two lines such that 20% of the first line is longer than 50% of the second line.

Now draw a line segment and identify what percent of a line the segment represents. Invite a volunteer to extend the line segment to its full length (i.e., to show 100%).

**EXAMPLE:**

- 50% ———— ANSWER: ————————————————————

Finally, have students estimate the percent of various marks on a number line (to the nearest 10%), and then superimpose a number line of the same length divided into ten equal parts so that students can check their estimates.
NS6-103
Comparing Decimals, Fractions & Percents

Review comparing and ordering

- fractions with the same denominator (\( \frac{7}{10} \) is greater than \( \frac{4}{10} \)).
- percents (30% is greater than 24% because \( \frac{30}{100} \) is greater than \( \frac{24}{100} \)).
- fractions with different denominators (\( \frac{5}{10} \) is greater than \( \frac{6}{20} = \frac{3}{10} \)).
- fractions and decimals (\( \frac{3}{8} \) is greater than 0.52 because \( \frac{46}{90} \) is greater than \( \frac{62}{100} \)).

Remind students of the signs for less than (<) and greater than (>) and use them throughout the lesson.

Teach students how to compare fractions and percents by changing both to an equivalent fraction with denominator 100. (EXAMPLES: Have students decide which is larger between \( \frac{1}{2} \) and 38%, \( \frac{3}{5} \) and 70%, \( \frac{9}{10} \) and 84%, \( \frac{7}{25} \) and 30%, \( \frac{3}{20} \) and 46%).

Then compare decimals and percents by changing both to an equivalent fraction with denominator 100. (EXAMPLES: 0.9 and 10%, 0.09 and 10%, 28% and 0.34, 4% and 0.3)

Now ask students, working independently, to put the following groups of numbers in order from least to greatest by first changing all three numbers to a fraction with denominator 100.

\[
a) \frac{28}{100} \quad 42\% \quad \frac{3}{10} \quad b) \frac{14}{50} \quad 23\% \quad 0.3 \\
c) \frac{19}{25} \quad 0.72 \quad 7\% \quad d) \frac{1}{2} \quad 4\% \quad 0.4
\]

**Bonus**

\( \frac{13}{20}, 0.6, 66\%, 0.7, 7\%, \frac{16}{20}, \frac{3}{50} \)

Then teach students how to compare fractions and percents when a denominator does not divide evenly into 100. **ASK:** How can we compare 35% to \( \frac{1}{3} \)? If we changed 35% to a fraction, what would it be? (\( \frac{35}{100} \)) Do we have a way to compare \( \frac{1}{3} \) to \( \frac{35}{100} \) or are we stuck? We have two fractions with different denominators, but 3 doesn’t divide evenly into 100. How can we give both fractions the same denominator? (Use denominator 300.) Have volunteers change both fractions to equivalent fractions with denominator 300 and ask the class to identify which is greater, 35% or \( \frac{1}{3} \), and to explain how they know.

Repeat with various reduced fractions whose denominator does not divide evenly into 100. Then have students compare more fractions and percents independently, in their notebooks.

**EXAMPLES:** Compare \( \frac{8}{5} \) and 85%, \( \frac{7}{4} \) and 42%, \( \frac{2}{5} \) and 21%.
Bonus
Make up your own question and have a partner solve it.

Finally, have students compare lists of numbers (fractions, percents, and decimals) in which the fractions do not have denominators that divide evenly into 100.

EXAMPLES:

a) \( \frac{1}{6} \), 0.17, 13%  
b) 0.37, \( \frac{1}{3} \), 28%  
c) \( \frac{6}{7} \), 71%, 0.68

Bonus
\( \frac{7}{9} \), .8, \( \frac{4}{7} \), 51%, .78, 62%

Extensions

1. (From Atlantic Curriculum A5.6) Ask students to name percents that indicate
   • almost all of something,
   • very little of something,
   • a little less than half of something.

   Ask students to explain their thinking.

2. (From Atlantic Curriculum A5.9) Ask students to look for percents in newspapers, flyers, magazines, and other printed materials, such as food packaging, trading cards, and order forms. What kind of information is expressed as a percent? Ask students to clip examples and to make a collage for a class display.
NS6-104
Finding Percents

GOALS
Students will find multiples of 10 percent of a number.

PRIOR KNOWLEDGE REQUIRED
Converting fractions to decimals and vice versa
The relationship between percents and fractions

VOCABULARY
percent

Tell your students that you will use one thousands block to represent one whole. Given this information, ask students to identify the fraction and the decimal each model represents:

a) b) c)

Then make a model of the number 1.6 (again, using one thousands block as one whole). ASK: What do I need to make the model? (1 thousands block, 6 hundreds blocks) How do you know? How can I show \( \frac{1}{10} \) of 1.6? (one tenth of a thousands block is a hundreds block and one tenth of a hundreds block is a tenth block, so I need a hundreds block and 6 tenths blocks to make \( \frac{1}{10} \) of 1.6) What number is \( \frac{1}{10} \) of 1.6? (0.16, since this is what the base ten materials show) Do a few more examples together.

a) 1 b) .01 c) 0.1 d) 7 e) 2.3 f) 0.41 g) 5.01

Ask students to explain how they can find \( \frac{1}{10} \) of any number. Remind your students that when they move the decimal point one place left, each digit becomes worth \( \frac{1}{10} \) as much, so the whole number becomes \( \frac{1}{10} \) of what it was before they moved the decimal point. (EXAMPLE: 4 is \( \frac{1}{10} \) of 40, and 0.1 is \( \frac{1}{10} \) of 1, so 4.1 is \( \frac{1}{10} \) of 41) ASK: What is this like dividing by? (10) Emphasize that to find \( \frac{1}{10} \) of anything, you divide it into 10 equal parts; to find \( \frac{1}{10} \) of a number, you divide the number by 10. ASK: What decimal is the same as \( \frac{1}{10} \) ? (0.1 or .1) What percent is the same as \( \frac{1}{10} \) ? (10%)

Ask your students to find 10% of each number by just moving the decimal point.

a) 40 b) 4 c) 7.3 d) 500
e) 408 f) 3.07 g) 432.5609

Then show this number line:

\[
\begin{align*}
0 & \quad 0\% \\
10 & \quad 10\% \\
20 & \quad 20\% \\
30 & \quad 30\% \\
40 & \quad 40\% \\
50 & \quad 50\% \\
60 & \quad 60\% \\
70 & \quad 70\% \\
80 & \quad 80\% \\
90 & \quad 90\% \\
100 & \quad 100\%
\end{align*}
\]

Have a volunteer fill in the missing numbers on the number line. Then ask volunteers to look at the completed number line and identify: 10% of 30, 40% of 30, 90% of 30, 70% of 30.
Repeat the exercise for a number line from 0 to 21.

**ASK:** If you know 10% of a number, how can you find 30% of that number? (multiply 10% of the number by 3) Tell your students that you would like to find 70% of 12. **ASK:** What is 10% of 12? (1.2) If I know that 10% of 12 is 1.2, how can I find 70% of 12? (multiply 1.2 \times 7)

Using this method, have students find:

- a) 60% of 15
- b) 40% of 40
- c) 60% of 4
- d) 20% of 1.5
- e) 90% of 8.2
- f) 70% of 4.3
- g) 80% of 5.5

Remind students that 5% is half of 10%. Have them find 5% of the following numbers by first finding 10% then dividing by 2. (Students should use long division on a separate piece of paper.)

- a) 80
- b) 16
- c) 72
- d) 50
- e) 3.2
- f) 2.34

Tell students to find 15% of the following numbers by finding 10% and 5%, and then adding. (Students should use a separate piece of paper for their rough work.)

- a) 60
- b) 240
- c) 12
- d) 7.2
- e) 3.80
- f) 6.10

Explain to students that taking 1% of a number is the same as dividing the number by 100. (The decimal shifts 2 places to the left.) Have students find 1% of:

- a) 27
- b) 3.2
- c) 773
- d) 12.3
- e) 68

**Extension**

Have students compare:

- a) 20% of 60 and 60% of 20
- b) 30% of 50 and 50% of 30
- c) 40% of 20 and 20% of 40
- d) 70% of 90 and 90% of 70
- e) 80% of 60 and 60% of 80
- f) 50% of 40 and 40% of 50

What pattern do students see? Challenge them to figure out why this pattern holds.
GOALS
Students will find any percentage of a number.

PRIOR KNOWLEDGE REQUIRED
Reducing fractions
Multiplying decimals
The standard algorithm for multiplying

VOCABULARY
percent

Ask the class how they would find 20% of 5.5. Someone will likely volunteer the following solution: 10% of 5.5 is 0.55, so 20% is $2 \times 10\% = 2 \times 0.55 = 1.1$. Now ask if anyone can think of an easier way to find 20% of 5.5. To guide students, **ASK:** What fraction is equivalent to 20%? If your students answer 20/100, ask them if the fraction can be reduced. When they see that 20% is equivalent to $\frac{1}{5}$, **ASK:** How can you find $\frac{1}{5}$ of a number? Remind students that finding $\frac{1}{5}$ of a number is just like dividing that number into 5 equal parts, and 5.5 is particularly easy to divide by 5. **WRITE:** $5.5 \div 5 = 1.1$.

Tell students that Maria found 80% of 5.5 by first finding 10% of 5.5 and then multiplying by 8. Sean found 80% of 5.5 by first finding 20% and then multiplying by 4. Have volunteers write out both solutions. Do they produce the same answer? Can students explain why? (Both methods give the same answer because 20% is $2 \times 10\%$, so 20% × 4 is the same as $10\% \times 2 \times 4 = 10\% \times 8$.)

**ASK:** How can you find 25% of a number easily? (divide by 4, since 25% is the same as $\frac{1}{4}$) If you know 25% of a number, how can you find 75%? (multiply by 3, since $75 = 3 \times 25$) Have students find:

a) 75% of 160 by first finding 25% of 160.

b) 75% of 160 by first finding 5% of 160.

Ask students what they need to multiply by in each case. (In a) they need to multiply 25% of 160 by 3 because 75% = $3 \times 25\%$. In b), they need to multiply by 15 because 75% = $15 \times 5\%$).

Remind students how to find a fraction of a whole number. For example, to find $\frac{3}{4}$ of 240, you can first find $\frac{1}{4}$ of 240 ($240 \div 4 = 60$) and then multiply by 3, since $\frac{3}{4}$ is 3 times as much as $\frac{1}{4}$. So, $\frac{3}{4}$ of 240 = 180.

Now tell students that you would like to find 53% of 12. First, ask if they can estimate the answer. To guide them, **ASK:** Is there a percentage of 12 that is close to 53% and easy to calculate? (yes, 50%) Will this estimate be lower or higher than the actual answer? (50% of 12 is 6, which is lower than the actual answer because 50% is less than 53%) Then **ASK:** What is 1% of 12? (0.12) How can we find 53% of 12 if we know 1% of 12? How many times greater than 1% is 53%? (53, so multiply 1% of 12 by 53 to find 53% of 12) Write on the board:

\[
53\% \text{ of } 12 = (12 \div 100) \times 53 \\
= 0.12 \times 53 \\
= 12 \times 53 \div 100 \\
= 636 \div 100 \\
= 6.36
\]

**ASK:** Is this answer reasonable? Why? Remind students that multiplying decimals is just like multiplying whole numbers except that they have to put the decimal point in the correct place.
ASK: Why is 1% of a number particularly easy to find? (Since 1% of a number is just the number divided by 100, you can move the decimal point 2 places to the left.) Have students find various percentages of different numbers using the strategy of first finding 1% and then multiplying by the correct amount. For example, to calculate 37% of 21, the student would first determine that 1% of 21 is 0.21 and then multiply $0.21 \times 37 = 21 \times 37 \div 100 = 777 \div 100 = 7.77$.

EXAMPLES: 13% of 85, 82% of 42, 33% of 33

Students can use the BLM “Percent Strips” to check their answers. They can also use the percent strip to check their estimates for various percentages of numbers. (EXAMPLES: 68% of 33, 91% of 33, 5% of 42, 76% of 85, 55% of 21)

Extensions

1. Sara says that to find 10% of a number, she divides the number by 10, so to find 5% of a number, she divides the number by 5. Is she right? Explain. (No—5% of a number is $\frac{5}{100}$ or $\frac{1}{20}$ of the number, so to find 5%, or $\frac{1}{20}$, of the number, she should divide it by 20.)

2. Continue the extension from NS6-104. Have students compare:
   a) 36% of 24 and 24% of 36   b) 17% of 35 and 35% of 17
   c) 29% of 78 and 78% of 29   d) 48% of 52 and 52% of 48
   Ask students to predict a rule and make up another example to check that the rule works.

3. DISCUSS: Does it make sense to talk about 140% of a number? What would it mean? Lead the discussion by referring to fractions greater than 1. Discuss what 100% and 40% of a number mean separately. Could 50% of a number be obtained by adding 20% and 30% of that number? Could 140% be obtained by adding 100% and 40% of the number?
Percent Strips