Unit 6 - Percent

Percent of a Number Lesson (7RP3, 7EE3)

REMEMBER – ALL PERCENTS ARE OUT OF 100

To find the percent of a number you can use either of the following methods.

a) write the percent as a fraction and then multiply

b) write the percent as a decimal and then multiply

1. Find 5% of 300 by writing the percent as a fraction.

\[
\frac{5}{100} = \frac{1}{20}
\]

\[
\frac{1}{20} \times 300 = \frac{300}{1} = \frac{3 \times 100}{20} = 15
\]

2. Find 25% of 180 by writing the percent as a decimal.

25% = 0.25

0.25 \times 300 = 75

To write a percent as a decimal, move the decimal point 2 places.

14\% = 0.14

3. Find 40% of 70 by writing the percent as a fraction

\[
\frac{40}{100} = \frac{2}{5}
\]

\[
\frac{2}{5} \times 70 = \frac{140}{5} = 28
\]

4. Find 55\% of a number by writing the percent as a decimal.

0.55\%
Find the percent of each number.

5. 15% of 100
   \[ \frac{15}{100} = \frac{3}{20} \]
   \[ \frac{3}{20} \times 100 = \frac{300}{20} = 15 \]

6. 75% of 280
   \[ \frac{75}{100} = \frac{3}{4} \]
   \[ \frac{3}{4} \times 280 = \frac{840}{4} = 210 \]

7. 125% of 10
   \[ \frac{125}{100} = \frac{5}{4} \]
   \[ \frac{5}{4} \times 10 = \frac{50}{4} = 12.5 \]

8. 0.5% of 60
   \[ \frac{0.5}{100} = \frac{5}{1000} = \frac{1}{200} \]
   \[ \frac{1}{200} \times 60 = \frac{60}{200} = 0.3 \]

9. 204% of 20
   \[ \frac{204}{100} = \frac{51}{25} \]
   \[ \frac{51}{25} \times 20 = \frac{1020}{25} = 40.8 \]

10. 150% of 28
    \[ \frac{150}{100} = \frac{3}{2} \]
    \[ \frac{3}{2} \times 28 = \frac{84}{2} = 42 \]

11. Suppose there are 20 questions on a multiple-choice test. If 25% of the answers are choice B, how many of the answers are not choice B?
    
    \[ 25\% \text{ of } 20 \text{ are choice B} \]
    
    \[ 75\% \text{ of } 20 \text{ are not choice B} \]

12. In a recent year, 17.7% of households watched the finals of a popular reality series. There are 110.2 million households in the United States. How many households watched the finals?
    
    \[ 17.7\% \text{ of } 110.2 \text{ million} \]
    
    \[ \frac{17.7}{100} \times 110.2 \text{ million} = 19,505.4 \text{ million households} \]
The Percent Proportion Lesson

Percent Equation: \( \frac{\text{part}}{\text{whole}} = \frac{\text{percent}}{100} \) or \( \frac{\text{is}}{\text{of}} = \frac{\text{percent}}{100} \)

Remember: Percent is always out of 100!

Remember: change the percent to a decimal

To Find Percent \( \frac{8}{50} = \frac{n}{100} \)

To Find Part \( \frac{n}{50} = \frac{16}{100} \)

To Find Percent \( \frac{8}{n} = \frac{16}{100} \)

Write an equation for each problem. Then solve. Round to the nearest hundredth if needed.

1. What percent of $15 is $9
   \[ \frac{9}{15} = \frac{n}{100} \]
   \[ n = 0.6 \times 100 = 60\% \]

2. 16 is what percent of 500?
   \[ \frac{16}{500} = \frac{n}{100} \]
   \[ n = \frac{16 \times 100}{500} = 3.2\% \]

3. What is 46% of 86?
   \[ \frac{x}{86} = \frac{46}{100} \]
   \[ x = \frac{46 \times 100}{86} = 53.5294 \]

4. 234 is 36% of what number?
   \[ \frac{234}{x} = \frac{36}{100} \]
   \[ x = \frac{234 \times 100}{36} = 650 \]
5. The brain weight of a newborn baby is about 13% of the body weight of the newborn. If a newborn weighs 2,900 grams, about how much does the brain weigh?

\[
\frac{x}{2900} = \frac{13}{100} \quad \Rightarrow \quad 100x = 37700 \quad \Rightarrow \quad x = 377
\]

377 grams

6. In a survey of 356 teachers, 87% of them prefer to wear blue jeans to work. How many teachers prefer blue jeans?

\[
\frac{x}{356} = \frac{87}{100} \quad \Rightarrow \quad 100x = 30972 \quad \Rightarrow \quad x = 309.72
\]

310 teachers

7. Eileen and Michelle scored 48% of their team’s points. If their team had a total of 50 points, how many points did they score?

\[
\frac{x}{50} = \frac{48}{100} \quad \Rightarrow \quad 100x = 2400 \quad \Rightarrow \quad x = 24
\]

24 points

8. Roman has 2 red pencils in his backpack. If this is 25% of the total number of pencils, how many pencils are in his backpack?

\[
\frac{2}{x} = \frac{25}{100} \quad \Rightarrow \quad 25x = 200 \quad \Rightarrow \quad x = 8
\]

8 pencils

9. Of the 60 books on a bookshelf, 24 are nonfiction. What percent of the books are nonfiction?

\[
\frac{24}{60} = \frac{x}{100} \quad \Rightarrow \quad 60x = 2400 \quad \Rightarrow \quad x = 40
\]

40%

10. A pair of sneakers is on sale as shown. This is 75% of the original price. What was the original price of the shoes?

\[
\frac{60}{x} = \frac{75}{100} \quad \Rightarrow \quad 75x = 6000 \quad \Rightarrow \quad x = 80
\]

$80
The Percent Equation Lesson 2.4

Find the percent: 3 is what percent of 6? \(3 = n \cdot 6\)
Find the Part: what number is 50% of 6? \(p = 0.50 \cdot 6\)
Find the Whole: 3 is 50% of What number \(3 = 0.50 \cdot x\)

Examples:

Write an equation for each problem. Then solve. Round to the nearest hundredth.

1. 16 is what percent of 500?
\[
\frac{16}{500} = \frac{n \cdot 500}{500} \quad n = 0.032 = 3.2\%
\]

2. What is 46% of 86?
\[
x = 0.46 \cdot 86 \quad x = 39.56
\]

3. 21 is what percent of 40?
\[
\frac{21}{40} = \frac{x \cdot 40}{40} \quad x = 0.525 = 52.5\%
\]

4. What percent of 40 is 9?
\[
\frac{9}{40} = \frac{x \cdot 40}{40} \quad x = 0.225 \quad 22.5\%
\]

5. 26% of what number is 45?
\[
x \cdot 0.26 = \frac{45}{0.26} \quad x = 173.08
\]

6. 234 is 36 percent of what number?
\[
\frac{234}{0.36} = \frac{x \cdot 0.36}{0.36} \quad x = 650
\]

7. The brain weight of a newborn baby is about 13% of the body weight of the newborn. If a newborn weighs 2,900 grams, about how much does the brain weigh?
\[
x = 0.13 \cdot 2900 \quad x = 377\text{ grams}
\]

8. In a survey of 356 teachers, 87% of them prefer to wear blue jeans to work. How many teachers prefer blue jeans?
\[
x = 0.87 \cdot 356 \quad x = 309.72 \quad 310\text{ teachers}
\]
Percent of Change Lesson

Percent of change is a ratio that compares the change in quantity to the original amount.

Percent of increase occurs when the original quantity is increased

Percent of decrease occurs when the quantity decreases

TO FIND THE PERCENT OF CHANGE

The percent of change of a quantity is given by:

\[ \text{Change (amount of increase or decrease)} \]
\[ \text{Original Amount} \]

This percent is a percent of increase if the quantity increased.

This percent is a percent of decrease if the quantity decreased.

Decide whether the two quantities represent a percent increase or a percent decrease, then find each percent of change. Round to the nearest whole percent.

1. original: 4
   new: 5
   \[ \frac{5 - 4}{4} = \frac{1}{4} = 0.25 \]
   \[ 25\% \]
2. $150 to $125
   \[ \frac{150 - 125}{150} = \frac{25}{150} = 0.16 \]
   \[ 16\% \] decrease
3. January: 52
   June: 75
   \[ \frac{75 - 52}{52} = \frac{23}{52} = 0.442 \]
   \[ 44.2\% \] increase
4. There were 2.2 million computers used in public schools in 1991 and 2 million in 1990.
   Is it an increase or decrease? Find the percent.
   \[ \frac{2.2 - 2}{2} = 0.1 \]
   \[ 10\% \]
5. In 1990 the number of tropical storms and hurricanes reaching the United States coastline was 14. In 1993, the number was 8. Is it an increase or decrease? Find the percent of change.

\[
\text{change} = 14 - 8 = 6
\]

\[
\text{orig} = \frac{6}{14} = 0.42857
\]

\[
\frac{\text{change}}{\text{orig}} = 42.9\%
\]

6. Yusuf bought a DVD recorder for $250. Now, it is on sale for $220. Find the percent of change in the price.

\[
\text{decrease} = 250 - 220 = 30
\]

\[
\text{change} = \frac{30}{250} = 0.12
\]

\[
\frac{\text{change}}{\text{orig}} = 12\%
\]

7. Three months ago, Santos could walk 2 miles in 40 minutes. Today he can walk 2 miles in 25 minutes. Find the percent of change.

\[
\text{change} = 40 - 25 = 15
\]

\[
\text{orig} = \frac{15}{40} = 0.375
\]

\[
\frac{\text{change}}{\text{orig}} = 37.5\% \text{ increased speed}
\]

8. Last school year the enrollment at Genoa Middle School was 465 students. This year the enrollment is 525. Find the percent of change.

\[
\text{increase} = 525 - 465 = 60
\]

\[
\text{change} = \frac{60}{465} = 0.129
\]

\[
\frac{\text{change}}{\text{orig}} = 12.9\% \text{ increase}
\]

9. The table shows the number of youth 7 years and older who played soccer from 2004 to 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>12.9</td>
</tr>
<tr>
<td>2005</td>
<td>13.7</td>
</tr>
<tr>
<td>2006</td>
<td>13.3</td>
</tr>
<tr>
<td>2007</td>
<td>13.3</td>
</tr>
<tr>
<td>2008</td>
<td>14.0</td>
</tr>
<tr>
<td>2009</td>
<td>13.8</td>
</tr>
</tbody>
</table>

a) Find the percent of change from 2008 to 2012. Round to the nearest tenth. If this a percent increase or percent decrease?

\[
13.3 \rightarrow 13.8 \text{ increase}
\]

\[
\text{change} = \frac{5}{13.3} = 0.375
\]

\[
\frac{\text{change}}{\text{orig}} = 3.75\%
\]

b) Find the percent of change from 2006 to 2008. Round to the nearest tenth. If this a percent increase or percent decrease?

\[
13.7 \rightarrow 13.3 \text{ decrease}
\]

\[
\text{change} = \frac{-4}{13.7} = 0.2919
\]

\[
\frac{\text{change}}{\text{orig}} = 2.9\%
\]
TO FIND THE PERCENT OF ERROR

The percent of error is a ratio that compares the inaccuracy of an estimate, or amount of error, to the actual amount:

\[
\frac{\text{Amount of Error}}{\text{Actual Amount}}
\]

10. Each week, Mr. Jones goes to the grocery store. Mr. Jones estimates that he will spend $120 when he goes to the grocery store this week. He actually spends $94. Find the percent of error.

\[
\frac{120 - 94}{94} = \frac{26}{94} = 0.2765
\]

\[
37.65 = 37.65 = 27.7\%
\]

11. Marcus estimates that 230 people will attend the choir concert. There was an actual total of 300 people who attended the choir concert. Find the percent of error.

\[
\frac{300 - 230}{300} = \frac{70}{300} = 0.233
\]

\[
23.3 = 23.3\%
\]

12. Ahmed wants to practice free-throws. He estimates that distance from the free-throw line to the hoop and marks it with chalk. Ahmed estimate was 13.5 feet. The actual distance should be 15 feet. Find the percent of error.

\[
\frac{15 - 13.5}{15} = \frac{1.5}{15} = 0.1
\]

\[
10\%
\]

13. Mrs. Borneman estimated that 32 students would participate in this year’s OHS math competition. On the day of the competition only 24 students showed up. Find the percent of error.

\[
\frac{32 - 24}{24} = \frac{8}{24} = 0.333
\]

\[
33.3 = 33.3\%
\]
Sales tax, Tips, and Markups Lesson 2.6

Sales tax is an additional amount of money charged on items that people buy.

Total cost of an item is the regular price plus the sales tax.

1. What is the sales tax on a $178.90 chair if the sales tax rate is 5.75%?
   \[ 0.0575 \times 178.90 = 10.28675 \]
   \[ \text{Sales tax} = 10.29 \]
   \[ \text{Total cost} = 178.90 + 10.29 = 189.19 \]

2. Drew wants to buy exercise equipment that costs $140 and the sales tax is 5.75%. What is the total cost of the equipment?
   \[ 0.0575 \times 140 = 7.905 \]
   \[ \text{Total cost} = 140 + 8.05 = 148.05 \]

3. Find the total cost to the nearest cent of a $1500 computer at a 7% tax rate?
   \[ 0.07 \times 1500 = 105 \]
   \[ \text{Total cost} = 1500 + 105 = 1605.00 \]

4. Find the total cost of a pair of $46 shoes at a sales tax rate of 2.9%.
   \[ 0.029 \times 46 = 1.334 \]
   \[ \text{Total cost} = 46 + 1.33 = 47.33 \]

5. Find the total cost of a pair of $65 jeans with a sales tax rate of 8%.
   \[ 0.08 \times 65 = 5.20 \]
   \[ \text{Total cost} = 65 + 5.20 = 70.20 \]
Tip or Gratuity is a small amount of money in return for a service.

Total price is the regular price of the service plus the tip.

1. Matt wants to leave a 20% tip on a $40 service. How much will the tip be?
   \[ \times 20 \times 40 = 8 \]
   \[ \text{(}$8\text{)} \]

2. As a waitress Marcy makes 18% on average each bill. Approximately how much tip would Marcy expect on a $85 bill?
   \[ \times 18 \times 85 = 15.3 \]
   \[ \text{(}$15.30\text{)} \]

3. A customer wants to tip 15% on a restaurant bill that is $35. What will be the total bill including the tip?
   \[ \text{tip} \times 15 \times 35 = 5.25 \]
   \[ \text{total} + 35.00 + 5.25 \]
   \[ \text{(}$40.25\text{)} \]

4. Scott wants to tip his taxicab driver 20%. If his commute costs $15, what is the total bill?
   \[ \text{tip} \times 20 \times 15 = 3 \]
   \[ \text{total} + \frac{15}{3} \]
   \[ \text{(}$18\text{)} \]

5. Find the total cost of a spa treatment of $42 including a 25% tip
   \[ \text{tip} \times 25 \times 42 = 10.50 \]
   \[ \text{total} + 42.00 + 10.50 \]
   \[ \text{(}$52.50\text{)} \]
6. A haircut costs $35. Sales tax is 4.75%. What would the total cost be if you leave a 15% tip

(hint: tip is calculated before tax AND tax does not include the tip)

\[
\begin{align*}
&\text{tip} \quad (0.15)(35) = $5.25 \\
&\text{tax} \quad (0.0475)(35) = 1.65 \\
&\text{total} \rightarrow 35.00 + 5.25 + 1.67 = $41.92
\end{align*}
\]

7. A restaurant bill comes to $28.35. Find the total cost if the tax is 6.25% and a 20% tip is left on the amount before tax.

\[
\begin{align*}
&\text{tip} \quad (0.20)(28.35) = 5.67 \\
&\text{tax} \quad (0.0625)(28.35) = 1.771875 \\
&\text{total} \rightarrow 28.35 + 5.67 + 1.78 = $35.80
\end{align*}
\]

8. You buy $23 worth of food at a restaurant. The sales tax is 8.5% and you wish to tip 20%. What is the bill after tax, how much tip should you leave, and what is the total cost of everything after tip and tax?

\[
\begin{align*}
&\text{tip} \quad (0.20)(23) = 4.60 \\
&\text{tax} \quad (0.085)(23) = 1.96 \\
&\text{total} \rightarrow 23 + 4.60 + 1.96 = $39.56
\end{align*}
\]

9. You buy $15 worth of food at a restaurant. The sales tax is 6.5% and you wish to tip 10%. What is the bill after tax, how much tip should you leave, and what is the total cost of everything after tip and tax?

\[
\begin{align*}
&\text{tip} \quad (0.10)(15) = 1.50 \\
&\text{tax} \quad (0.065)(15) = 0.975 = 0.98 \\
&\text{total} \rightarrow 15 + 1.50 + 0.98 = $17.48
\end{align*}
\]

10. You buy $37 worth of food at a restaurant. The sales tax is 6.5% and you wish to tip 15%. What is the bill after tax, how much tip should you leave, and what is the total cost of everything after tip and tax?

\[
\begin{align*}
&\text{tip} \quad (0.15)(37) = 5.55 \\
&\text{tax} \quad (0.065)(37) = 2.405 = $2.41 \\
&\text{total} \rightarrow 37 + 5.55 + 2.41 = $44.96
\end{align*}
\]
A store sells items for more than it pays for those items. The amount of increase is called the **markup**.

1. **Selling Price** is the amount the customer pays for an item.

1. A store pays $56 for a GPS navigation system. The markup is 25%. Find the selling price.
   
   1. **Markup** \((0.25 \times 56) = 14\)
   2. **Sell**: \(56 + 14 = \$70\)

2. A store pays $150 for a portable basketball backboard and the markup is 40%. What is the selling price?
   
   1. **Markup** \((0.40 \times 150) = 60\)
   2. **Sell**: \(150 + 60 = \$210\)

3. Find the selling price of a $62.25 karaoke machine with a 60.5% markup.
   
   1. **Markup** \((0.605 \times 62.25) = 37.66125\)
   2. **Sell**: \(62.25 + 37.67 = \$99.92\)

4. Find the selling price of a $270 bicycle with a 24% markup.
   
   1. **Markup** \((0.24 \times 270) = 64.80\)
   2. **Sell**: \(270 + 64.80 = \$334.80\)

5. Find the selling price of a $450 painting with a 45% markup?
   
   1. **Markup** \((0.45 \times 450) = 202.50\)
   2. **Sell**: \(450 + 202.50 = \$652.50\)
Discount or Markdown is the amount by which the regular price of an item is reduced. \( \text{① Find the discount price} \quad \text{② Subtract that from the normal price} \)

Sales price is the regular price minus the discount.

1. A DVD normally cost $22. This week it is on sale for 25% off the original price. What is the sale price of the DVD?
   \( \text{① discount} \ (0.25)(22) = 5.50 \quad \text{② sale} \ : \ 22 - 5.50 = $16.50 \)

2. A shirt is regularly priced at $42. It is on sale for 15% off of the regular price. What is the sale price of the shirt?
   \( \text{① discount} \ (0.15)(42) = 6.30 \quad \text{② sale} \ : \ 42 - 6.30 = $35.70 \)

3. A jacket that is regularly priced for $64 is advertised with a 20% discount. What is the sale price?
   \( \text{① discount} \ (0.20)(64) = 12.80 \quad \text{② sale} \ : \ 64 - 12.80 = $51.20 \)

4. A boogie board that has a regular price of $69 is on sale at a 35% discount. What is the sale price with a 7% tax?
   \( \text{① discount} \ (0.35)(69) = 24.15 \quad \text{③ tax} \ (0.07)(44.85) = 3.1395 \)
   \( \text{② sale price} \ 69 - 24.15 = $44.85 \quad \text{④ total} \ 44.85 + 3.14 = $47.99 \)
5. A tennis racket at Sport City cost $180 and is discounted 15%. The same model racket cost $200 at Tennis World and is on sale for 20% off. Which store is offering the better deal?

Sport City
1. Discount \((0.15)(180) = 27\)
2. Sale: \(180 - 27 = \$153\)

Tennis World
1. Discount \((0.20)(200) = 40\)
2. Sale: \(200 - 40 = \$160\)

Sport City has the better deal

6. A cell phone is on sale for 30% off. If the sale price is $239.89, what is the original price?

\[
\frac{0.70 x = 239.89}{x = \frac{239.89}{0.70}}
\]

\[
x = 342.70
\]

$342.70

7. The Wares want to buy a new computer. The regular price is $1,049. The store is offering a 20% discount and a sales tax of 5.25% is added after the discount. What is the total cost?

1. Discount \((0.20)(1049) = \$209.80\)
2. Sale price: \(1049 - 209.80 = \$839.20\)

3. Tax \((0.0525)(839.20) = 44.058 = \$44.06\)

4. Total: \(839.20 + 44.06 = \$883.26\)

8. What is the total cost of a $156 item with a discount of 30% and a tax rate of 6.5%?

1. Discount \((0.30)(156) = \$46.80\)
2. Sale price: \(156 - 46.80 = \$109.20\)

3. Tax \((0.065)(109.20) = 7.098 = \$7.09\)

4. Total: \(109.20 + 7.09 = \$116.30\)
Financial Literacy: Simple Interest Lesson

Simple Interest is the product of the principle (p) the annual interest rate (r) and the time expressed in years (t).

\[ I = prt \]

Example:

$4500.00 at 9.5% for 6 years

\[ I = Prt \]

\[ I = (4500.00)(0.095)(6) \]

\[ I = $2565.00 \]

1. Arnold puts $580 into a savings account. The savings account pays 3% simple interest. How much interest will he earn in 6 months?

\[ I = Prt \]

\[ I = (580)(0.03)(0.5) \]

\[ I = $8.70 \]

2. How much interest will Arnold earn in 5 years?

\[ I = (580)(0.03)(5) \]

\[ I = $87.00 \]

3. Jenny puts $1560 into a savings account. The account pays 2.5% simple interest. How much interest will she earn in 3 years?

\[ I = Prt \]

\[ I = (1560)(0.025)(3) \]

\[ I = $117 \]
4. Marcos invest $760 into a savings account. The account pays 4% simple interest. How much interest will he earn after 5 years.

\[ I = Prt \]
\[ I = (760)(0.04)(5) \]
\[ I = \boxed{152} \]

5. Max puts $500 into a saving account that pays 1.5% simple interest. How much interest will Max earn after 1.5 years?

\[ I = Prt \]
\[ I = (500)(0.015)(1.5) \]
\[ I = \boxed{11.25} \]

*If you BORROW money from a bank, you pay the bank interest for the use of their money. You also pay interest to a credit card company if you have an unpaid balance.*

6. Rondell's parents borrow $6300 from the bank for a new car. The Interest rate is 6% per year. How much simple Interest will they pay if they take 2 years to repay the loan?

\[ I = Prt \]
\[ I = (6300)(0.06)(2) \]
\[ I = \boxed{756} \]

7. Derrick's dad bought new tires for $900 on a credit card. His card has an interest rate of 19%. If he has no other charges on his card and does not make a payment, how much money will he owe after just one month?

\[ I = Prt \]
\[ I = (900)(0.19)(\frac{1}{12}) \]
\[ I = \boxed{4.25} \]

\[ 900 + 4.25 = \boxed{904.25} \]
8. Mrs. Hanover borrows $1400 at a rate of 5.5\% per year. How much simple interest will she pay if it takes 8 months to repay the loan?

\[
I = Prt \\
I = (1400)(0.055)(0.67) \\
I = 51.59
\]

9. Leon charged $75 at an interest rate of 12.5\%. How much will Leon have to pay after one month if he makes no payments?

\[
I = Prt \\
I = (75)(0.125)(0.083) \\
I = 7.872 \\
I = 7.79 \\
75 + 7.79 = 82.79
\]

10. Jamerra received a $300 car loan. She plans on paying off the loan in 2 years. At the end of 2 years, Jamerra will have paid $450 interest. What is the simple interest rate on the car loan?

\[
I = Prt \\
450 = (300)r(2) \\
\frac{450}{600} = \frac{r}{2} \\
0.75 = r \\
75% = 75\%
\]

11. If Pablo invest $4200 for 3 years and earns $360, what is the simple interest rate?

\[
I = Prt \\
360 = 4200 \cdot r \cdot 3 \\
\frac{360}{12600} = \frac{r}{12600} \\
0.285 = r
\]

\[
0.285 = 28.5\%
\]