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# Math on the Move

## Lesson 10 Percents

### **Objectives**

- Understand the relationship between decimals and percents
- Convert between decimals and percents
- Find percentages of decimals and whole numbers
- Find what percent a number is of another number

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At the grocery store, you decide to buy a pack of 3 markers for \$1 and a pack of gum for \$0.32. Your total is \$1.32. Before you check out, you notice a sign that says, "8% sales tax". What does this mean? How much will you pay?

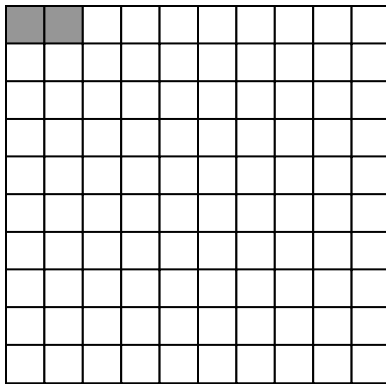
Let's begin with 8%. 8% is read as "eight **percent**."

- A **percent** is a comparison of any number to 100. The symbol % means  $\frac{1}{100}$ .

For example, 3% means  $\frac{3}{100}$ , or .03

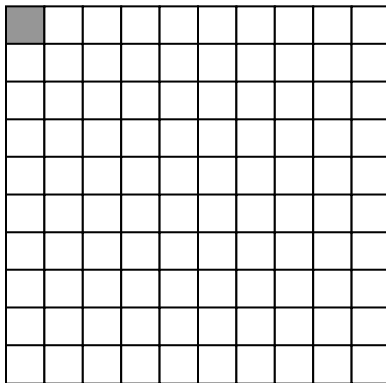
Let's think about what this means. Percents compare everything to 100.

Suppose our model equals 100, and we want to show 2.



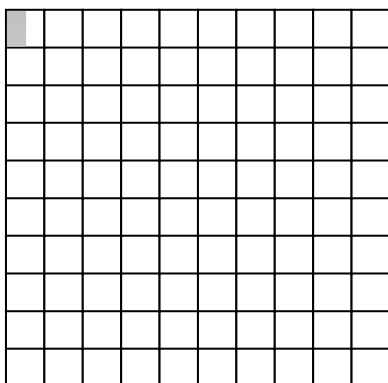
The entire model is equal to 100. When we break our model into 100 equal sized boxes, each little box is worth 1. To show 2, we shade two boxes. Since we shaded 2 out of 100 boxes, this shows us that we shaded 2% of the whole model. This tells us that 2 is 2% of 100.

What if the model is equal to 200, and we want to show 2?



Since this whole model equals 200, each little box is now worth 2. In order to show 2, we only shade 1 box. Since we shaded 1 out of 100 boxes, this shows us that 2 is 1% of 200.

Let's keep the value of the whole model at 200, but let's show 1.



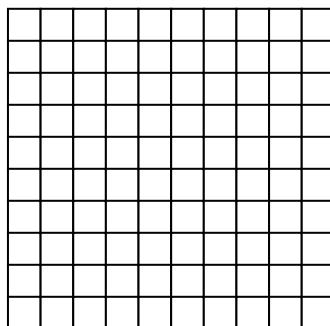
The whole is worth 200, so each little box is worth 2. One is half of 2, so 1 is shown by shading half of a little box. Since we shaded one half of a box out of 100 boxes, this shows that 1 is 0.5% of 200.



Given the value of the whole model, shade in the value compared to it, state how much each little box is worth, then state the percent it takes up.

1. The whole is 100, so each little square is worth \_\_\_\_\_.

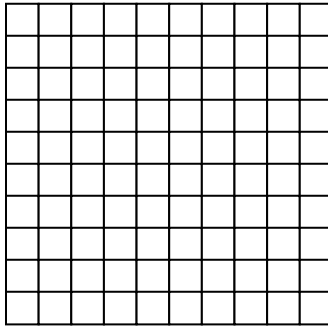
Now shade 37.



Percent that 37 is of 100: \_\_\_\_\_

2. The whole is 200, so each little square is worth \_\_\_\_\_.

Now shade in 75

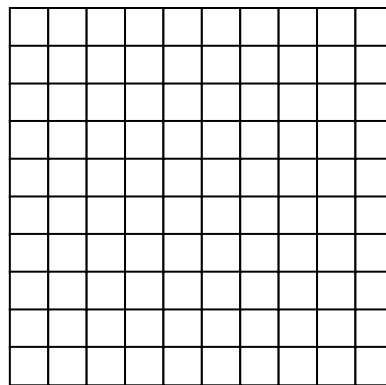
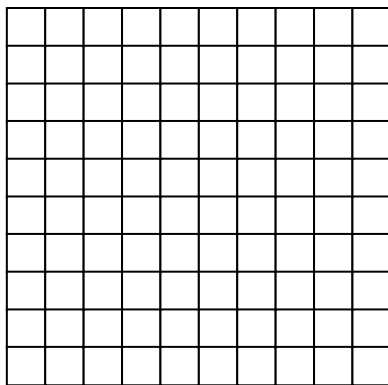


The percent that 75 is of 200: \_\_\_\_\_

3. The whole represents 50. The value of one little box is \_\_\_\_\_.

Now shade 60.

(*Hint:* There are two wholes. 60 is bigger than 50).

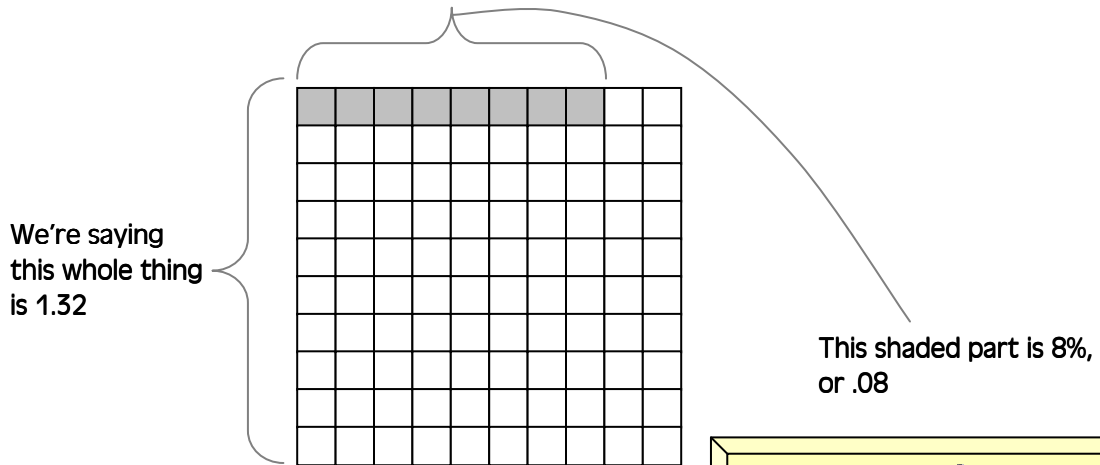


The percent 60 is of 50: \_\_\_\_\_

Now back to the marker and gum purchase. There is an 8% sales tax on the \$1.32 purchase,

8% really means  $\frac{8}{100}$  or .08, so the tax is .08 of 1.32

If we use a model again, we say the whole is 1.32, and we want to know how much the shaded area represents



One box of the whole is one hundredth of 1.32, or

$$1.32 \times .01$$

The 8 shaded boxes represent the tax on the items, or

$$1.32 \times .08$$

**FACT**

*The word "of" implies multiplication. For example, half of four means  $\frac{1}{2} \times 4$*

Think back to our method for multiplying decimals (from Lesson 9). Multiply

$$\begin{array}{r} 132 \\ \times 8 \\ \hline 1056 \end{array}$$

We need to move the decimal point four places to the left in our answer. The sales tax, then, is

$$\$0.1056$$

Rounded to the nearest cent (or hundredth), the sales tax becomes,

$$\$0.11$$

So, the total for the markers and gum is the cost of purchase plus the sales tax.

$$\begin{aligned} 1.32 + .11 &= 1.43 \\ &= \$1.43 \end{aligned}$$



### Algorithm

**To find a percentage of a number:**

1. Convert the percent to a decimal by moving the decimal point two places to the left.
2. Multiply the decimal by the number.

Find 13% of 75.

$$13\% = 0.13$$

$$\begin{aligned} 75 \times 0.13 \\ = 9.75 \end{aligned}$$

### **Example**

What is 15% of 13?

**Solution**

*Step 1:*

$$15\% = 15 \div 100 = 0.15$$

*Step 2:*

$$0.15 \times 13$$

$$\begin{array}{r} 15 \\ \times 13 \\ \hline 45 \\ + 150 \\ \hline 195 \end{array}$$

**1.95**

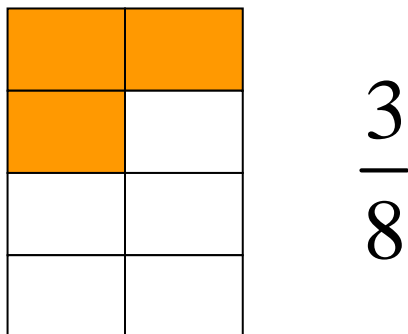
Sometimes, we are given two numbers and asked to find a percent.

### **Example**

What percent of 8 is 3?

**Solution**

We want to know what percent 3 is out of 8. In other words, we want to know



This is 3 of 8. As a decimal, this is

$$\begin{array}{r} .375 \\ 8 \overline{) 3.000} \\ \underline{-2.4} \phantom{0} \\ 60 \\ \underline{-56} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

Now, we would like to show this as a percent. We said before that

$$\% = \frac{1}{100}$$

so,

$$\begin{aligned} & 100\% \\ &= 100 \times \frac{1}{100} \\ &= \frac{100}{100} \\ &= 1 \end{aligned}$$

We may multiply anything by 100% because of the identity property of multiplication!



This means, as a percent,

$$\begin{aligned} &.375 \\ &= .375 \times 100\% \\ &= 37.5\% \end{aligned}$$

What we just found is that 3 is 37.5% of 8. We can make this into a rule for finding percents.



### Algorithm

**To find what percent a number is of another number:**

1. Convert the statement into a fraction of the form "is over of," or  $\frac{\text{"is"}}{\text{"of"}}$ .
2. Convert the fraction to a decimal using long division.
3. Convert the decimal to a percentage. Multiply the decimal by 100, and write a % sign at the end of the number.

### **Example**

To the nearest percent, what percent of 11 is 3?

#### **Solution**

Step 1:  $\frac{\text{"is"}}{\text{"of"}}$

Here, we see that 3 "is" some percentage "of" 11. So our fraction is

$$\frac{\text{"is"}}{\text{"of"}} = \frac{3}{11}$$

Step 2: Convert to a decimal

$$\begin{array}{r} \frac{3}{11} \\ = 11 \overline{)3.000\dots} \\ \underline{- 2.2} \phantom{00} \\ 80 \phantom{0} \\ \underline{- 77} \phantom{0} \\ 30 \phantom{0} \\ \underline{- 22} \phantom{0} \\ \phantom{0} \phantom{0} \phantom{0} \dots \\ = \overline{.27} \end{array}$$

Step 3: Convert to a percent

$$\begin{aligned} \overline{.27} &\times 100\% \\ &= 27.\overline{27}\% \end{aligned}$$

Step 4: Round to the nearest percent

$$27.\overline{27}\% \approx 27\%$$

**Example**

Convert 38% to a decimal.

**Solution**

Going back to the meaning of percent,

$$\begin{aligned} 38\% &= 38 \times \frac{1}{100} \\ &= \frac{38}{100} \\ &= .38 \end{aligned}$$

We simply moved the decimal point two spaces to the left!



**Algorithm**

**To convert from a decimal to a percent:**

1. Move the decimal point two places to the right
2. Put a % sign at the end.

0.43

43

43%

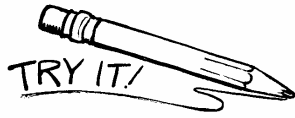
**To convert from a percent to a decimal:**

1. Drop the % sign.
2. Move the decimal point two places to the left.

17%

17

0.17



4) What percent of 5 is 4?

5) What is 14% of 2,350?

6) Convert the percents to decimals.

- |        |          |         |
|--------|----------|---------|
| a) 10% | b) 25%   | c) 19%  |
| d) 61% | e) 72.1% | f) 129% |

7) Convert each decimal into a percent.

- |         |         |          |         |
|---------|---------|----------|---------|
| a) 0.14 | b) 0.10 | c) 0.78  | d) 0.01 |
| e) 1.02 | f) 0.75 | g) 0.003 | h) 2.45 |

8) Write an example showing when something is greater than 100% in real life.

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## Review

1. Highlight the following definitions
  - a. percent
2. Highlight all the "Algorithm" boxes.
3. Write one question you would like to ask your mentor, or one new thing you learned in this lesson.

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## Practice Problems

### Math On the Move Lesson 10

Directions: Write your answers in your math journal. Label this exercise Math On the Move – Lesson 10, Set A and Set B.

#### ***Set A***

1. Find:

- |               |              |               |               |
|---------------|--------------|---------------|---------------|
| a) 10% of 30  | b) 15% of 75 | c) 50% of 47  | d) 25% of 20  |
| e) 19% of 279 | f) 4% of 46  | g) 3.5% of 99 | h) 127% of 66 |

2. Convert the following fractions to percents.

- |                  |                  |                   |                  |
|------------------|------------------|-------------------|------------------|
| a) $\frac{1}{2}$ | b) $\frac{1}{4}$ | c) $\frac{3}{11}$ | d) $\frac{6}{5}$ |
|------------------|------------------|-------------------|------------------|

e)  $\frac{2}{12}$

f)  $\frac{7}{8}$

g)  $1\frac{1}{5}$

h)  $\frac{9}{10}$

3. Solve the following percent word problems

- a) 10 is what percent of 60?    b) 2 is what percent of 55?  
 c) 20 is what percent of 22?    d) 4.5 is what percent of 12?

**Set B**

1. Put the following in order from least to greatest

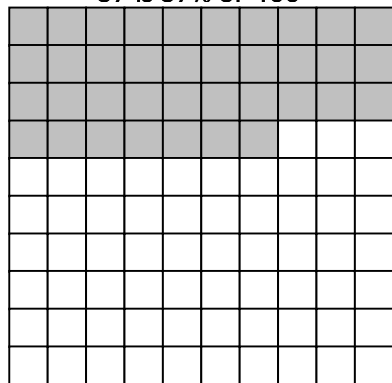
$$0, 13\% \text{ of } 5, .1, 1, \frac{2}{3}$$

2. At the store, you have a coupon for 30% off a \$4.00 gallon of orange juice.

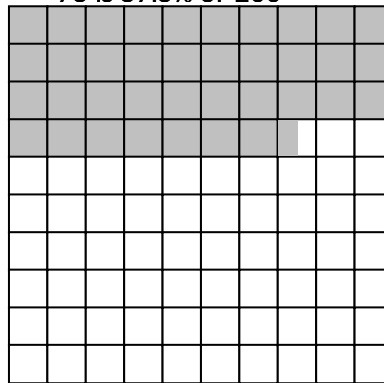
- a) Can you solve this by saying that you will pay 70% of \$4.00?  
 b) Solve for how much the juice will cost with the discount.  
 c) After the discount, there is an 8% sales tax. How much will the juice cost now?

**ANSWERS TO TRY IT**

1. Each box is worth 1  
 37 is 37% of 100

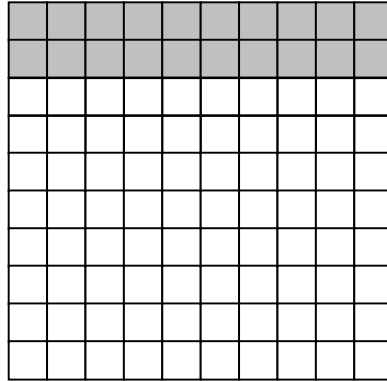
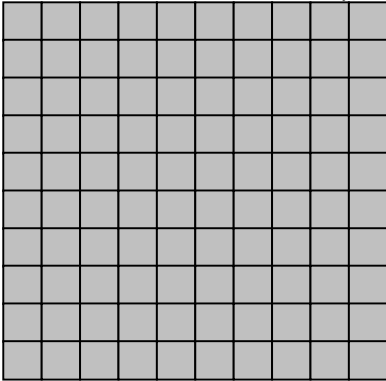


2. Each box is worth 2  
 75 is 37.5% of 200



3.

Each box is worth .5, and 60 is 120% of 50



4.  $\frac{4}{5} = 80\%$

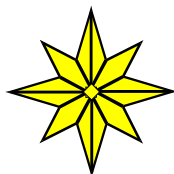
5. 329

6. a) .1      b) .25      c) .19      d) .61      e) .721 f) 1.29

7. a) 14%      b) 10%      c) 78%      d) 1%      e) 102%      f) 75%  
g) 0.3%      h) 245%

8. It is possible to have more than 100%. Imagine that you have \$10. Then, the next week you have \$20. You have 200% of what you started with!

**NOTES**



**End of Lesson 10**