

## PERCENT

### Lesson 1 Percent of a Number Word Problems

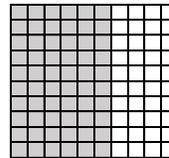
#### 1. WHAT IS PERCENT?

Percent is used to show a portion of a total. You are probably familiar with 50%, which means half of the total, 100% which means all of the total, and 0% which means none of the total.

You can think of percent as parts out of 100. For example, 35% means that if you divide one whole thing into 100 equal pieces, you have 35 of those pieces. It can be helpful to think about a specific percent in terms of where it fits between 0% and 100%.

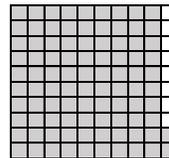
**You know that 50% means half, so 60% means a little more than half**, because 60 is a little more than 50. 60% of my pay means a little more than half of my pay.

60 out of 100 squares are shaded.  
60% of the squares are shaded.  
A little more than half of the whole thing is shaded.



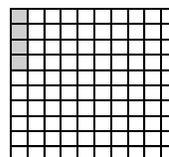
**You know that 100% means all of something, so 92% means almost all of something**, because 92 is almost as big as 100. If an employee is on time 92% of the days, the employee is on time almost all of the days, but not quite all of the days.

92 out of 100 squares are shaded.  
92% of the squares are shaded.  
Almost all of the whole thing is shaded.



**You know that 0% means none of something, so 4% means a very small amount of something**, because 4 is just a little bigger than 0. If 4% of parts being manufactured are defective, it means a very small amount of parts are defective.

4 out of 100 squares are shaded.  
4% of the squares are shaded.  
A very small amount of the whole thing is shaded.



## 2. CONVERTING PERCENTS TO DECIMALS

Before you can do mathematical operations with a percent like 42%, you must convert it to a fraction or a decimal. We will focus on converting to a decimal, as that is easier for most people.

**The rule is:** Locate the decimal point in the number, move it 2 places to the left, then drop the percent sign.

**TIP** – The number 42 is the same as 42.0, but we don't write the .0 part.

The decimal point is located to the right of the 2, even though it is not written.

### Examples

$$42\% \rightarrow 42.\% \rightarrow \underset{\cup}{4}\underset{\cup}{2}.\% \rightarrow .42 \quad 42\% = .42 = 0.42$$

$$2\% \rightarrow 2.\% \rightarrow \underset{\cup}{2}\underset{\cup}{.}\% \rightarrow .02 \quad 2\% = .02 = 0.02$$

Notice that if the percentage is a number less than 10, you will have an empty slot after moving the decimal point 2 places to the left. Fill the slot with a 0.

Study the difference between the following two conversions:  $2\% = 0.02$   
 $20\% = 0.2$

A common mistake is to convert a percent like 2% to 0.2 instead of to 0.02.

**NOTE** – 0.02 is the same as .02  
0.42 is the same as .42

The only difference is that 0.02 and 0.42 have a 0 filling the ones column. In formal writing this is the way you will usually see it, and it is also the way it will display on the calculator.

To enter a decimal on the calculator, it is faster to enter .02 instead of 0.02, but either is correct and will work fine.

**NOTE** – When a decimal comes at the end of a sentence it is followed by a period, like you see in this sentence: Next, calculate 8% of \$42.50. This looks a little odd. Don't think it is another decimal point. It is just the period that ends the sentence.

**Percents can have a decimal point within the number.** For example, 62.6% means an amount greater than 62% but less than 63%. Convert to a decimal the same way as above. Move the decimal point 2 places to the left, and drop the percent sign.

### Examples

$$62.6\% \rightarrow \underset{\cup}{6}\underset{\cup}{2}.6\% \rightarrow .626 \quad 62.6\% = .626 = 0.626$$

$$3.4\% \rightarrow \underset{\cup}{3}\underset{\cup}{.}4\% \rightarrow .034 \quad 3.4\% = .034 = 0.034$$

**You can also use the calculator to convert percents to decimals.**

**The rule is:** Enter the number and divide by 100.

To convert 29% to a decimal, enter  $29 \div 100 =$  the calculator displays 0.29

To convert 7.8% to a decimal, enter  $7.8 \div 100 =$  the calculator displays 0.078

**Practice One** Convert the following percents to decimals. Answers – p. 9

- |        |          |
|--------|----------|
| 1. 52% | 6. 14%   |
| 2. 4%  | 7. 3.9%  |
| 3. 33% | 8. 77.8% |
| 4. 6%  | 9. 66.6% |
| 5. 60% | 10. 5%   |

### 3. CALCULATING THE PERCENT OF A NUMBER

Most percent word problems involve calculating the percent of a number. For example, a question may ask: How much tip will you leave if your restaurant bill is \$23 and you want to leave a 15% tip?

You need to get: the **percent** of a **number**.

The tip will be: **15%** of **\$23**.

Think of the word “of” as multiplication and follow these steps to find the percent of a number.

1. Convert the percent to a decimal.
2. Replace the word “of” with the multiplication sign.
3. Calculate.

#### Example 1

$$15\% \text{ of } \$23 \rightarrow 0.15 \times \$23 = \mathbf{\$3.45}$$

#### Example 2

$$45\% \text{ of } 950 \rightarrow 0.45 \times 950 = \mathbf{427.5} \quad \text{If needed, round to } \mathbf{428}.$$

#### Example 3

$$7\% \text{ of } \$57.50 \rightarrow 0.07 \times \$57.50 = \mathbf{\$4.025} \quad \text{Round to } \mathbf{\$4.03}, \text{ or } \mathbf{\$4}.$$

#### Example 4

$$2.8\% \text{ of } 6,950 \rightarrow 0.028 \times 6,950 = \mathbf{194.6} \quad \text{If needed, round to } \mathbf{195}.$$

**TIP** – On the HiSET Math Test, look at the way the multiple choice answers are rounded to see how you should round your answer.

**Percents can be greater than 100%.**

If you know that 100% is the whole thing, then percents greater than 100% mean you have more than the whole thing.

200% is like 100% + 100%, or, the whole thing twice, so multiply x 2.

$$200\% \text{ of } 8 = 2 \times 8 = 16$$

300% is the whole thing three times, so multiply x 3.

$$300\% \text{ of } 8 = 3 \times 8 = 24$$

150% is the whole thing plus another half of the thing, so multiply x 1.5.

$$150\% \text{ of } 8 = 1.5 \times 8 = 12$$

**Example 5**

200% of 350

Move the decimal 2 places to the left and drop the % sign.

$$200\% \rightarrow 200.\% \rightarrow 2.00 \rightarrow 2$$

$$2 \times 350 = \mathbf{700}$$

**Example 6**

125% of \$60

Move the decimal 2 places to the left and drop the % sign.

$$125\% \rightarrow 125.\% \rightarrow 1.25$$

$$1.25 \times \$60 = \mathbf{\$75}$$

**Example 7**

136% of \$150

Move the decimal 2 places to the left and drop the % sign.

$$136\% \rightarrow 136.\% \rightarrow 1.36$$

$$1.36 \times \$150 = \mathbf{\$204}$$

**Practice Two**

*Find the following percents. Answers – p. 9*

1. 16% of 77

8. 67% of \$800

2. 2% of 60

9. 47.7% of 90

3. 20% of 60

10. 4% of 12,500

4. 6.5% of \$18

11. 9% of 400

5. 15% of 499

12. 100% of 57

6. 150% of 40

13. 120% of \$39

7. 500% of 229

14. 106% of 90

## 4. BASIC PERCENT WORD PROBLEMS – THE PERCENT OF A NUMBER

### Example 1

Maya's hairdresser charged her \$40 for a haircut, and Maya wants to leave a 15% tip. How much tip will she leave?

- A. \$600      B. \$6      C. \$60      D. \$46      E. \$25

The amount of tip will be 15% of \$40. Convert 15% to a decimal and multiply.

$$15\% \text{ of } \$40 \rightarrow 0.15 \times \$40 = \$6$$

**Answer: B. \$6**

**NOTE** – The question asked is: How much tip will she leave? Answer: \$6

The question could also have been: What is the total Maya will pay her hairdresser? To answer that question, you would have to add the \$6 tip to the \$40 haircut charge for a total of \$46.

Be careful when reading and doing percent problems. Make sure you are answering the question that is being asked. Often, additional steps will be needed after you do the percent calculation.

### Example 2

A customer ordered some books that cost \$42.50 from an on-line store. A shipping & handling charge of 8% of the cost is added to the order. What is the total cost of the order?

- A. \$3.40      B. \$50.50      C. \$39.10      D. \$34.00      E. \$45.90

Shipping & handling charge is 8% of \$42.50. Convert 8% to a decimal and multiply.

$$8\% \text{ of } \$42.50 \rightarrow 0.08 \times \$42.50 = \$3.40$$

Add to cost of books to get the total cost of the order.  $\$42.50 + \$3.40 = \$45.90$

**Answer: E. \$45.90**

### Example 3

An artist has to pay a 35% commission to the art gallery on any of her paintings sold at the gallery. If she sold paintings totaling \$2,295, what is the approximate amount she will have to pay in commission?

- A. \$800      B. \$850      C. \$65      D. \$70      E. \$750

The amount of commission will be 35% of \$2,295.

Convert 35% to a decimal and multiply.

$$35\% \text{ of } \$2,295 \rightarrow 0.35 \times \$2,295 = \$803.25$$

The problem asks for the approximate amount, so round \$803.25 down to \$800.

**Answer: A. \$800**

### Example 4

For his office meeting, Joe ordered 2 dozen donuts, 8 muffins, and 1 fruit tray as priced in the chart below. If Joe's state has a 6% sales tax on food items, what is the total cost of all the food ordered?

- A. \$3.16      B. \$52.69      C. \$55.85      D. \$42.70      E. \$84.30

Item	Price Each	Price per Dozen
Donut	\$1.05	\$9.99
Muffin	\$1.59	\$16.99
Bagel	\$1.25	\$12.99
Fruit Cup	\$1.50	\$16.99
Fruit Tray	\$19.99	n/a

**Step One** – Add up the cost of the food.

Donuts:  $2 \times \$9.99 = \$19.98$

Muffins:  $8 \times \$1.59 = \$12.72$

Fruit Tray:  $1 \times \$19.99 = \$19.99$

Total =  $\$19.98 + \$12.72 + \$19.99 = \$52.69$

**Step Two** – Calculate the sales tax.

6% of \$52.69  $\rightarrow 0.06 \times \$52.69 = \$3.1614 \rightarrow \$3.16$

**Step Three** – Add the food cost and sales tax together.

$\$52.69 + \$3.16 = \$55.85$

**Answer: C. \$55.85**

### Example 5

If a clothing store is having a 20% off sale, what is the sale price of a hat that is regularly priced at \$35?

- A. \$7      B. \$15      C. \$42      D. \$28      E. \$25

The discount is 20% of \$35  $\rightarrow 0.2 \times \$35 = \$7$

Sale price = Regular price – Discount  $\rightarrow \$35 - \$7 = \$28$

**Answer: D. \$28**

**Think about it** – The regular price is 100% of the cost of the hat, and 20% is being deducted as a discount. What percent of the regular price is left over for the sale price of the hat?  $100\% - 20\% = 80\%$

So, a way to do this problem in one step is to calculate 80% of the regular price.

80% of \$35  $\rightarrow 0.8 \times \$35 = \$28$



Do this kind of problem in whichever way makes the most sense to you. Most people prefer the first way shown with two steps.

### **Example 6**

Mrs. Kayem's restaurant bill was \$25 and she left a 15% tip. What was the total amount that she paid?

- A. \$3.75      B. \$3.00      C. \$40.00      D. \$28.75      E. \$35.00

The amount of tip will be 15% of \$25. Convert 15% to a decimal and multiply.

$$15\% \text{ of } \$25 \rightarrow 0.15 \times \$25 = \$3.75$$

The question asks for the total amount paid, so add the tip to the restaurant bill.

$$\$25 + \$3.75 = \$28.75 \quad \text{Answer: D. } \$28.75$$

**Think about it** – \$25 is 100% of the restaurant bill, and another 15% of the restaurant bill is being added as a tip. A total of  $100\% + 15\% = 115\%$  of the restaurant bill will be paid. So, a way to do this problem in one step is to calculate 115% of \$25.

$$115\% \text{ of } \$25 \rightarrow 1.15 \times \$25 = \$28.75$$

Do this kind of problem in whichever way makes the most sense to you. Most people prefer the first way shown with two steps.

### **Practice Three**      Answers – p. 9

1. The Marquez family had to make a 20% down payment to purchase their new house which cost \$189,000. What was the amount of the down payment?

- A. \$37,800      B. \$9,450      C. \$151,200      D. \$39,600      E. \$3,780

2. How much will a shopper save on a winter coat if the store is having a 15% off sale, and the coat's regular price is \$45?

- A. \$38.25      B. \$3.00      C. \$30.00      D. \$6.75      E. \$6.00

3. A family purchased 8 notebooks, 3 packs of pencils, and 4 packs of pens for their back to school supplies. If sales tax in their state is 7%, and prices for the supplies are as shown in the chart below, what was the total cost of the school supplies?

- A. \$24.13      B. \$22.55      C. \$23.85      D. \$25.25      E. \$25.52

Item	Price Each
Notebooks	\$1.29
Pack of Pens	\$2.49
Pack of Pencils	\$1.19

- 4.** The goal of a manufacturing company is to have no more than 2% of all parts that are made labeled as defective by the quality control department. If the company makes 2,500 parts per day, what is the maximum number of defective parts the company can have per day and still meet its goal?  
A. 500      B. 50      C. 13      D. 40      E. 400
- 5.** A store is having a 25% off sale. What is the sale price of a TV that is regularly priced at \$349.99?  
A. \$87.50      B. \$14.00      C. \$226.49      D. \$262.49      E. \$324.99
- 6.** If a customer had to pay an energy surcharge of 2.5% on a shipment of merchandise that cost \$1,500, what was the customer's total bill?  
A. \$1,875.00      B. \$600.00      C. \$1,537.50      D. \$37.50      E. \$375.00
- 7.** If a company donates 3% of its profits to charity, and profits were \$20,250 what is the approximate amount of the donation?  
A. \$6,000      B. \$60      C. \$600      D. \$7,000      E. \$700
- 8.** If a taxi cab fare is \$18.50, and the rider wants to leave a 15% tip, how much will he pay the cab driver?  
A. \$2.78      B. \$21.28      C. \$33.50      D. \$28.21      E. \$2.87

## ANSWER KEY Lesson 1 Percent of a Number Word Problems

### **Practice One**

1.  $52\% = .52$  or **0.52**
2.  $4\% = .04$  or **0.04**
3.  $33\% = .33$  or **0.33**
4.  $6\% = .06$  or **0.06**
5.  $60\% = .6$  or **0.6**
6.  $14\% = .14$  or **0.14**
7.  $3.9\% = .039$  or **0.039**
8.  $77.8\% = .778$  or **0.778**
9.  $66.6\% = .666$  or **0.666**
10.  $5\% = .05$  or **0.05**

### **Practice Two**

1.  $16\%$  of 77  $\rightarrow 0.16 \times 77 = \mathbf{12.32}$
2.  $2\%$  of 60  $\rightarrow 0.02 \times 60 = \mathbf{1.2}$
3.  $20\%$  of 60  $\rightarrow 0.2 \times 60 = \mathbf{12}$
4.  $6.5\%$  of \$18  $\rightarrow 0.065 \times \$18 = \mathbf{\$1.17}$
5.  $15\%$  of 499  $\rightarrow 0.15 \times 499 = \mathbf{74.85}$
6.  $150\%$  of 40  $\rightarrow 1.5 \times 40 = \mathbf{60}$
7.  $500\%$  of 229  $\rightarrow 5 \times 229 = \mathbf{1,145}$
8.  $67\%$  of \$800  $\rightarrow 0.67 \times \$800 = \mathbf{\$536}$
9.  $47.7\%$  of 90  $\rightarrow 0.477 \times 90 = \mathbf{42.93}$
10.  $4\%$  of 12,500  $\rightarrow 0.04 \times 12,500 = \mathbf{500}$
11.  $9\%$  of 400  $\rightarrow 0.09 \times 400 = \mathbf{36}$
12.  $100\%$  of 57  $\rightarrow 1 \times 57 = \mathbf{57}$
13.  $120\%$  of \$39  $\rightarrow 1.2 \times \$39 = \mathbf{\$46.80}$
14.  $106\%$  of 90  $\rightarrow 1.06 \times 90 = \mathbf{95.4}$

### **Practice Three**

1. The Marquez family had to make a 20% down payment to purchase their new house which cost \$189,000. What was the amount of the down payment?  
**A. \$37,800**    B. \$9,450    C. \$151,200    D. \$39,600    E. \$3,780

The amount of down payment was 20% of \$189,000.

$$20\% \text{ of } \$189,000 \rightarrow 0.2 \times \$189,000 = \$37,800 \quad \text{Answer: A. } \$37,800$$

**NOTE** – When buying an expensive item like a car or a house, most people pay a portion of the price at the time of purchase, and take out a loan for the rest of the purchase price. The amount paid at the time of purchase is called a down payment.

2. How much will a shopper save on a winter coat if the store is having a 15% off sale, and the coat's regular price is \$45?  
**A. \$38.25**    B. \$3.00    C. \$30.00    **D. \$6.75**    E. \$6.00

The amount of savings is 15% of \$45  $\rightarrow 0.15 \times \$45 = \$6.75$

**Answer: D. \$6.75**

3. A family purchased 8 notebooks, 3 packs of pencils, and 4 packs of pens for their back to school supplies. If sales tax in their state is 7%, and prices for the supplies are as shown in the chart below, what was the total cost of the school supplies?

- A. \$24.13      B. \$22.55      C. \$23.85      D. \$25.25      E. \$25.52

Item	Price Each
Notebooks	\$1.29
Pack of Pens	\$2.49
Pack of Pencils	\$1.19

**Step One** – Add up the cost of the supplies.

Notebooks:  $8 \times \$1.29 = \$10.32$

Pencils:  $3 \times \$1.19 = \$3.57$

Pens:  $4 \times \$2.49 = \$9.96$

Total =  $\$10.32 + \$3.57 + \$9.96 = \$23.85$

**Step Two** – Calculate the sales tax.

7% of \$23.85  $\rightarrow 0.07 \times \$23.85 = \$1.6695 \rightarrow \$1.67$

**Step Three** – Add the supplies cost and sales tax together.

$\$23.85 + \$1.67 = \$25.52$

**Answer: E. \$25.52**

**OR**

100% of the cost plus another 7% for the tax is  $100\% + 7\% = 107\%$  of the cost.

107% of \$23.85  $\rightarrow 1.07 \times \$23.85 = \$25.5195 \rightarrow \$25.52$

4. The goal of a manufacturing company is to have no more than 2% of all parts that are made labeled as defective by the quality control department. If the company makes 2,500 parts per day, what is the maximum number of defective parts the company can have per day and still meet its goal?

- A. 500      **B. 50**      C. 13      D. 40      E. 400

2% of 2,500 parts is the maximum number of defective parts within the stated goal.

2% of 2,500  $\rightarrow 0.02 \times 2,500 = 50$

**Answer: B. 50**

5. A store is having a 25% off sale. What is the sale price of a TV that is regularly priced at \$349.99?

- A. \$87.50      B. \$14.00      C. \$226.49      **D. \$262.49**      E. \$324.99

The discount is 25% of \$349.99  $\rightarrow 0.25 \times \$349.99 = \$87.4975 \rightarrow \$87.50$

Sale price = Regular price – Discount  $\rightarrow \$349.99 - \$87.50 = \$262.49$

**Answer: D. \$262.49**

**OR** – If the regular price is 100% of the cost, and 25% is being deducted as a discount,  $100\% - 25\% = 75\%$  is the amount left to pay.

75% of \$349.99  $\rightarrow 0.75 \times \$349.99 = \$262.4925 \rightarrow \$262.49$

6. If a customer had to pay an energy surcharge of 2.5% on a shipment of merchandise that cost \$1,500, what was the customer's total bill?

- A. \$1,875      B. \$600.00      **C. \$1,537.50**      D. \$37.50      E. \$375.00

Surcharge is 2.5% of \$1,500  $\rightarrow 0.025 \times \$1,500 = \$37.50$

Add merchandise cost plus surcharge to get total bill.

$\$1,500 + \$37.50 = \$1,537.50$       **Answer: C. \$1,537.50**

**OR** – 100% of the cost plus another 2.5% for the surcharge is

$100\% + 2.5\% = 102.5\%$  of the cost.

102.5% of \$1,500  $\rightarrow 1.025 \times \$1,500 = \$1,537.50$

7. If a company donates 3% of its profits to charity, and profits were \$20,250 what is the approximate amount of the donation?

- A. \$6,000      B. \$60      **C. \$600**      D. \$7,000      E. \$700

The donation is 3% of \$20,250  $\rightarrow 0.03 \times \$20,250 = \$607.50$

The question asks for the approximate amount, so round to \$600.

**Answer: C. \$600**

8. If a taxi cab fare is \$18.50, and the rider wants to leave a 15% tip, how much will he pay the cab driver?

- A. \$2.78      **B. \$21.28**      C. \$33.50      D. \$28.21      E. \$2.87

The tip is 15% of \$18.50  $\rightarrow 0.15 \times \$18.50 = \$2.775 \rightarrow \$2.78$

Total paid to cab driver:  $\$18.50 + \$2.78 = \$21.28$

**Answer: B. \$21.28**

**OR** – 100% of the cost plus another 15% for the tip is

$100\% + 15\% = 115\%$  of the cost.

115% of \$18.50  $\rightarrow 1.15 \times \$18.50 = \$21.275 \rightarrow \$21.28$