

## 2.2.10: Percents Part 3



You may use a calculator throughout this module.

There is one more situation involving percents that often trips people up: working backwards from the result of a percent change to find the original value.

$$\text{Amount} = \text{Rate} \cdot \text{Base}$$

$$A = R \cdot B$$

### Finding the Base After Percent Increase

Suppose a 12% tax is added to a price; what percent of the original is the new amount?

Well, the original number is 100% of itself, so the new amount must be  $100\% + 12\% = 112\%$  of the original.

As a proportion,  $\frac{A}{B} = \frac{112}{100}$ . As an equation,  $A = 1.12 \cdot B$ .

If a number is **increased** by a percent, add that percent to 100% and use that result for  $R$ .

The most common error in solving this type of problem is applying the percent to the new number instead of the original. For example, consider this question: “After a 12% increase, the new price of a computer is \$ 1, 120. What was the original price?”

People often work this problem by finding 12% of \$ 1, 120 and subtracting that away: 12% of 1, 120 is 134.40 and  $1, 120 - 134.40 = 985.60$ . It appears that the original price was \$ 985.60 but if we check this result, we find that the numbers don’t add up. 12% of 985.60 is 118.272 and  $985.60 + 118.272 = 1, 103.872$  not 1, 120.

The correct way to think about this is  $1, 120 = 1.12 \cdot B$ . Dividing 1, 120 by 1.12 gives us the answer 1, 000, which is clearly correct because we can find that 12% of 1, 000 is 120, making the new amount 1, 120. The original price was \$ 1, 000.

To summarize, we cannot subtract 12% from the new amount; we must instead **divide** the new amount by 112%.

#### ? Exercises 2.2.10.1

1. A sales tax of 8% is added to the selling price of a lawn tractor, making the total price \$ 1, 402.92. What is the selling price of the lawn tractor without tax?
2. The U.S. population in 2018 was estimated to be 327.2 million, which represents a 7.6% increase from 2008. What was the U.S. population in 2008?

#### Answer

1. \$ 1, 299.00
2. 304.1 million

### Finding the Base After Percent Decrease

Suppose a 12% discount is applied to a price; what percent of the original is the new amount?

As above, the original number is 100% of itself, so the new amount must be  $100\% - 12\% = 88\%$  of the original.

As a proportion,  $\frac{A}{B} = \frac{88}{100}$ . As an equation,  $A = 0.88 \cdot B$ .

If a number is **decreased** by a percent, subtract that percent from 100% and use that result for  $R$ .

As above, the most common error in solving this type of problem is applying the percent to the new number instead of the original. For example, consider this question: “After a 12% decrease, the new price of a computer is \$ 880. What was the original price?”

People often work this problem by finding 12% of 880 and adding it on: 12% of 880 is 105.60 and  $880 + 105.60 = 985.60$ . It appears that the original price was \$ 985.60 but if we check this result, we find that the numbers don’t add up. 12% of 985.60 is 118.272 and  $985.60 - 118.272 = 867.328$  not 880.

The correct way to think about this is  $880 = 0.88 \cdot B$ . Dividing 880 by 0.88 gives us the answer 1,000, which is clearly correct because we can find that 12% of 1,000 is 120, making the new amount 880. The original price was \$ 1,000.

To summarize, we cannot add 12% to the new amount; we must instead **divide** the new amount by 88%.

### ? Exercises 2.2.10.1

3. A city department’s budget was cut by 5% this year. If this year’s budget is \$ 3.04 million, what was last year’s budget?
4. CCC’s enrollment in Summer 2019 was 9,116 students, which was a decrease of 2.17% from Summer 2018. What was the enrollment in Summer 2018? (Round to the nearest whole number.)<sup>[1]</sup>
5. An educational website claims that by purchasing access for \$ 5, you’ll save 69% off the standard price. What was the standard price? (Use your best judgment when rounding your answer.)

#### Answer

3. \$ 3.20million
4. 9,318students
5. \$ 16.13 or more likely, just \$ 16.

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1. These enrollment numbers don't match those in Percents Part 2, which makes me wonder how accurate the yearly reports are. Or maybe I inadvertently grabbed data from two different ways that enrollment was being counted. ↩
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