Percent Error

Let's use percentages to describe other situations that involve error.

14.1 Math Talk: What Percentage?

Find each percentage mentally.

- 3 is what percent of 6?
- 3 is what percent of 12?
- 3 is what percent of 120?
- 3 is what percent of 600?

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14.2 Plants, Bicycles, and Crowds

1. Instructions to care for a plant say to water it with $\frac{3}{4}$ cup of water every day. The plant has been getting 25% too much water. How much water has the plant been getting?

2. The pressure on a bicycle tire is 63 psi. This is 5% higher than what the manual says is the correct pressure. What is the correct pressure?

3. The crowd at a sporting event is estimated to be 3,000 people. The exact attendance is 2,486 people. What is the **percent error**?

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Are you ready for more?

A micrometer is an instrument that can measure lengths to the nearest micron. (A micron is a millionth of a meter.) Would this instrument be useful for measuring any of the following things? If so, what would the largest percent error be?

1. the thickness of an eyelash, which is typically about 0.1 millimeter

2. the diameter of a red blood cell, which is typically about 8 microns

3. the diameter of a hydrogen atom, which is about 100 picometers (a picometer is a trillionth of a meter).

14.3 Saw Mill

1. A saw mill cuts boards that are 16 feet long. After they are cut, the boards are inspected and rejected if the length has a percent error of 1.5% or more.

   a. List some board lengths that should be accepted.

   b. List some board lengths that should be rejected.

2. The saw mill also cuts boards that are 10, 12, and 14 feet long. An inspector rejects a board that is 2.3 inches too long. What was the intended length of the board?

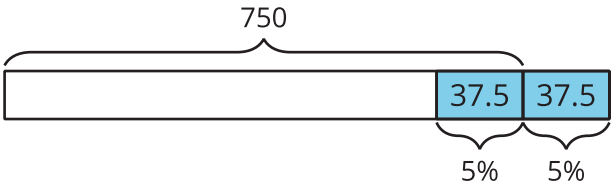
Lesson 14 Summary

Percent error can be used to describe any situation where there is a correct value and an incorrect value, and we want to describe the relative difference between them. For example, if a milk carton is supposed to contain 16 fluid ounces, and it only contains 15 fluid ounces:

- The measurement error is 1 oz.
- The percent error is 6.25% because $1 \div 16 = 0.0625$.

We can also use percent error when talking about estimates. For example, a teacher estimates there are about 600 students at their school. If there are actually 625 students, then the percent error for this estimate is 4%, because $625 - 600 = 25$ and $25 \div 625 = 0.04$.

Percent error is often used to express a range of possible values. For example, if a box of cereal is guaranteed to have 750 grams of cereal, with a margin of error of less than 5%, what are possible values for the actual number of grams of cereal in the box? The error could be as large as $(0.05) \cdot 750 = 37.5$ and could be either above or below the correct amount.



Therefore, the box can have anywhere between 712.5 and 787.5 grams of cereal in it, but it should not have 700 grams or 800 grams, because both of those are more than 37.5 grams away from 750 grams.

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