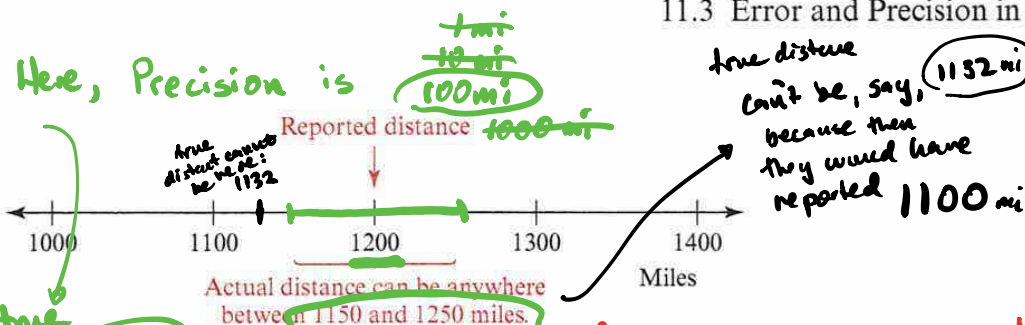


Figure 11.13

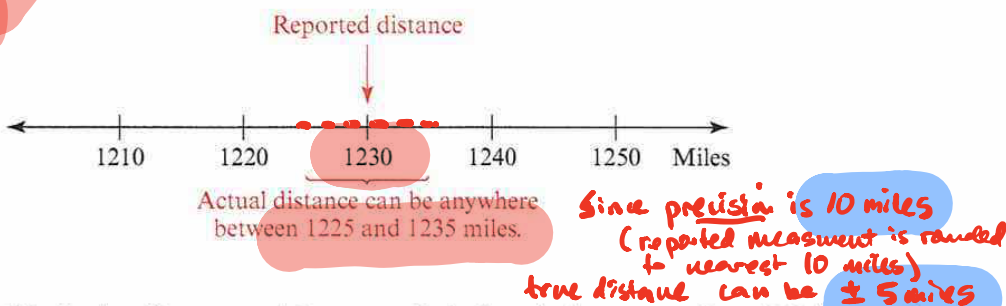
Interpreting a reported distance of 1200 miles.



Now suppose that the distance between two cities is reported as 1230 miles, then we assume (unless we are told otherwise) that this measurement is *rounded to the nearest ten*. In other words, the actual distance between the cities is between 1220 miles and 1240 miles, but closer to 1230 miles than to either 1220 miles or 1240 miles. In this case, the actual distance between the two cities could be anywhere between 1225 and 1235 miles, as indicated in Figure 11.14. Notice that in this case, we are getting a much smaller range of numbers that the actual distance could be than in the previous example. Here it's a range of 10 miles (1225 miles to 1235 miles), whereas in the previous case it's a range of 100 miles (1150 miles to 1250 miles).

Figure 11.14

Interpreting a reported distance of 1230 miles.



Similarly, if your weight on a digital scale is reported as 130.4 pounds, then (assuming the scale's report is accurate) this is your actual weight, *rounded to the nearest tenth*. In other words, your actual weight is between 130.3 and 130.5 pounds, but closer to 130.4 pounds than to either 130.3 or 130.5 pounds. In this case, your actual weight is between 130.35 and 130.45 pounds.

Notice that there is a difference in reporting that the weight of an object is 130.0 pounds and reporting the weight as 130 pounds. When the weight is reported as 130.0 pounds, we assume that this weight is *rounded to the nearest tenth* of a pound. In this case, the actual weight is between 129.95 and 130.05 pounds. On the other hand, when the weight of an object is reported as 130 pounds, we assume this weight is *rounded to the nearest ten* pounds. In this case, we know only that the actual weight is between 125 and 135 pounds, which allows for a much wider range of actual weights than the range of 129.95 to 130.05 pounds (a 10-pound range versus a 0.1-pound range). So, when a weight is reported as 130.0 pounds, the weight is known with greater accuracy than when the weight is reported as 130 pounds.

What do we do when we know a distance more accurately than the way we write it would suggest? For example, suppose we know that a certain distance is 130,000 km, but that this is rounded to the nearest *hundred* kilometers, not to the nearest *ten-thousand* kilometers, as the way the number is written would suggest. In this case, we can report the distance as "130,000 km to 4 significant digits."

How Do We Calculate with Measurements?

In the next section and the chapters that follow we will calculate various lengths, areas, and volumes of objects by using lengths associated with these objects. In some cases, the lengths are taken to be *given* as opposed to actually *measured*, and the area and volume calculations are then purely theoretical. For example, we will be able to calculate the area of a circle that has radius 6.25 inches. In this case, we are imagining a circle that has radius 6.25 inches, and we are calculating the exact area that such an imagined circle would have.

Practice Exercises for Section 11.3

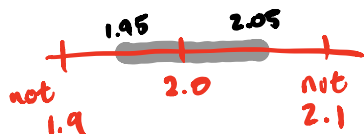
1. What is the difference between reporting that an object weighs 2 pounds and reporting that it weighs 2.0 pounds?

Reporting "2 lbs" means true weight is between 1.5 lbs and 2.5 lbs.

(The next one down would be 1 lbs so true weight is past halfway point b/w 1 lb & 2 lb.)

Reporting "2.0 lbs" means true weight is between 1.95 lbs & 2.05 lbs

("They report 2.0 not 1.9 not 2.1")



2. If the distance between two cities is reported as 2500 miles, does that mean that the distance is exactly 2500 miles? If not, what can you say about the exact distance?

No.

Reported measurement is
2500 mi

True measurement is
between 2450 mi & 2550 mi
(range of possible true measurements)

2600
→ 2500 { 2550
2400 { 2450