2.6 Measures of Relative Standing

2.0678
2.07

-4.876
-4.88

z-score: (standard score) is the number of standard deviations that a value x is above/below the mean

Sample	Population
$z = \frac{x - \bar{x}}{s}$	$z = \frac{x - \mu}{\sigma}$

$\bar{x}$: mean of sample

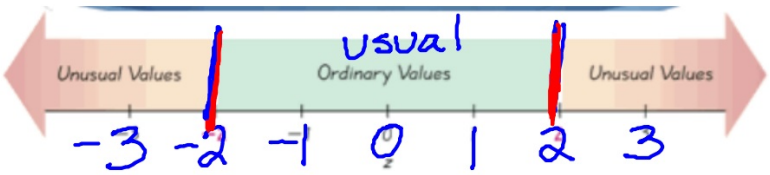
s : st. dev. of sample

μ : population mean

σ : population st. dev.

Round to 2 decimal places

Interpreting z-scores



Ordinary values: *z* score between −2 and 2 sd

Unusual Values: *z* score < −2 or *z* score > 2 sd

A negative z score means the value is less than the mean
(you can think of the negative sign as denoting direction)

The mean height of men is 69 inches with a standard deviation of 2.8 in

Danny Devito is 5 ft tall. Is his height considered unusual? yes; Z-score is -3.21; more than 2 st. dev.

$$Z = \frac{X - \mu}{\sigma} = \frac{60 - 69}{2.8} = -3.21$$

6'1" $X = 73$

$$Z = \frac{73 - 69}{2.8} = 1.43$$

Z-scores do not have any units. They measure the distance of each data value from the mean in standard deviations.

Using z-scores makes it possible to compare values that are measured on different scales, with different units, or different populations.

Z-scores should be rounded to two decimal places.

The best 800-m time, run by Getrud Bacher of Italy, was 129 seconds which was faster than the mean (137 seconds). The standard deviation for the qualifying times was 5.0 seconds.

The winning long jump by the Russian Yelena Prokhorova was 60 cm longer than the mean. The standard deviation was 30 cm.

WHO'S FEAT WAS MORE IMPRESSIVE? To compare, we need to look how many standard deviations better than the mean each performance was--ie the Z-score.

Bacher's Z-score

$$z = \frac{129s - 137s}{5s} = -1.6$$

Prokhorova's Z-score

$$z = \frac{60cm}{30cm} = 2$$

Suppose the mean score of the ACT is 20.8 with a standard deviation of 4.8.

Find the z-score.

$$Z = \frac{31 - 20.8}{4.8} = 2.13$$

Would a score of 31 be considered unusual?

Yes; more than 2

Suppose the mean score of the ACT is 20.8 with a standard deviation of 4.8.

If a student's z-score for the ACT was 1.25, find the ACT score.

$$Z = \frac{X - \mu}{\sigma}$$

$$1.25 = \frac{X - 20.8}{4.8}$$

$$6 = X - 20.8$$

$$26.8 = X$$

$$27 = X$$

The mean speed of vehicles along a stretch of highway is 56 mph with a standard deviation of 4 mph.

a. Calculate the z-score for 62 mph and 47 mph and 70 mph

b. Are any of these speeds unusual?

FlorenceFreshman took college placement exams in French and math.

The French exam had a mean of 72 and a std dev of 8, while the math exam had a mean of 68 and a std of 12.

She scored an 82 on the French exam and an 86 on the math. On which exam did she do better compared to the other freshman?

French

$$Z = \frac{82-72}{8} = 1.25$$

Math

$$Z = \frac{86-68}{12} = 1.5$$

better