Chapter 11 Section 2

MA1020 Quantitative Literacy

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Suppose a data set is represented by a normal distribution with a mean of 125 and a standard deviation of 7.

- 1 What data value is 2 standard deviations above the mean?
- 2 What data value is 3 standard deviations below the mean?
- 3 What data value is 1.5 standard deviations below the mean?
- 4 What data value is 2.5 standard deviations above the mean?
- 5 What data value is  $\frac{1}{5}$  standard deviations below the mean?

## Relationship between Normal Distributions and the Standard Distribution



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Approximately 50% of the data in a standard normal distribution are between  $-\frac{2}{3}$  and  $\frac{2}{3}$ , or within  $\frac{2}{3}$  of a standard deviation of the mean. Suppose the measurements on a population are normally distributed with mean 145 and standard deviation 12.

- **1** What data value is  $\frac{2}{3}$  of a standard deviation above the mean?
- 2 What data value is  $\frac{2}{3}$  of a standard deviation below the mean?
- 3 What percentage of measurements of the population lie between 137 and 153?

## 68-95-99.7 Rule for Normal Distributions

- Approximately 68% of the measurements in any normal distribution lie within 1 standard deviation of the mean.
- Approximately 95% of the measurements in any normal distribution lie within 2 standard deviation of the mean.
- Approximately 99.7% of the measurements in any normal distribution lie within 3 standard deviation of the mean.

A certain population has measurements that are normally distributed with a mean of  $\mu$  and a standard deviation of  $\sigma.$ 

- **1** Find the percentage of measurements that are between  $\mu 2\sigma$  and  $\mu + 2\sigma$ .
- 2 Find the percentage of measurements that are between  $\mu 3\sigma$  and  $\mu + 2\sigma$ .
- 3 Find the percentage of measurements that are not between  $\mu-3\sigma$  and  $\mu+\sigma.$

The population *z*-score of a measurement, x, is given by

$$z=\frac{x-\mu}{\sigma},$$

where  $\mu$  is the population mean and  $\sigma$  is the population standard deviation.

|z| is the number of standard deviations that a data point x is away from the mean.

Suppose a normal distribution has mean 20.5 and standard deviation 0.4. Find the *z*-scores of the measurements 19.3, 20.2, 20.5, 21.3, and 23.

In a normally distributed data set, find the value of the standard deviation if the following additional information is given.

- **1** The mean is 226.2 and the *z*-score for a data value of 230 is 0.2.
- 2 The mean is 14.6 and the *z*-score for a data value of 5 is -0.3.

The lifetime of a certain brand of passenger tire is approximately normally distributed with a mean of 41,500 miles and a standard deviation of 1950 miles.

- Find the *z*-scores of each of the following tire lifetimes: 38,575; 41,500; 46,765.
- What percentage of this brand of tires with have lifetimes between 38,575 and 41,500 miles? Use the *z*-scores you found in it prior part and Table 11.3.
- 3 What percentage of tires will have lifetimes between 38,575 and 46,765 miles? Use the *z*-scores you found in the first part and Table 11.3.
- What percentage of tires will have lifetimes of more than 46,765 miles?