

11-3 Study Guide and Intervention

The Normal Distribution

The Normal Distribution A **normal distribution** is a continuous probability distribution. The graph of a normal distribution is symmetric and bell-shaped. It approaches but never touches the x -axis. It includes 100% of the data, so the area under the curve is 1. The **z -value** represents the number of standard deviations that a given data value is from the mean.

$$z = \frac{X - \mu}{\sigma}, \text{ where } X \text{ is the data value, } \mu \text{ is the mean, and } \sigma \text{ is the standard deviation.}$$

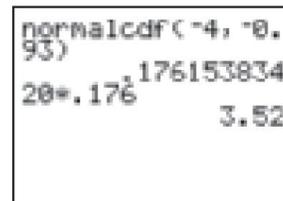
The **standard normal distribution** has a mean of 0 and a standard deviation of 1.

Example: On his last 20 airline trips, an employee had an average layover of 82 minutes with a standard deviation of 7.5 minutes. Find the number of layovers that were less than 75 minutes.

First, find the z -value.

$$z = \frac{X - \mu}{\sigma} \quad \text{Formula for } z\text{-values}$$
$$= \frac{75 - 82}{7.5} \text{ or about } -0.93 \quad X = 75, \mu = 82, \text{ and } \sigma = 7.5$$

Use a graphing calculator to find the area under the curve that is to the left of 75. Press $\boxed{2\text{nd}}$ [DISTR] and choose **normalcdf**(. Enter the lower value (you can use -4 instead of negative infinity) and the upper value as -0.93 . The resulting area is 0.176. This means that about 17.6% of the data values are less than -0.93 standard deviations from the mean.



Because there are 20 flights, about $20 \cdot 0.176$ or about 4 flights had layover times that were less than 75 minutes.

Exercises

1. At a restaurant, the average time between when an order is placed and when the entree is served is 12.5 minutes with a standard deviation of 1.2 minutes. Out of 100 randomly selected customers, how many will be served their entrees within 14 minutes of ordering?
2. Mrs. Quan, a full professor at a community college, earns a salary of \$48,600. The average salary for a full professor at the college is \$52,000 with a standard deviation of \$3600. How many of the 45 full professors earn less than Mrs. Quan?
3. During one October, the average water temperature of a pond was 53.2° with a standard deviation of 2.3° . How many days was the temperature greater than 50° ?

11-3 Study Guide and Intervention

The Normal Distribution

The Normal Distribution A **normal distribution** is a continuous probability distribution. The graph of a normal distribution is symmetric and bell-shaped. It approaches but never touches the x -axis. It includes 100% of the data, so the area under the curve is 1. The **z -value** represents the number of standard deviations that a given data value is from the mean.

$$z = \frac{X - \mu}{\sigma}, \text{ where } X \text{ is the data value, } \mu \text{ is the mean, and } \sigma \text{ is the standard deviation.}$$

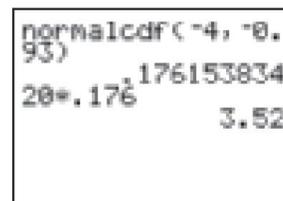
The **standard normal distribution** has a mean of 0 and a standard deviation of 1.

Example: On his last 20 airline trips, an employee had an average layover of 82 minutes with a standard deviation of 7.5 minutes. Find the number of layovers that were less than 75 minutes.

First, find the z -value.

$$\begin{aligned} z &= \frac{X - \mu}{\sigma} && \text{Formula for } z\text{-values} \\ &= \frac{75 - 82}{7.5} \text{ or about } -0.93 && X = 75, \mu = 82, \text{ and } \sigma = 7.5 \end{aligned}$$

Use a graphing calculator to find the area under the curve that is to the left of 75. Press $\boxed{2\text{nd}}$ $\boxed{[DISTR]}$ and choose **normalcdf**(. Enter the lower value (you can use -4 instead of negative infinity) and the upper value as -0.93 . The resulting area is 0.176. This means that about 17.6% of the data values are less than -0.93 standard deviations from the mean.



Because there are 20 flights, about $20 \cdot 0.176$ or about 4 flights had layover times that were less than 75 minutes.

Exercises

1. At a restaurant, the average time between when an order is placed and when the entree is served is 12.5 minutes with a standard deviation of 1.2 minutes. Out of 100 randomly selected customers, how many will be served their entrees within 14 minutes of ordering?
2. Mrs. Quan, a full professor at a community college, earns a salary of \$48,600. The average salary for a full professor at the college is \$52,000 with a standard deviation of \$3600. How many of the 45 full professors earn less than Mrs. Quan?
3. During one October, the average water temperature of a pond was 53.2° with a standard deviation of 2.3° . How many days was the temperature greater than 50° ?

11-3 Study Guide and Intervention

The Normal Distribution

The Normal Distribution A **normal distribution** is a continuous probability distribution. The graph of a normal distribution is symmetric and bell-shaped. It approaches but never touches the x -axis. It includes 100% of the data, so the area under the curve is 1. The **z -value** represents the number of standard deviations that a given data value is from the mean.

$$z = \frac{X - \mu}{\sigma}, \text{ where } X \text{ is the data value, } \mu \text{ is the mean, and } \sigma \text{ is the standard deviation.}$$

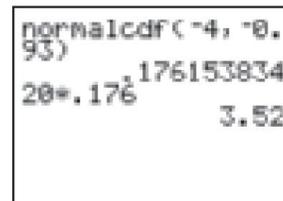
The **standard normal distribution** has a mean of 0 and a standard deviation of 1.

Example: On his last 20 airline trips, an employee had an average layover of 82 minutes with a standard deviation of 7.5 minutes. Find the number of layovers that were less than 75 minutes.

First, find the z -value.

$$\begin{aligned} z &= \frac{X - \mu}{\sigma} && \text{Formula for } z\text{-values} \\ &= \frac{75 - 82}{7.5} \text{ or about } -0.93 && X = 75, \mu = 82, \text{ and } \sigma = 7.5 \end{aligned}$$

Use a graphing calculator to find the area under the curve that is to the left of 75. Press $\boxed{2\text{nd}}$ [DISTR] and choose **normalcdf**(. Enter the lower value (you can use -4 instead of negative infinity) and the upper value as -0.93 . The resulting area is 0.176. This means that about 17.6% of the data values are less than -0.93 standard deviations from the mean.



Because there are 20 flights, about $20 \cdot 0.176$ or about 4 flights had layover times that were less than 75 minutes.

Exercises

1. At a restaurant, the average time between when an order is placed and when the entree is served is 12.5 minutes with a standard deviation of 1.2 minutes. Out of 100 randomly selected customers, how many will be served their entrees within 14 minutes of ordering?
2. Mrs. Quan, a full professor at a community college, earns a salary of \$48,600. The average salary for a full professor at the college is \$52,000 with a standard deviation of \$3600. How many of the 45 full professors earn less than Mrs. Quan?
3. During one October, the average water temperature of a pond was 53.2° with a standard deviation of 2.3° . How many days was the temperature greater than 50° ?

11-3 Study Guide and Intervention

The Normal Distribution

The Normal Distribution A **normal distribution** is a continuous probability distribution. The graph of a normal distribution is symmetric and bell-shaped. It approaches but never touches the x -axis. It includes 100% of the data, so the area under the curve is 1. The **z -value** represents the number of standard deviations that a given data value is from the mean.

$$z = \frac{X - \mu}{\sigma}, \text{ where } X \text{ is the data value, } \mu \text{ is the mean, and } \sigma \text{ is the standard deviation.}$$

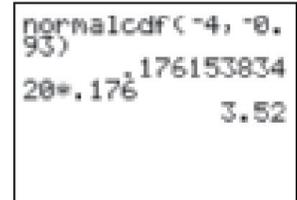
The **standard normal distribution** has a mean of 0 and a standard deviation of 1.

Example: On his last 20 airline trips, an employee had an average layover of 82 minutes with a standard deviation of 7.5 minutes. Find the number of layovers that were less than 75 minutes.

First, find the z -value.

$$\begin{aligned} z &= \frac{X - \mu}{\sigma} && \text{Formula for } z\text{-values} \\ &= \frac{75 - 82}{7.5} \text{ or about } -0.93 && X = 75, \mu = 82, \text{ and } \sigma = 7.5 \end{aligned}$$

Use a graphing calculator to find the area under the curve that is to the left of 75. Press $\boxed{2\text{nd}}$ $\boxed{[DISTR]}$ and choose **normalcdf**(. Enter the lower value (you can use -4 instead of negative infinity) and the upper value as -0.93 . The resulting area is 0.176. This means that about 17.6% of the data values are less than -0.93 standard deviations from the mean.



Because there are 20 flights, about $20 \cdot 0.176$ or about 4 flights had layover times that were less than 75 minutes.

Exercises

1. At a restaurant, the average time between when an order is placed and when the entree is served is 12.5 minutes with a standard deviation of 1.2 minutes. Out of 100 randomly selected customers, how many will be served their entrees within 14 minutes of ordering?
2. Mrs. Quan, a full professor at a community college, earns a salary of \$48,600. The average salary for a full professor at the college is \$52,000 with a standard deviation of \$3600. How many of the 45 full professors earn less than Mrs. Quan?
3. During one October, the average water temperature of a pond was 53.2° with a standard deviation of 2.3° . How many days was the temperature greater than 50° ?