# Normal Distributions - Standard Normal

**Normal Distributions - Standard Normal**

- We are in sections 6.1 and 6.2 of the textbook
- The most common type of continuous random variable is called a *normal distribution*. These distributions appear very commonly in practice.
- All normal distributions look the same if we measure the $x$ axis using standard deviations. We view the probability as the area of a certain region under the normal curve.
- We use the letter $z$ to stand for the number of standard deviations. So $z = 1$ means one standard deviation above the mean, and $z = -2$ means two standard deviations below the mean.
- We use the letter $x$ to stand for actual data values, such as 15 inches or 40 pounds.
- The values of $z$ and $x$ are related by the formula

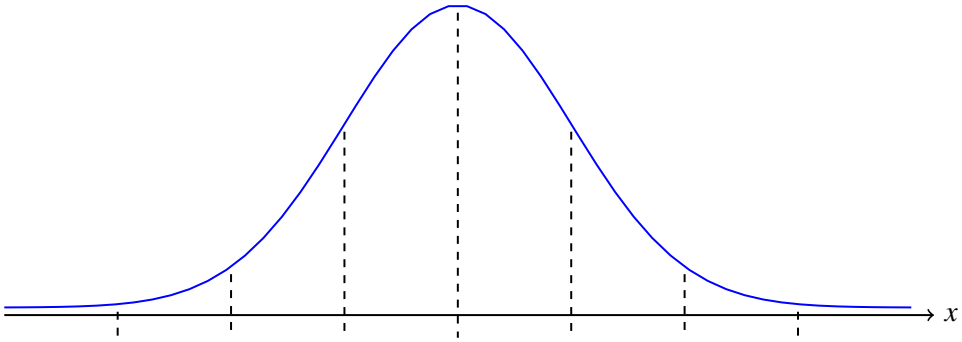
$$z = \frac{(x - \mu)}{\sigma}$$
$$x = \mu + z \times \sigma$$

1. Suppose we have a normal distribution with a mean of 40 and a standard deviation of 5. Fill in this table:

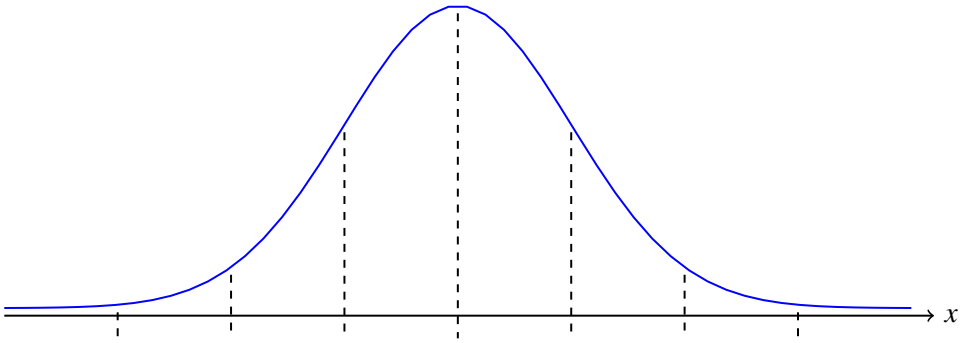
| $x$ | $z$ |
|---|---|
| 45 | |
| 30 | |
| | 2 |
| | -1 |
| 48 | |
| | 1.5 |

2. For each of the following, **label the diagram** and **shade in** the area that is requested. **DO NOT find the value**.

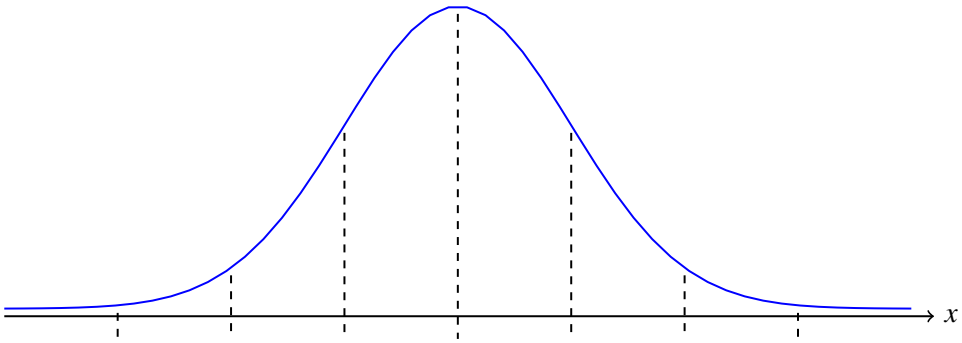
(a) $P(z > 0)$



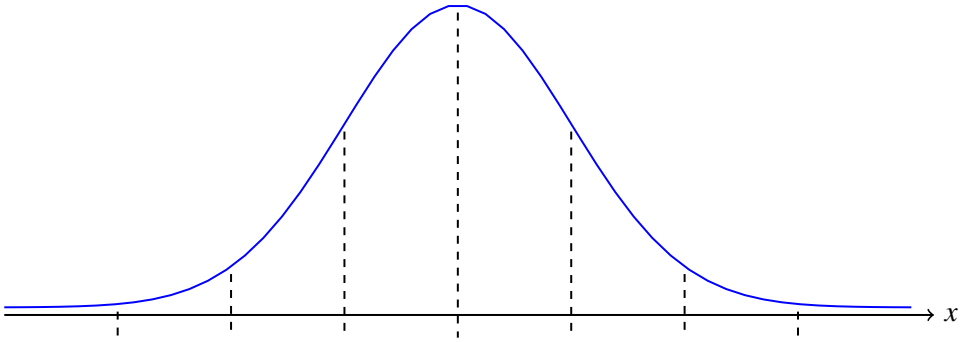

(b) $P(z < 1)$



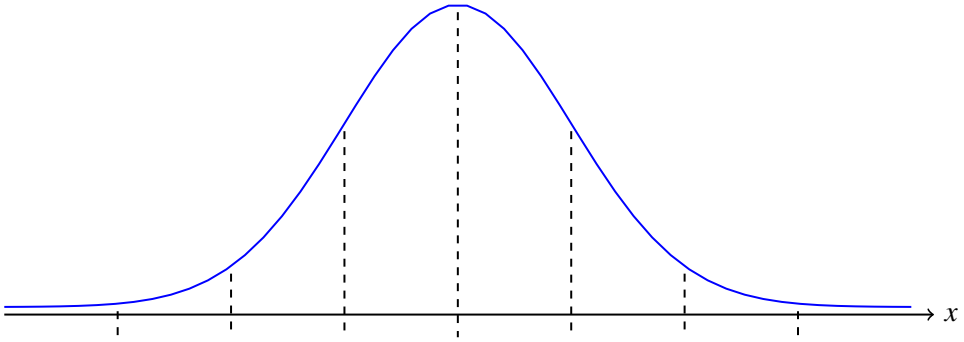

(c) $P(-2 < z < 2)$.



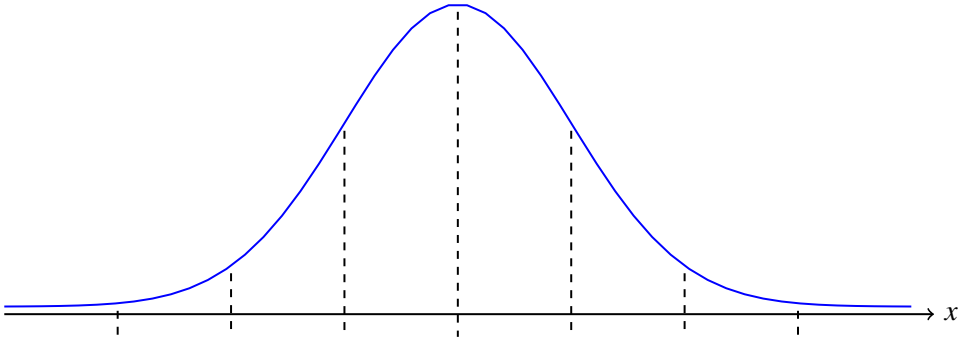
(d) The percentage of data that fall within one standard deviation of the mean.



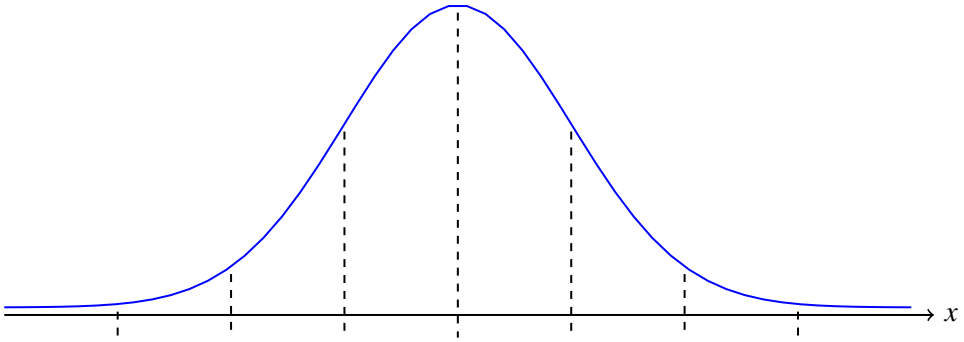

(e) The percentage of data that fall within one-half standard deviation of the mean.



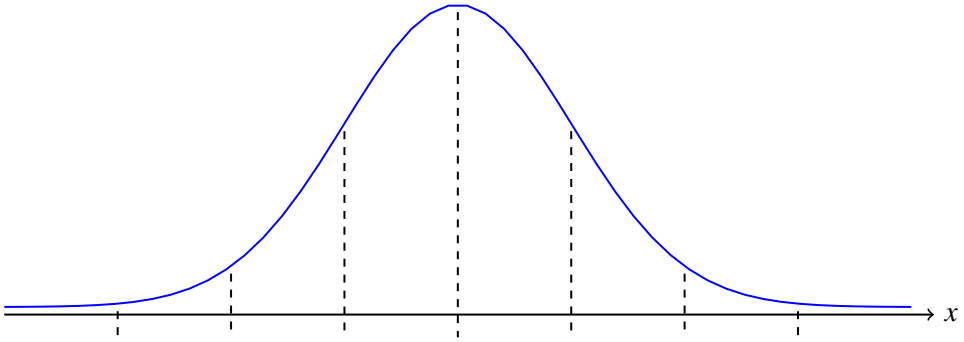

(f) The percentage of data the are more than two standard deviations from the mean.



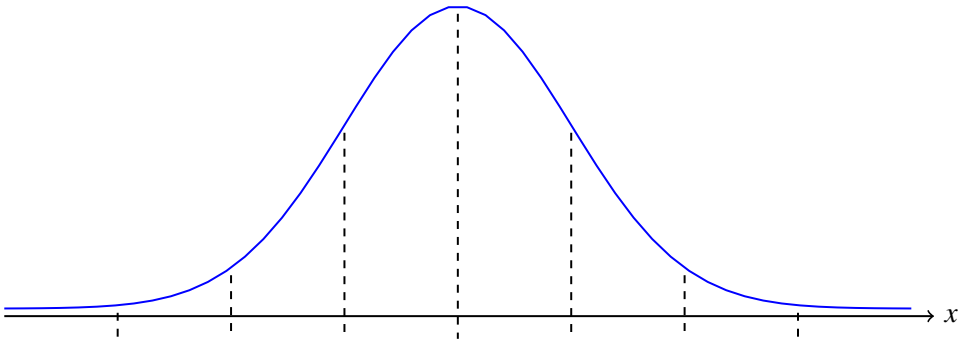
(g) Have a higher value (are to the right of) a point 3 standard deviations below the mean.




(h) The data that are above the 85th percentile.




(i) The data that are below the 25th percentile.



3. Suppose a normal distribution have a mean of 50 and a standard deviation of 1.

   (a) What $z$-value corresponds to each of these $x$-values?

| $x$ | $z$ |
|---|---|
| 50 | |
| 53 | |
| 49 | |
| 48.5 | |

   (b) What $x$-value corresponds to each of these $z$-values?

| $z$ | $x$ |
|---|---|
| $-1$ | |
| 2.5 | |
| $-1.25$ | |

4. For each of these, find the desired probability using a $z$-table.

   (a) $P(z < 0.25)$

   (b) $P(z > 0.75)$

   (c) $P(0.25 < z < 0.25)$

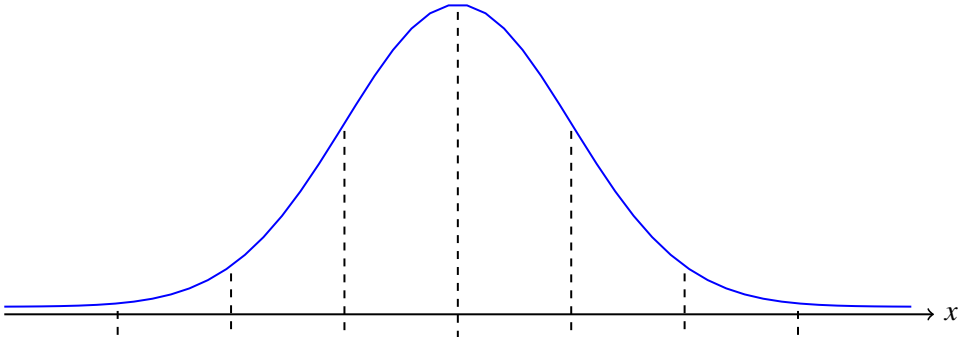
   (d) $P(z < -0.67)$

   (e) $P(-0.1 < z < 0.1)$

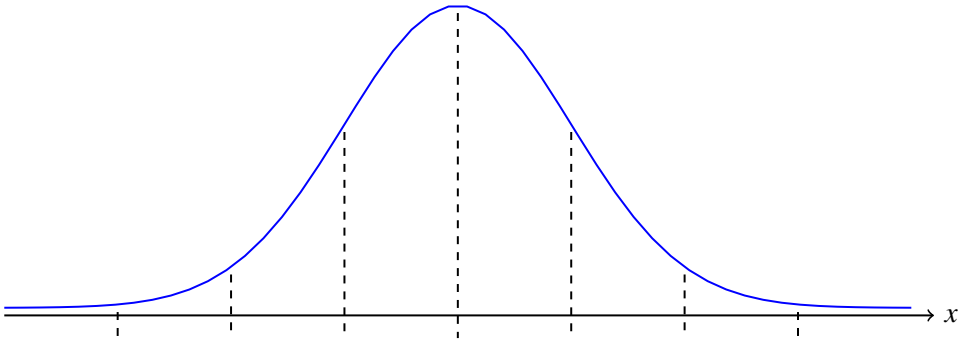
5. A data set has $x$ values that are normally distributed. The mean is 15 and the standard deviation is 2.

   For each of the following, **label the diagram** and **shade in** the area that is requested. Then use the $z$-chart to **find the value** that was requested.

   (a) $P(x > 15)$




   (b) $P(x < 18)$




   (c) $P(14 < x < 18)$.