

Section 11.1 **Normal Distributions**

May
18 - 22

Target: We are learning to use the mean and standard deviation of a data set to fit it to a normal distribution so that we can estimate population percentages.

In many naturally occurring data sets, the histogram of the data is bell-shaped. In statistics, such data sets are said to have a **normal distribution**.

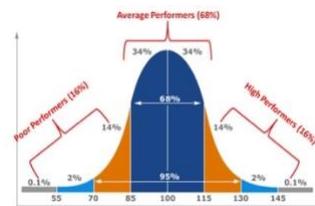
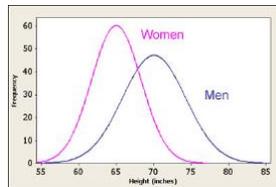
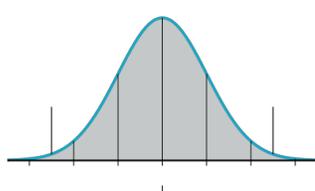
Not all distributions are normal.

The **mean** is a measure of center that represents the center, or typical value of a data set. It is calculated **by the sum of the data divided by the number of data values**.

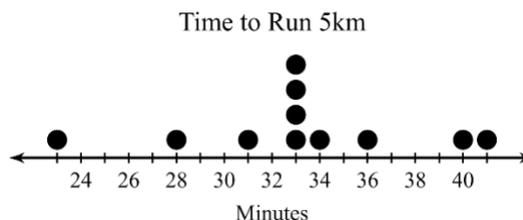
The **standard deviation** is a measure of how much a typical value in the data set differs from the mean.

Estimate population percentages.

The areas under a normal curve can be interpreted as **probabilities** in a normal distribution. So, in a normal distribution, the probability that a randomly chosen x -value is between a and b is given by the area under the normal curve between a and b .

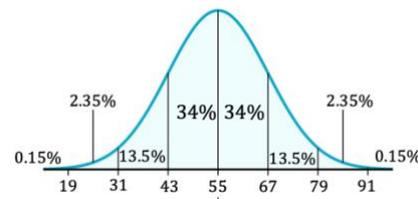


Example 1: **The data shows the distribution of 11 people's time in minutes to run a 5 km race.**



- Calculate the mean and interpret the meaning in context.
- The standard deviation is 5. Interpret the meaning in context.

Example 2: **The scores for last year's AP statistics exam is normally distributed with a mean of 55 and a standard deviation of 12. Use the curve to answer the questions.**



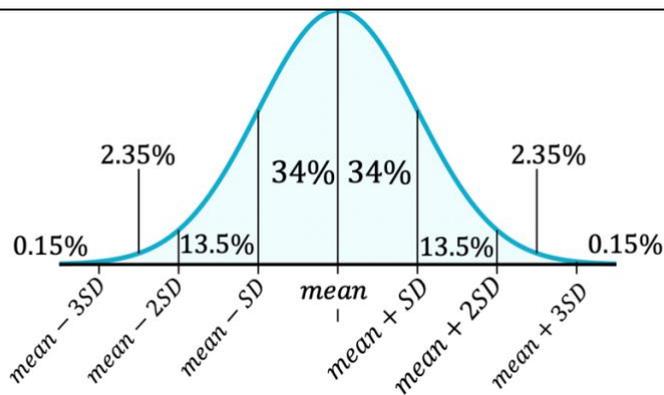
- What percent of students scored between 43 and 67?
- What percent of students scored higher than 67?
- What percent of students scored at least 31?

Areas under a Normal Curve:

A normal distribution with mean and standard deviation (SD) has these properties. The total area under the curve is 100%. The data lies within one, two, and three (SD) of the mean.

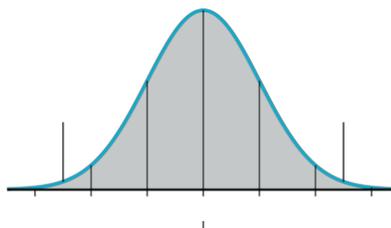
Estimate population percentages.

The areas under a normal curve can be interpreted as **probabilities** in a normal distribution. So, in a normal distribution, the probability that a randomly chosen x -value is between a and b is given by the area under the normal curve between a and b .



Example 3. The results for a Fortnite competition are normally distributed with a mean of 25 and a standard deviation of 2. The Company Ghost Clan is bringing gamers Ghost Aydan and Ghost Kayuun to compete with the high scorers.

- Fill in the curve. For the normal distribution, estimate the percent of the data that lies within one, two, and three standard deviations of the mean.



- About what percent of the people competing have results between 25 and 29?
 $P(25 \leq x \leq 29) =$
- The company Ghost Clan is looking to hire gamers with results of at least 29. About what percent of the people have results that make them eligible to be hired by Ghost Clan?
 $P(x \geq 29) =$
- Ghost Clan will not allow contestants with results of at most 27 to compete with Ghost Aydan and Ghost Kayuun. About what percent of the contestants will be ineligible?
 $P(x \leq 27) =$

Summary:

Today I learned

This connects to what I know about

What I learned today can help me later when

A2 5.18 - 5.22 Notes - solutions

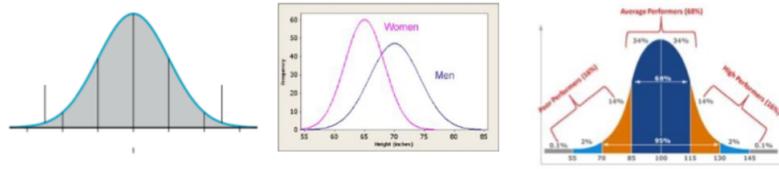
A2 5.18 - 5.22 Notes

Section 11.1 Normal Distributions

May
18 - 22

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Not all distributions are normal.

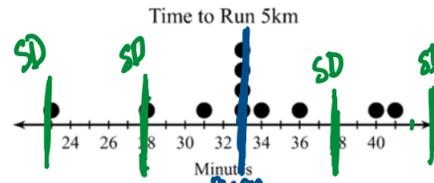
The **mean** is a measure of center that represents the center, or typical value of a data set. It is calculated by the sum of the data divided by the number of data values.

The **standard deviation** is a measure of how much a typical value in the data set differs from the mean.

Estimate population percentages.

The areas under a normal curve can be interpreted as **probabilities** in a normal distribution. So, in a normal distribution, the probability that a randomly chosen x -value is between a and b is given by the area under the normal curve between a and b .

Example 1: The data shows the distribution of 11 people's time in minutes to run a 5 km race.

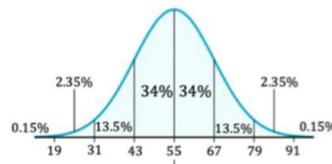


- a. Calculate the mean and interpret the meaning in context.

$$\text{mean} = \frac{(23+28+31+33+33+33+33+34+36+40+41)}{11}$$

$$\text{mean} = 33.18$$
 ∴ The mean is the average time it took people to run a 5 km race.
- b. The standard deviation is 5. Interpret the meaning in context.
 Most runners took either 5 min (SD) longer or 5 min (SD) shorter to run 5 km compared to the average time.

Example 2: The scores for last year's AP statistics exam is normally distributed with a mean of 55 and a standard deviation of 12. Use the curve to answer the questions.



- a. What percent of students scored between 43 and 67?

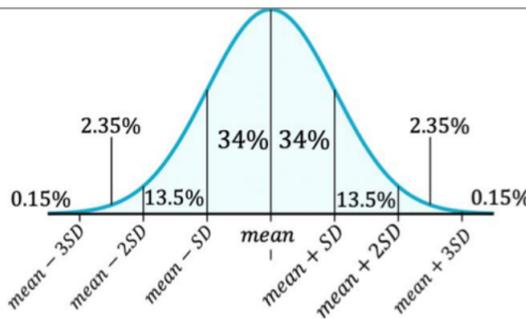
$$P(43 \leq x \leq 67) = 34\% + 34\% = 68\%$$
- b. What percent of students scored higher than 67?

$$P(x \geq 67) = 13.5\% + 2.35\% + 0.15\% = 16\%$$
- c. What percent of students scored at least 31?

$$P(x \geq 31) = 13.5 + 34 + 34 + 13.5 + 2.35 + 0.15 = 97.5\%$$
 scored at least 31
- OR $100 - (2.35 + 0.15) = 100 - 2.5 = 97.5\%$ scored at most 31

Areas under a Normal Curve:

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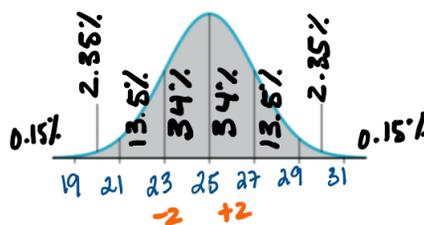


Estimate population percentages.

The areas under a normal curve can be interpreted as **probabilities** in a normal distribution. So, in a normal distribution, the probability that a randomly chosen x -value is between a and b is given by the area under the normal curve between a and b .

Example 3: The results for a Fortnite competition are normally distributed with a mean of 25 and a standard deviation of 2. The Company Ghost Clan is bringing gamers Ghost Aydan and Ghost Kayuun to compete with the high scorers.

- a. Fill in the curve. For the normal distribution, estimate the percent of the data that lies within one, two, and three standard deviations of the mean.



- b. About what percent of the people competing have results between 25 and 29?

$$P(25 \leq x \leq 29) = 34\% + 13.5\% = 47.5\%$$
- c. The company Ghost Clan is looking to hire gamers with results of at least 29. About what percent of the people have results that make them eligible to be hired by Ghost Clan?

$$P(x \geq 29) = 2.35\% + 0.15\% = 2.5\%$$
- d. Ghost Clan will not allow contestants with results of at most 27 to compete with Ghost Aydan and Ghost Kayuun. About what percent of the contestants will be ineligible?

$$P(x \leq 27) = 0.15 + 2.35 + 13.5 + 34 + 34 = 84\%$$
 OR $100 - (13.5 + 2.35 + 0.15) = 84\%$ ineligible

Summary:

Today I learned
 This connects to what I know about
 What I learned today can help me later when

Algebra 2 5.18 – 5.22 Assignment
Week 7

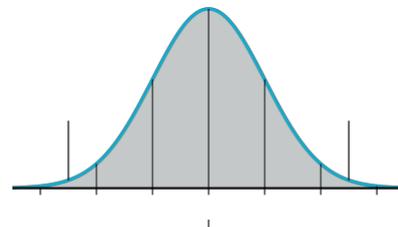
Name _____

Date _____ Period _____

1. Joe is trying to calculate the average number of yards he has run for the first half of the football season. Here are the rushing yards from each game: 124, 118, 97, 140, 112.

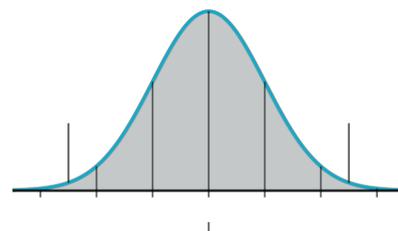
- a) Calculate the **mean** and **interpret** the meaning in context.
- b) The standard deviation is 14. **Interpret** the meaning in context.

2. The lifetimes of 10,000 watch batteries are normally distributed. The mean lifetime is 500 days. The standard deviation is 60 days. Sketch a normal curve that represents this distribution; label the mean and 3 standard deviations.



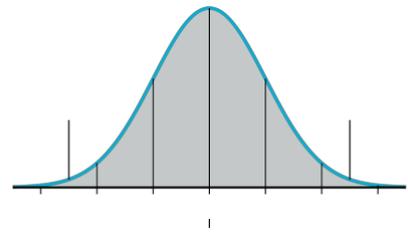
- a.) What percentage of batteries last between 440 – 560 days?
- b.) What percentage of batteries last between 380 – 620 days
- c.) What percentage of batteries last between 320 – 680 days
- d.) What percentage of batteries last between 440-680 days?

3. A group of students weighs 500 US pennies. They find that the pennies have normally distributed weights with a mean of 3.1g and a standard deviation of 0.14g. Sketch a normal curve that represents this distribution; label the mean and 3 standard deviations.



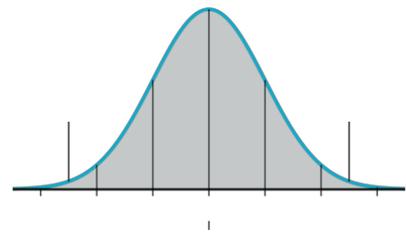
- a) What percentage of pennies will weigh between 2.96 and 3.52g?
- b) What percentage of pennies will weigh between 2.68 and 3.24g?
- c.) What percentage of pennies will weigh less than 2.96g?
- d.) What percentage of pennies will weigh more than 3.38g?

4. A set of 1000 values has a normal distribution. The mean of the data is 120, and the standard deviation is 20. Sketch a normal curve that represents this distribution; label the mean and 3 standard deviations.



- a) What percent of the data is in the range 120 to 180?
- b) What percent of the data is in the range 100 to 120?
- c) How many values are within the limits 100 and 160?
- d) How many values are greater than 140?

5. The scores on the Alg 2 Chapter 9 Quiz were normally distributed with a mean of 28 and standard deviation of 3. Sketch a normal curve that represents this distribution; label the mean and 3 standard deviations.



- a) What percent scored between 25 and 34?
- b) What percent scored between 22 and 37?
- c) What percent scored at most 31?
- d) What percent scored at least 31?