

Questions on lesson 1.3?

We will be having our concept mastery quiz shortly.

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data value $Z = \frac{(x - \mu)}{\sigma}$ *mean*
standard deviation

PROBLEM 2 More or Less ...

$\mu = 54$
 $\sigma = 6$

1. Calculate the percent of hybrid cars that get less than 50 miles per gallon.

$$Z = \frac{50 - 54}{6} = \frac{-4}{6} = \frac{-2}{3} = -0.67$$

2. Use your answer to Question 1 to calculate the percent of hybrid cars that get more than 50 miles per gallon. Explain your reasoning.

1.3 Z-Scores and Percentiles 29

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-1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
-1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
-1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
-1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
-1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
-1.2	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
-1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
-1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
-0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
-0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
-0.7	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
-0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
-0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
-0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
-0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
-0.2	0.3829	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
-0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
-0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

-0.67

-0.6

0.07

0.2514

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32 Chapter 1 Interpreting Data in Normal Distributions

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PROBLEM 2 More or Less \downarrow

1. Calculate the percent of hybrid cars that get less than 50 miles per gallon.

$Z = \frac{62 - 54}{6} = \frac{8}{6} = \frac{4}{3} = 1.33$ z-score

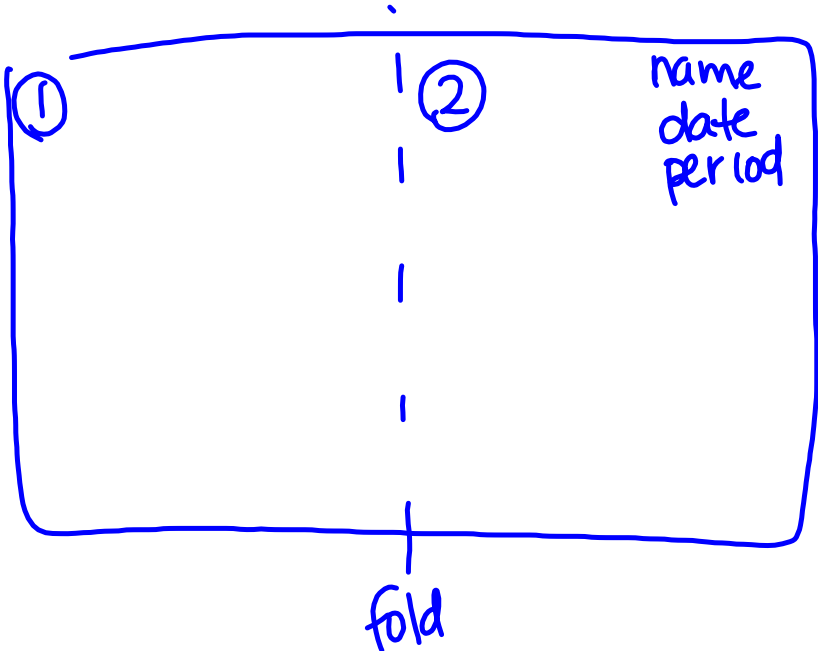
$0.9082 = 90.82\%$ % less than

2. Use your answer to Question 1 to calculate the percent of hybrid cars that get more than 50 miles per gallon. Explain your reasoning.

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1.3 Z-Scores and Percentiles 29



Finish up Lesson 1.3

NOT IN BOOK

Below the Line, Above the Line, and Between the Lines Z-Scores and Percentiles

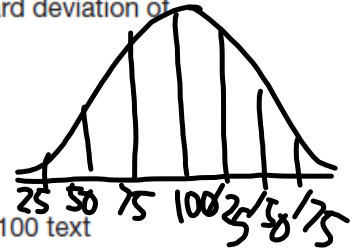
1. The birth weights of African lions are normally distributed. The average birth weight of an African lion is 3.6 pounds with a standard deviation of 0.4 pound.
 - a. What percent of newborn African lions weigh less than 3 pounds?
 - b. What percent of newborn African lions weigh more than 3.8 pounds?
 - c. What percent of newborn African lions weigh between 2.7 and 3.7 pounds?
 - d. Determine the birth weight of a lion cub in the 80th percentile.
 - e. Determine the birth weight of a lion cub in the 10th percentile.
 - f. Determine the birth weight of a lion cub in the 97th percentile.
 - g. A lioness gives birth to 2 cubs. One cub is in the 47th percentile and 1 is in the 62nd percentile. Determine the difference in the cubs' weights.

PG. 30-31 IN YOUR BOOK

You may have heard someone say, "My baby's weight is in the 90th percentile" or, "My student scored in the 80th percentile in math." What do these phrases mean?

A **percentile is a data value for which a certain percentage of the data is below the data value in a normal distribution.** For example, 90% of the data in a set is below the value at the 90th percentile, and 80% of the data is below the value at the 80th percentile.

The number of text messages teens send and receive every day can be represented as a normal distribution with a mean of 100 text messages per day and a standard deviation of 25 texts per day.



1. Calculate the 50th percentile for this data set. Explain your reasoning.
2. Would a teen in the 90th percentile send and receive more or fewer than 100 text messages per day? Explain your reasoning.
3. Would a teen in the 10th percentile send and receive more or fewer than 100 text messages per day? Explain your reasoning.
4. Use a z-score table to determine the 90th percentile for teen text messages.
 - a. Determine the percent value in the z-score table that is closest to 90%. Explain what information the z-score provides.

100 texts

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

0.8997 → 1.28 score

$$25 \cdot 1.28 = \frac{x - 100}{25} \cdot 25 \rightarrow \frac{32}{100} = \frac{x - 100}{100} \rightarrow 132 = x \text{ texts}$$

You can also use a graphing calculator to calculate a percentile. To calculate a percentile, you can use the inverse of the normal cumulative density function (invNorm). The invNorm function takes a percent as input and returns the data value.



You can use a graphing calculator to determine the total number of text messages that correspond to the 90th percentile.

Step 1: Press **2nd** and then **VARS**.
Select **3:invNorm(**

Step 2: Enter the percentile in decimal form, the mean, and the standard deviation, including commas between each number.

Step 3: Press **ENTER**.

In the texting situation, the percentile is 0.90, the mean is 100, and the standard deviation is 25.

Using the graphing calculators to help you determine percents below a value.

PG.27 IN YOUR BOOK

A graphing calculator can determine a percent of data below a z-score. This function is called the normal cumulative density function (normalcdf). The function determines the percent of data values within an interval of a normal distribution.



You can also use a graphing calculator to determine the percent of data below a given z-score.

Step 1: Press **2nd** and then **VARs**.
Select **2:normalcdf(**

Step 2: Enter the lower bound of the interval, the upper bound of the interval, the mean, and the standard deviation, including commas between each number.

Step 3: Press **ENTER**. Calculator results will vary from results obtained using a z-score table.

In this problem, the lower bound is negative infinity, the upper bound is 57, the mean is 54, and the standard deviation is 6. Most calculators do not have an infinity button. You can use -1×10^{99} , a very small number, for the lower bound.

You Make the Call

Normal Distributions and Probability

1.4

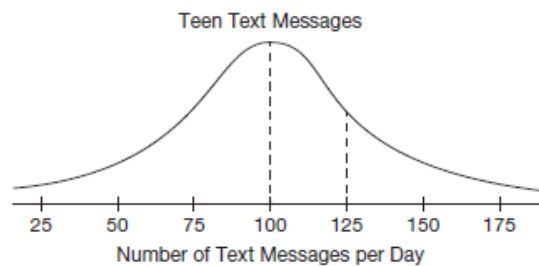
PG.36 IN YOUR BOOK

PROBLEM 1 Teens and Texting

So far, you have explored the percent of data values that fall within specified intervals. However, you can also interpret a normal distribution in terms of probabilities.



Based on a survey, the number of text messages that teens send and receive every day is a normal distribution with a mean of 100 text messages per day and a standard deviation of 25 text messages per day.



You randomly select a teen from the survey. Calculate each probability.

1. Determine the probability that the randomly selected teen sends and receives between 100 and 125 text messages per day.
2. Determine the probability that the randomly selected teen sends and receives fewer than 75 text messages per day.
3. Determine the probability that the randomly selected teen sends and receives more than 140 text messages per day.

PG.37 IN YOUR BOOK**PROBLEM 2 Pizza Anyone?**



You have collected data on the delivery times for two local pizza shops, Antonio's Pizza and Wood Fire Pizza. Based on your data, Antonio's Pizza has a mean delivery time of 30 minutes and a standard deviation of 3 minutes. Wood Fired Pizza has a mean delivery time of 25 minutes and a standard deviation of 8 minutes.

1. What factors could influence the delivery time of an order from either pizza shop?
2. What can you conclude based only on the mean and standard deviation for each pizza shop?
3. A friend of yours is planning a party. She needs the pizza for the party delivered in 35 minutes or less or the party will be a complete disaster! Which pizza shop has a greater probability of delivering the order within 35 minutes?

PG. 38 IN YOUR BOOK**PROBLEM 3 You Say Tomato, I Say Prize-Winning Tomato!**



1. Brad and Toby both plan to enter the county tomato growing competition. Each person who enters the competition must submit a basket of tomatoes. The judges randomly select a tomato from each contestant's basket. According to the rules of the competition, a "golden" tomato has a diameter between 4 inches and 4.5 inches.
The diameters of tomatoes in Brad's basket are normally distributed with a mean diameter of 3.6 inches and a standard deviation of 1 inch. The diameters of tomatoes in Toby's basket are also normally distributed with a mean diameter of 3.8 inches and a standard deviation of 0.2 inches.
When the judges randomly select a tomato from Brad's and Toby's basket, whose is more likely to result in a "golden" tomato?

Homework

Finish lesson 1.4