Math 3 **9.3 Z-Scores** Unit 9

*SWBAT use the z-scores of a data set to find the percentage of data under the normal curve.*

**Z-Score:** A statistical measurement of a score’s relationship to the mean of a group of scores. A Z-score of 0 means the score is the same as the mean. A Z-score can also be positive or negative, indicating whether it is above or below the mean and by how many standard deviations.

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| $$Z Score=\frac{ Raw Score-Mean }{Standard Deviation}$$ |

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| Symbols ☺ | **Sample Population** | **Entire Population** |
| **Mean** |  |  |
| **Standard Deviation** |  |  |

**Example 1:** Suppose a normal distribution has a mean of 10 and a standard deviation of 2. Find the z-scores of the following measurements:

1. 9
2. 10
3. 11
4. 14

**Example 2:** 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?

**Example 3:** In a normally distributed data set, find the value of the standard deviation if the following additional information is given.

1. The mean is 22.6 and the z-score for a data value of 230 is 0.2.
2. The mean is 9.8 and a z-score for the data value of 10.3 is 2.

**ALWAYS SKETCH A NORMAL CURVE AND LABEL THE X-AXIS.**

**Example 1:** A forest products company claims that the amount of usable lumber in its harvested trees averages 172 cubic feet and has a standard deviation of 12.4 cubic feet. Assume that these amounts have approximately a normal distribution.

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| **How to find Proportions with Z-Scores** |
| **Step 1:** | Draw a normal curve and label the x-axis. |
| **Step 2:** | Find the z-score corresponding to the value indicated in the question. Interpret this in terms of standard deviations away from the mean. |
| **Step 3:** | Hit 2nd-VARS-2: normalcdf(lower bound, upper bound). The answer is the proportion corresponding to your z-score. Write as a percentage. |
| ***Note:*** *Use 999 for the upper bound if it is not already given.* ***Note:*** *Use -999 for the lower bound it if is not already given.* |

1. What proportion of trees contains more than 150 cubic feet?
2. What proportion of trees contain between 175 and 190 cubic feet?

**Example 2:** Healthy 10-week-old domesticated kittens have average weight 24.5 oz. with a standard deviation of 5.25 oz. The distribution is approximately normal. A kitten is designated as dangerously underweight when, at 10 weeks, it weighs less than 10.0 oz. What proportion of kittens will designate as dangerously underweight?

**You Try!** Suppose that there are 100 franchises of Betty's Boutique in similar shopping malls across America. The gross Saturday sales of these boutiques are approximately normally distributed with a mean of $4610 and a standard deviation of $370.

1. Draw a normal curve below and label the horizontal axis.
2. Find the z-scores of each of the following gross Saturday sales amounts: $3870, $4425, and $5535.
3. What percentage of Betty's Boutique franchises had gross Saturday sales between $4425 and $5535? Use the z-scores you found in part (a) and the normalcdf( function in the calculator.
4. What percentage had gross Saturday sales between $3870 and $5535? Use the z-scores you found in part (a) and normalcdf function in the calculator.
5. What percentage of stores had gross Saturday sales less than $5535?