

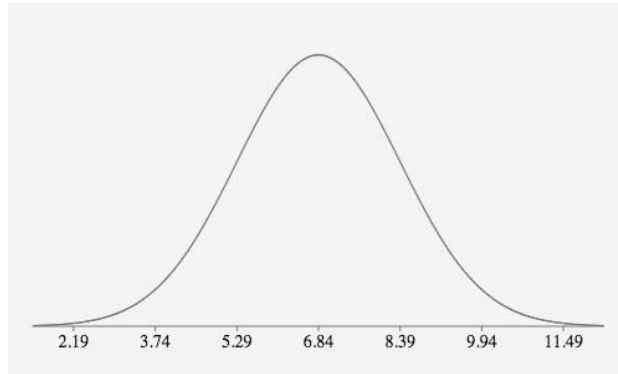
## Section 3.4 Worksheet – Normal Distribution

MDM4U

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1) The distribution of vocabulary scores for seventh---graders in Indiana is  $N(6.84, 1.55^2)$ .

a) Sketch a normal curve for this distribution of vocabulary scores. Label the points that are 1, 2, and 3 standard deviations from the mean.



b) What percent of the vocabulary scores are less than 3.74?

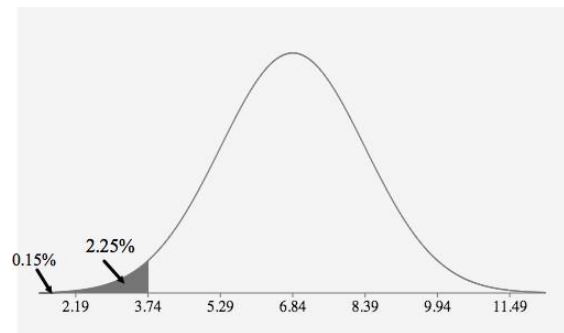
**Method 1:**

*Area under curve = 0.15% + 2.25% = 2.4%*

**Method 2:**

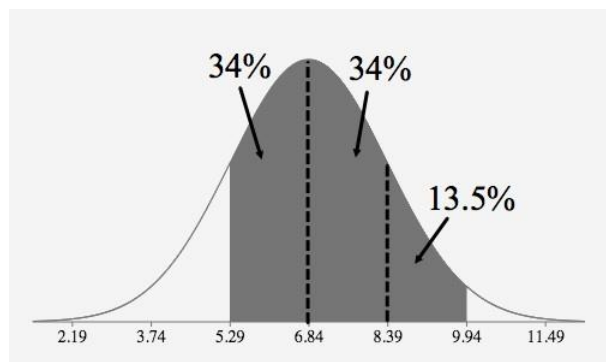
*95% are within  $2\sigma$  of  $\mu$  (between 3.74 and 9.94). The other 5% are outside of this range. Because the normal distribution is symmetric, 2.5% are lower than 3.74 and 2.5% are bigger than 9.94.*

*Area under curve = 2.5%*



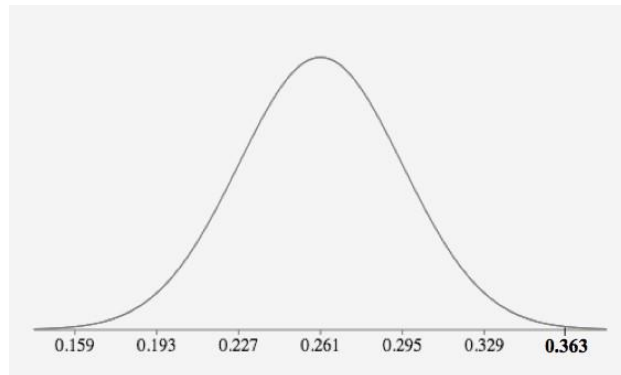
c) What percent of scores are between 5.29 and 9.94?

*Area under curve = 34% + 34% + 13.5% = 81.5%*



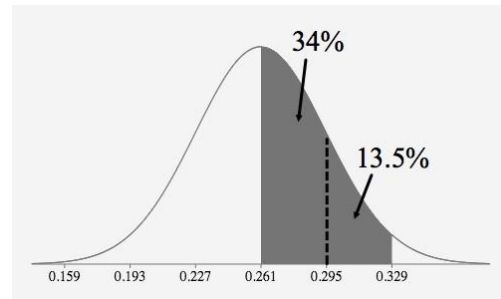
**2)** For Major League Baseball players, the mean of 432 batting averages is 0.261 with a standard deviation of 0.034. Suppose that the distribution is normally distributed.

**a)** Sketch a normal curve for this distribution of batting averages. Label the points that are 1, 2, and 3 standard deviations from the mean.



**b)** What percent of batting averages are between 0.261 and 0.329?

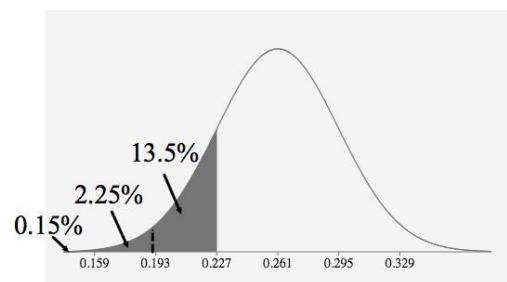
*Area under curve = 34% + 13.5% = 47.5%*



**c)** What percent of batting averages are less than 0.227?

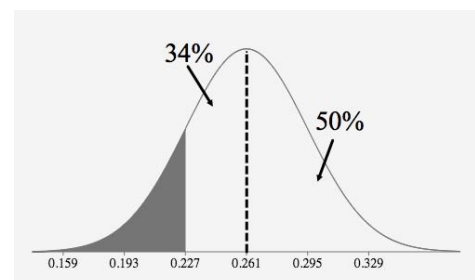
**Method 1:**

*Area under curve = 0.15% + 2.25% + 13.5% = 15.9%*



**Method 2:**

*Area under curve = 100% - 50% - 34% = 16%*

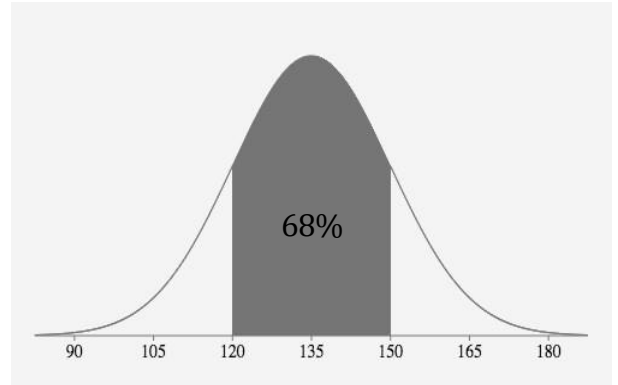


3) Out of 100 packages of jawbreakers, 68 packages contain between 120 and 150. Use your knowledge of normal distribution to estimate the average number of jawbreakers and the standard deviation of the sample.

*68% implies within 1 standard deviation of the mean. In other words, a total of 2 standard deviations. Therefore:*

$$\sigma = \frac{150-120}{2} = 15$$

$$\mu = 120 + 15 = 135$$



4) The amount of coffee an automatic machine dispenses (in ounces) can be represented by the normal distribution  $X \sim N(10.2, 0.6^2)$ .

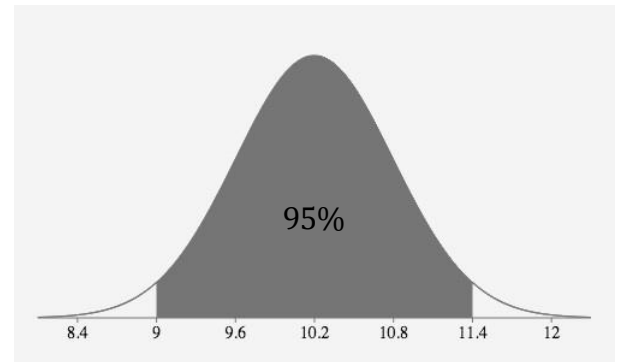
a) What range does 95% of the quantity of coffee dispensed lie between?

*68% of the data is within 1 standard deviation of the mean.*

$$\mu + 2\sigma = 10.2 + 2(0.6) = 11.4$$

$$\mu - 2\sigma = 10.2 - 2(0.6) = 9$$

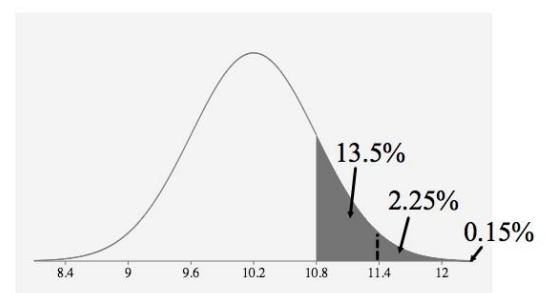
*Therefore, 95% of the quantity of coffee dispensed should be between 9 and 11.4 ounces.*



b) What percent of cups dispensed contain greater than 10.8 ounces?

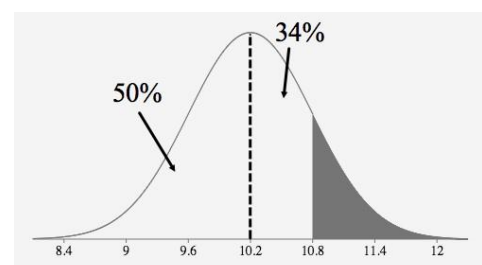
**Method 1:**

$$\text{Area under curve} = 13.5\% + 2.25\% + 0.15\% = 15.9\%$$



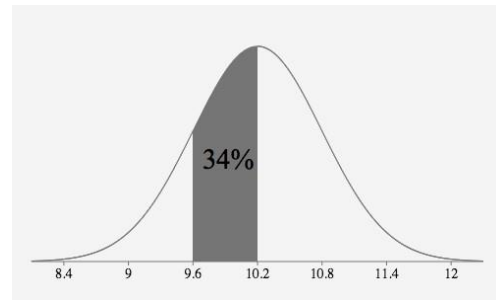
**Method 2:**

$$\text{Area under curve} = 100\% - 50\% - 34\% = 16\%$$



c) What percent of cups dispensed contain between 9.6 and 10.2 ounces?

*Area under curve = 34%*



d) What percent of cups dispensed contain less than 9 ounces?

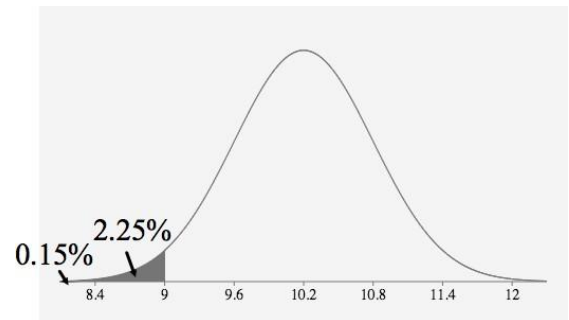
**Method 1:**

*Area under curve = 0.15% + 2.25% = 2.4%*

**Method 2:**

*95% are within  $2\sigma$  of  $\mu$  (between 9 and 11.4). The other 5% are outside of this range. Because the normal distribution is symmetric, 2.5% are lower than 9 and 2.5% are bigger than 11.4.*

*Area under curve = 2.5%*



5) Burns Appliance Co. offers a replacement warranty on their toaster ovens, which have a mean lifespan of 8.5 years, with a standard deviation of 0.8 years. How long a warranty would they establish if they could only afford to repair no more than 2.5% of the toaster ovens they make?

*2.5% at the end of the lower half means 5% at both ends combined. Since 95% of data in a normal distribution is within 2 standard deviations of the mean, a possible warranty they could establish is...*

*warranty =  $\mu - 2\sigma = 8.5 - 2(0.8) = 6.9$ .*

*Area under curve less than 6.9 years is 2.5%.*

*Therefore they should offer a 6.9 year warranty.*

