What you will learn about:
Standardized Values

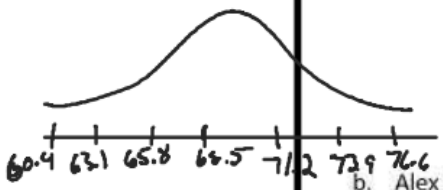
1. Examine the table below, which gives information about the heights of young Americans aged 18 to 24. Each distribution is approximately normal.

Heights of American Young Adults (in inches)

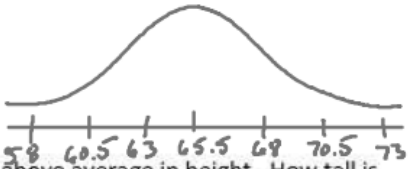
	Men	Women
Mean μ	68.5	65.5
Standard Deviation σ	2.7	2.5

a. Sketch the two distributions. Include a scale on the horizontal axis.

men



women



b. Alex is 3 standard deviations above average in height. How tall is she?

73 in

$65.5 + 3(2.5)$

c. Marvin is 2.1 standard deviations below average in height. How tall is he?

$68.5 - 2.1(2.7)$

$68.5 - 5.67$

62.83

d. Miguel is 74" tall. How many standard deviations above average height is he?

$74 = 68.5 + x(2.7)$

$\frac{5.5}{2.7} = \frac{2.7x}{2.7}$

$x = 2.037$

$62 = 65.5 - x(2.5)$

$-3.5 = -x(2.5)$

$x = 1.40$

e. Jackie is 62" tall. How many standard deviations below average height is she?

$62 = 65.5 + x(2.5)$

$-3.5 = x(2.5)$

$-1.40 = x$

f. Marina is 68" tall. Steve is 71" tall. Who is relatively taller for her or his gender, Marina or Steve. Explain your reasoning.

Marina = 1

Steve = .925

Standardized Value

How many Standard Deviations from the mean

Z-Score

$z > 0$ Above mean

$z < 0$ below mean

2. Look more generally how standardized values are computed.

a. Refer to Problem 1, Parts d and e. Compute the standardized values for Miguel's height and Jackie's height.

b. Write a formula for computing the standardized value ***z*** of a value ***x*** if you know the mean of the population μ and the standard deviation of the population σ.

$$X = \mu + z(\sigma)$$

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

3. Now consider how standardizing values can help you make comparisons. Refer to the table in Problem 1.

$5ft = 60in$

a. Find the standardized value for the height of a young woman who is 5 feet tall.

$$z = \frac{60 - 65.5}{2.5} = -2.20$$

$5'2" = 62in$

b. Find the standardized value for the height of a young man who is 5 feet 2 inches tall.

$$z = \frac{62 - 68.5}{2.7} = -2.41$$

c. Is a young woman in Part a or the young man in Part b shorter, relative to his or her own gender? Explain your reasoning.

$z = -2.20$

$z = -2.41$

4. In an experiment about half the effects of mental stress, subjects' systolic blood pressure and heart rate were measured before and after doing a stressful mental task. Their systolic blood pressure increased an average of 22.4 mm Hg (millimeters of Mercury) with a standard deviation of 2. Their heart rates increased by an average of 7.9 beats per minute with a standard deviation of 0.7. Each distribution was approximately normal.
Suppose that after completing the task, Mario's blood pressure increased by 25 mm Hg and his heart rate increased by 9 beats per minute. On which measure did he increase the most, relative to the other participants?

BP

$(22.4, 2)$

$z = \frac{25 - 22.4}{2}$

$= 1.30$

HR

$(7.9, .7)$

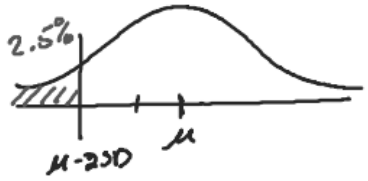
$z = \frac{9 - 7.9}{.7}$

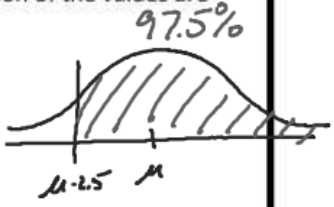
$= 1.57$

What you will learn about:
Using Standardized Values to Find Percentiles

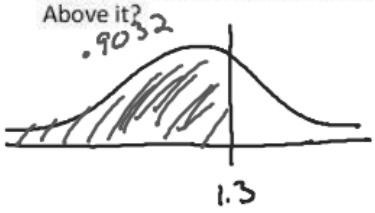
1. Use the table to help answer the following questions. In each part draw a sketches that illustrate your answers.

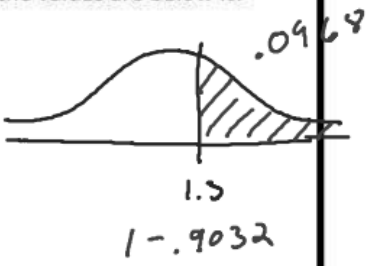
a. Suppose that a value from a normal distribution is two standard deviations below the mean. What proportion of the values are below it? What proportion is above it?



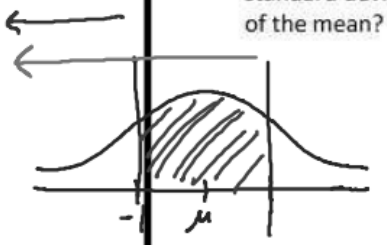


b. It a value from a normal distribution is 1.3 standard deviations above the mean, what proportions of the values are below it? Above it?





c. Based on the table, what proportions of values are within one standard deviation of the mean? Within two standard deviations of the mean? Within three standard deviations of the mean?



z=1 84.13

z=-1 - 15.87

68.26% ✓

95.44 ✓

z= 97.72

2.28

99.74 ✓