c. What percentage of the values in a normal distribution lie more than two standard deviations above the mean?

d. What percentage of the values in a normal distribution lie more than one standard deviation from the mean?

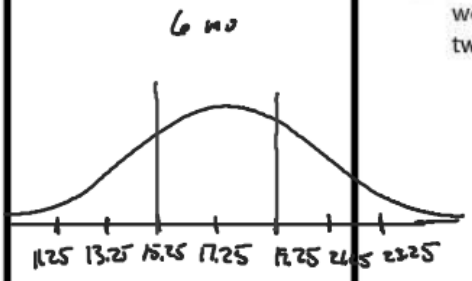
5. The weight of babies of a given age and gender are approximately normally distributed. This fact allows a doctor or nurse to use a baby's weight to find the weight percentile to which the child belongs. The table below gives information about the weights of six-month-old and twelve-month-old baby boys.

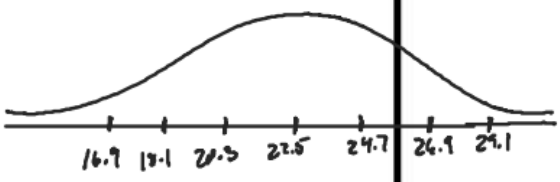
Weights of Baby Boys

	Weight at Six Months (in pounds)	Weight at Twelve Months (in pounds)
Mean μ	17.25	22.50
Standard Deviation σ	2.0	2.2

Source: Tannenbaum, Peter, and Robert Arnold. *Excursions in Modern Mathematics*. Englewood Cliffs, New Jersey: Prentice Hall. 1992.

a. On a separate axis, draw sketches that represent the distribution of weights for six-month-old boys and the distribution of weighs for twelve-month-old boys. How do the distributions differ?

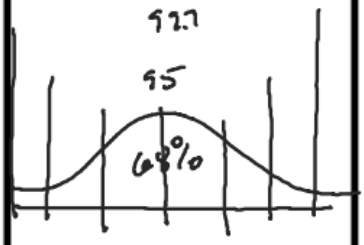




b. About what percentage of six-month-old weigh between 15.25 pounds and 19.25 pounds?

68%

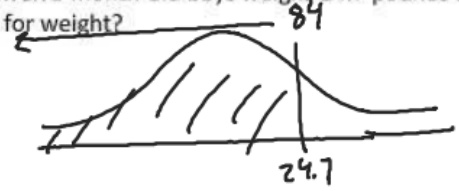
Percentile



c. About what <u>percentage</u> of twelve-month-old boys weigh more than 26.9 pounds?

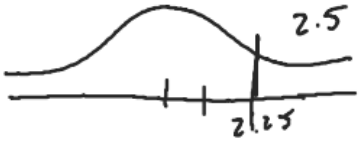
2.5%

d. A twelve-month-old boys weighs 24.7 pounds at what <u>percentile</u> is he for weight?

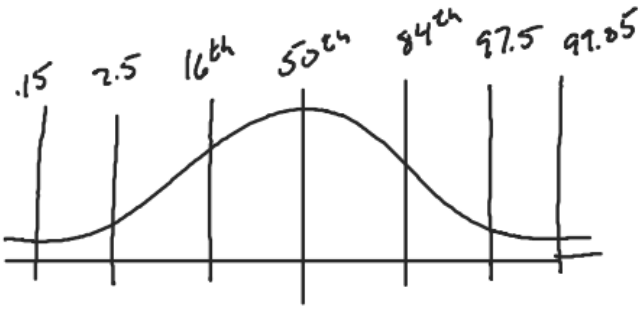


84th

e. A six-month-old boy who weighs 21.25 pounds is at what percentile?



97.5th



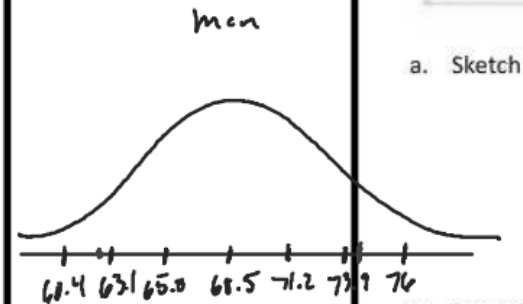
What you will learn about:
Standardized Values

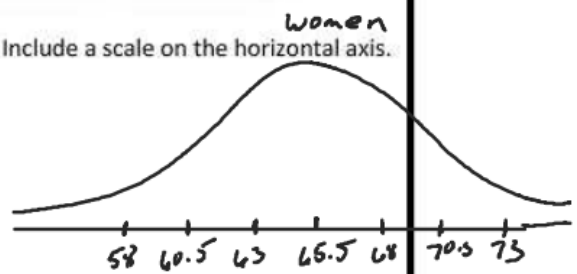
1. Examine the table below, which gives information about the heights of young Americans aged 18 to 24. Each distribution is approximately normal.

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.





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

73"

61
62.83
62.7

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

$68.5 - 2.1(2.7) = \text{height}$

$68.5 - 5.67 = 62.83"$

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

$68.5 + x(2.7) = 74$

$2.7x = 5.5$

$x = 2.04$

e. Jackie is 62" tall. How many standard deviations below average height is she? $65.5 + x(2.5) = 62$

$2.5x = -3.5$

$x = -1.4$

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

$65.5 + x(2.5) = 68$ $\quad x = 1$

$68.5 + x(2.7) = 71$ $\quad x = .93$

z-score

Standardized Value

How far above or below the mean

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

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.

$\mu + z\sigma = x$

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

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

a. Find the standardized value for the height of a young woman who is 5 feet tall. $z = \frac{60 - 65.5}{2.5} = -2.20$

b. Find the standardized value for the height of a young man who is 5 feet 2 inches tall. $z = \frac{62 - 68.5}{2.7} = \frac{-6.5}{2.7}$

$= -2.41$

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.

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?

Blood Pressure

(22.4, 2)

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

$= 1.30$

Heart Rate

(7.9, .7)

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

$= 1.57$