

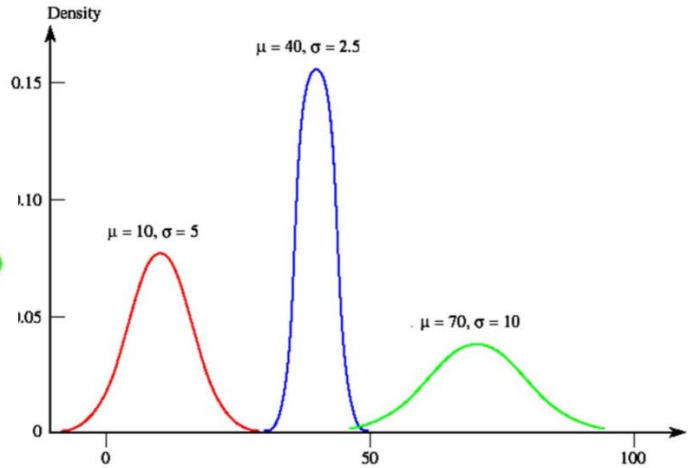
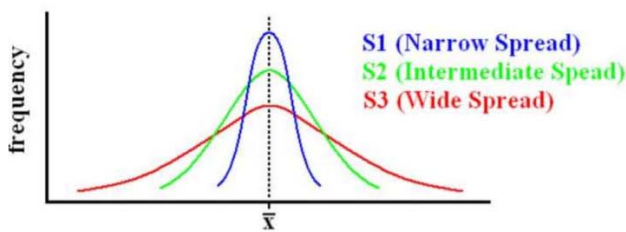
# Day 2 standard deviation

Wednesday, April 19, 2017 8:50 AM

Day 2 Notes – Standard Deviation

**Spread:** how wide or how narrow, are data pts close together, are there any gaps

**Standard Deviation:** a value that characterizes spread



$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \mu)^2}{n}}$$

where  $\mu = \text{mean}$  ("mu")  
and  $n$  is the # of data points

The square root of the average of the squared deviations.

A. Find the standard deviation of the data:

41, 42, 43, 48, 51

$$\mu = \frac{41 + 42 + 43 + 48 + 51}{5} = 45$$

x	x - $\mu$	(x - $\mu$ ) <sup>2</sup>
41	-4	16
42	-3	9
43	-2	4
48	3	9
51	6	36

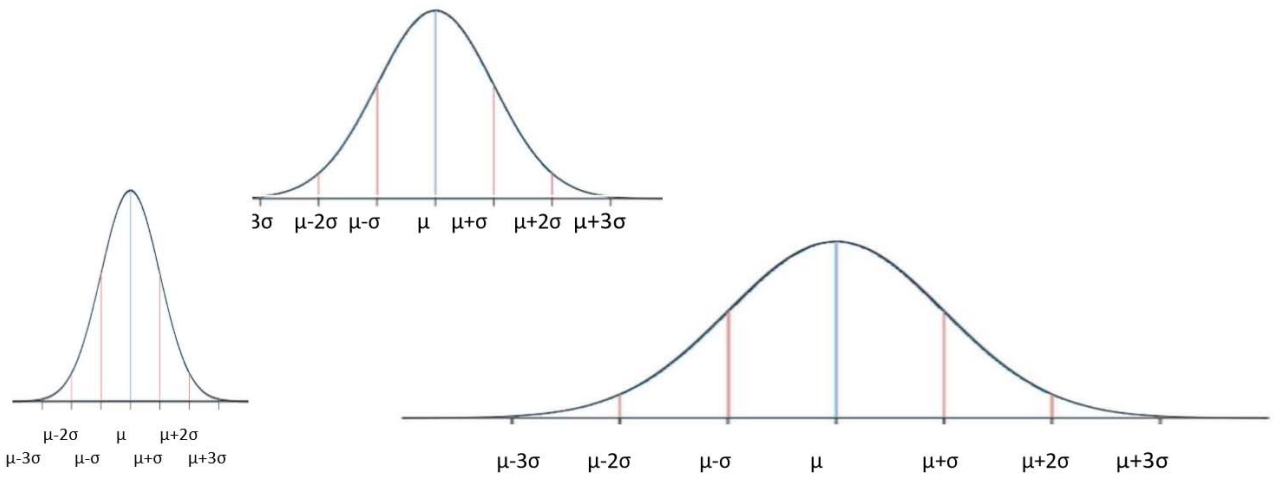
$\sigma^2 = 14.8$   
 $\sigma = 3.85$

B. Without calculating the standard deviation, predict if it would be bigger or smaller than the standard deviation in part a. Why?

34, 42, 43, 48, 58

Bigger. Data is more spread out.

### Make a prediction!



Use the normal distributions above to help you make a prediction. Each normal distribution represents a population with all data values plotted.

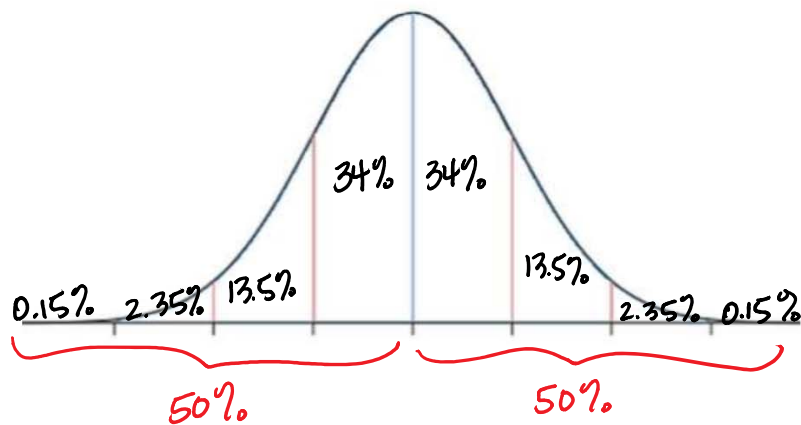
What percentage of the data falls within 1 standard deviation of the mean? *68%*

What percentage of the data falls within 2 standard deviations of the mean? *95%*

What percentage of the data falls within 3 standard deviations of the mean? *99.7%*

Using mathematical notation, let  $x$  be a data value from any population.

$$P(\mu - \sigma < x < \mu + \sigma) = \underline{68\%} \quad P(\mu - 2\sigma < x < \mu + 2\sigma) = \underline{95\%} \quad P(\mu - 3\sigma < x < \mu + 3\sigma) = \underline{99.7\%}$$



**Ex 1:** A normal distribution has a mean  $\mu$  and a standard deviation  $\sigma$ . An  $x$ -value is randomly selected from the distribution. Find:

a.  $P(x \leq \mu) = 50\%$

b.  $P(x \geq \mu) = 50\%$

c.  $P(\mu \leq x \leq \mu + 3\sigma) = 49.85\%$



d.  $P(\mu - 2\sigma \leq x \leq \mu) = 47.5\%$

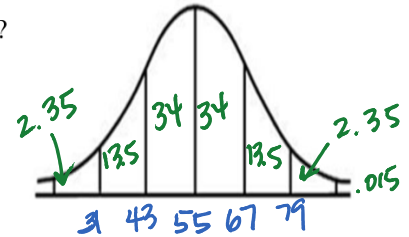
e.  $P(\mu - \sigma \leq x \leq \mu + 3\sigma) = 83.35\%$

f.  $P(\mu - 3\sigma \leq x \leq \mu + 3\sigma) = 99.7\%$

**Ex 2:** The scores for a state's peace officer standards and training are normally distributed with a mean of 55 and a standard deviation of 12. The test scores range from 0 to 100.

a. About what percent of the people taking the test have scores between 31 and 67?

81.5%



b. An agency in the state will only hire applicants with test scores of 67 or greater. About what percent of the people have test scores that make them eligible to be hired by the agency?

16%

**Ex 3:** Women's heights are normally distributed with a mean of 65 inches and a standard deviation of 3 inches. Find the percent of woman that have heights  $x$  in the following ranges.

a.  $x > 65$

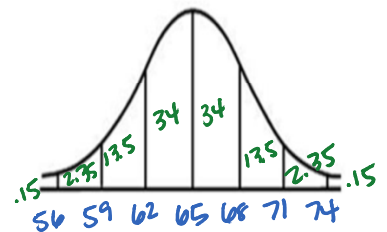
50%

b.  $62 < x < 68$

68%

c.  $59 < x < 74$

97.35%



d.  $x > 56$

99.85%

e.  $x > 74$

0.15%

f.  $56 < x < 68$

83.85%

## Day 2 Homework

(1-2) For each, determine whether the data appears to be skewed right, skewed left, or normally distributed.

1. 20 Most Visited National Parks

Visitors (millions)	Number of Parks
3-4	9
4-5	3
5-6	2
6-7	2
7-8	1
8+	3

2. Tallest Buildings in the World

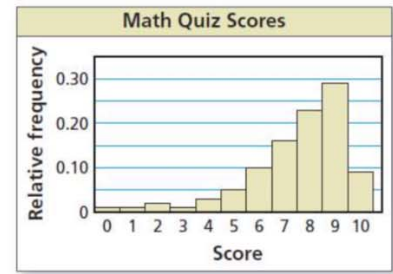
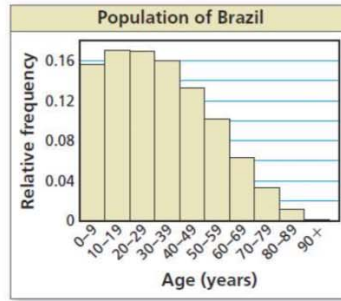
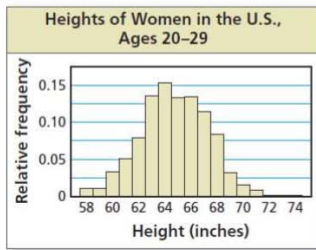
Stories	Number of Buildings
0-39	1
40-59	11
60-79	35
80-99	9
100+	6

3. a. Calculate the standard deviation of the data: 49, 49, 52, 53, 56, 62, 65, 66

b. Give a list of data that would have a larger standard deviation than the given set.  
(Do not calculate)

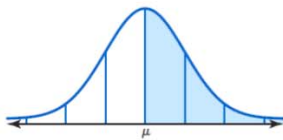
c. Give a list of data that would have a smaller standard deviation than the given set.  
(Do not calculate)

4. Which of the following has a normal distribution? What is the shape of the remaining two?

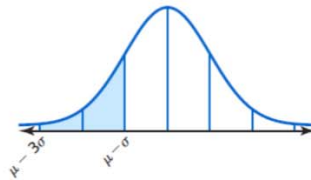


(5-8) Give the percent of the area under the normal curve represented by the shaded region.

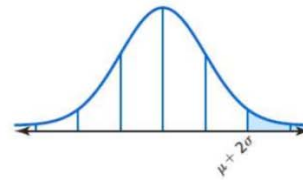
5.



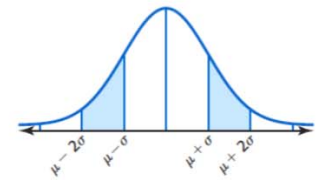
6.



7.



8.



9. (a - f) A normal distribution has a mean  $\mu$  and a standard deviation  $\sigma$ . An x-value is randomly selected from the distribution. Find:

a.  $P(x \leq \mu - \sigma)$

b.  $P(x \geq \mu - \sigma)$

c.  $P(x \geq \mu + 2\sigma)$

d.  $P(x \leq \mu + \sigma)$

e.  $P(\mu - \sigma \leq x \leq \mu + \sigma)$

f.  $P(\mu - \sigma \leq x \leq \mu + 3\sigma)$

10. A normal distribution has a mean of 33 and a standard deviation of 4. Find the probability that a randomly selected  $x$ -value from the distribution is in the given interval:

a. between 29 and 37

b. between 33 and 45

c. at least 25

d. at least 29

e. at most 37

f. at most 21

11. The wing lengths of houseflies are normally distributed with a mean of 4.6 millimeters and a standard deviation of 0.4 millimeters.



a. About what percent of houseflies have wing lengths between 3.8 millimeters and 5.0 millimeters?

b. About what percent of houseflies have wing lengths that are longer than 5.8 millimeters?

c. About what percent of houseflies have wing lengths that are shorter than 5.4?