



# Algebra 2 – Year 2

Lesson 11.6 - Standard Deviation  
Notes & Examples (Day 1)

Name: \_\_\_\_\_  
Date: \_\_\_\_\_ Hour: \_\_\_\_\_

*Measures of spread*, like range and interquartile range, were discussed previously, but there are two other important measures of spread: **variance** and **standard deviation**.

**Variance**( $\sigma^2$ ) and **standard deviation**( $\sigma$ ) are measures showing how much data values deviate from the mean.

The steps for calculating the variance and standard deviation are as follows:

**Take note**

### Key Concepts Finding Variance and Standard Deviation

- Find the mean,  $\bar{x}$ , of the  $n$  values in a data set.
- Find the difference,  $x - \bar{x}$ , between each value  $x$  and the mean.
- Square each difference,  $(x - \bar{x})^2$ .
- Find the average (mean) of these squares. This is the variance.

$$\sigma^2 = \frac{\sum(x - \bar{x})^2}{n}$$

- Take the square root of the variance. This is the standard deviation.

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$$

**Example 1** – Find the variance and standard deviation. The height of four dogs has been measured (in millimeters):

600, 470, 170, 430, 300

170 300 430 470 600

$$\bar{x} = \frac{1970}{5} = 394$$

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
170	$170 - 394 = -224$	50176
300	$300 - 394 = -94$	8836
430	$430 - 394 = 36$	1296
470	$470 - 394 = 76$	5776
600	$600 - 394 = 206$	42436
	Add $(x - \bar{x})^2$ column:	108500
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	21704
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	147.3

**On your test, I will give you this table, but no headers. You need to know what to fill in!**

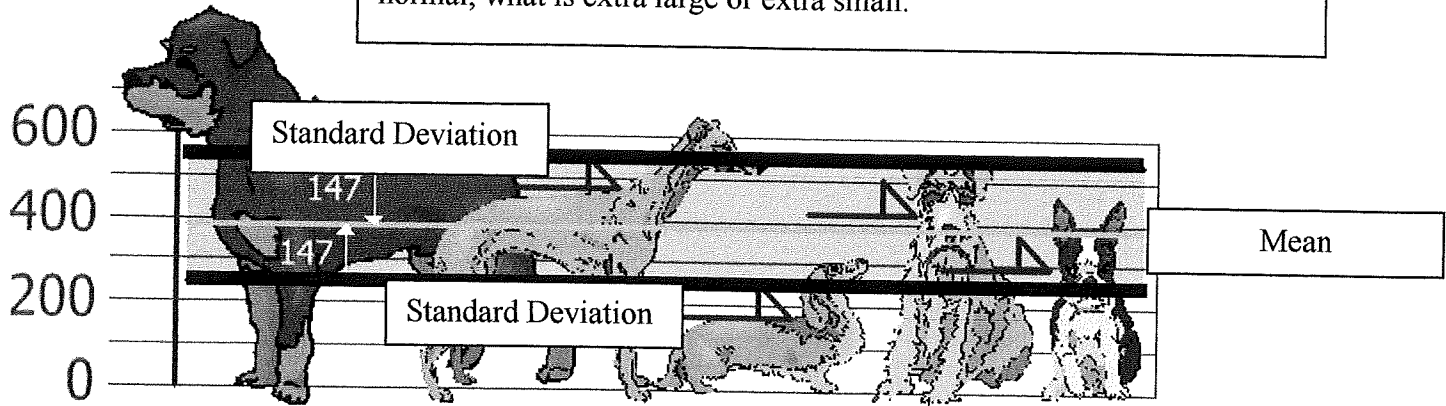
$$\sqrt{21704}$$

Variance:  $\sigma^2 = 21704$

Standard deviation:  $\sigma = 147.3$



The standard deviation allows us to see how far from the mean the height deviates. Then we have a "standard" way of knowing what is normal, what is extra large or extra small.



Got It? 1. What are the mean, variance, and standard deviation of these values?  
52 63 65 77 80 82

$$\bar{x} = \frac{419}{6} = 69.8$$

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
52	$52 - 69.8 = -17.8$	316.84
63	$63 - 69.8 = -6.8$	46.24
65	$65 - 69.8 = -4.8$	23.04
77	$77 - 69.8 = 7.2$	51.84
80	$80 - 69.8 = 10.2$	104.04
82	$82 - 69.8 = 12.2$	148.84
	Add $(x - \bar{x})^2$ column:	690.84
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	115.14
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	10.7

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Mean:  $\bar{X} = 69.8$     Variance:  $\sigma^2 = 115.14$     Standard deviation:  $\sigma = 10.7$



You can use a calculator to find the variance and the standard deviation. You can create a list of your data set, as seen in the steps to the right.

**Example 2** – The table displays the numbers of U.S. hurricane strikes by decade from the years 1851 to 2000.

What are the mean and standard deviation for this data set?

Decade	Strikes
1	19
2	15
3	20
4	22
5	21
6	18
7	21
8	13
9	19
10	24
11	17
12	14
13	12
14	15
15	14

Mean =  $\bar{X}$  = 17.6

Standard Deviation =  $\sigma_x$  = 3.5

Homework:

Find the mean, variance, and standard deviation for each data set.

6. 78 90 456 673 111 381 21      21 78 90 111 381 456 673

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
21	$21 - 258.6 = -237.6$	56453.76
78	$78 - 258.6 = -180.6$	32616.36
90	$90 - 258.6 = -168.6$	28425.96
111	$111 - 258.6 = -147.6$	21785.76
381	$381 - 258.6 = 122.4$	14981.76
456	$456 - 258.6 = 197.4$	38966.76
673	$673 - 258.6 = 414.4$	171727.36
	Add $(x - \bar{x})^2$ column:	364957.72
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	52136.8
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	

$\bar{x} = \frac{1810}{7} = 258.6$

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Mean:  $\bar{X}$  = 258.6      Variance:  $\sigma^2$  = 52136.8      Standard deviation:  $\sigma$  = 228.3



7. 13 15 17 18 21 10

10 12 13 15 17 18 21  $\bar{x} = 15.1$

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
10	$10 - 15.1 = -5.1$	26.01
12	$12 - 15.1 = -3.1$	9.61
13	$13 - 15.1 = -2.1$	4.41
15	$15 - 15.1 = -.1$	.01
17	$17 - 15.1 = 1.9$	3.61
18	$18 - 15.1 = 2.9$	8.41
21	$21 - 15.1 = 5.9$	34.81
	Add $(x - \bar{x})^2$ column:	86.87
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	12.41
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	3.5

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Mean:  $\bar{X} = 15.1$  Variance:  $\sigma^2 = 12.41$  Standard deviation:  $\sigma = 3.5$

9. 60 40 35 45 39

35 39 40 45 60

$\bar{x} = \frac{219}{5} = 43.8$

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
35	$35 - 43.8 = -8.8$	77.44
39	$39 - 43.8 = -4.8$	23.04
40	$40 - 43.8 = -3.8$	14.44
45	$45 - 43.8 = 1.2$	1.44
60	$60 - 43.8 = 16.2$	262.44
	Add $(x - \bar{x})^2$ column:	378.8
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	75.76
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	8.7

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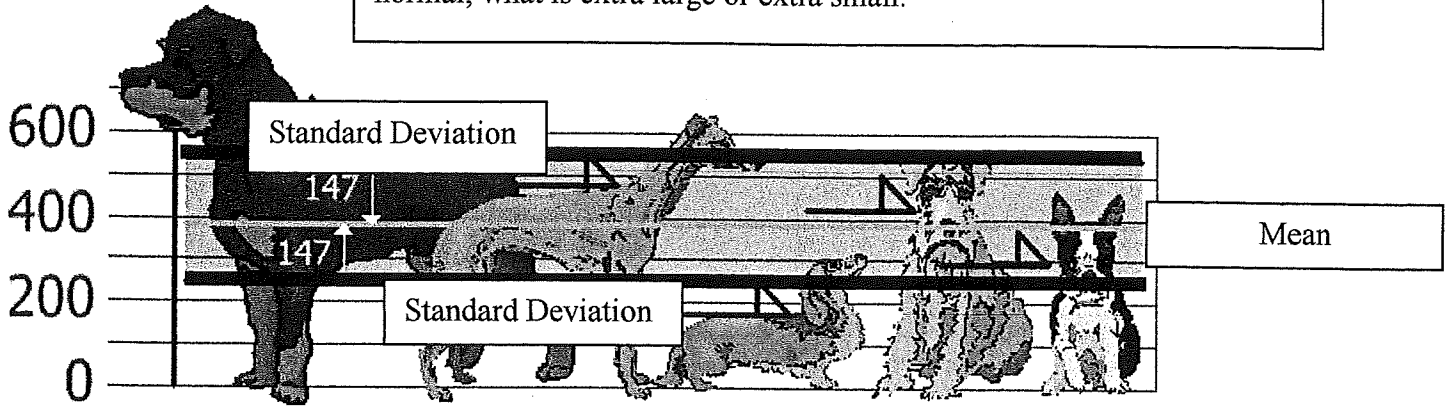
Mean:  $\bar{X} = 43.8$  Variance:  $\sigma^2 = 75.76$  Standard deviation:  $\sigma = 8.7$







The standard deviation allows us to see how far from the mean the height deviates. Then we have a "standard" way of knowing what is normal, what is extra large or extra small.



**Got It?** 1. What are the mean, variance, and standard deviation of these values?

52 63 65 77 80 82

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
	Add $(x - \bar{x})^2$ column:	
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	

**On your test, I will give you this table, but no headers. You need to know what to fill in!**

Mean:  $\bar{X} =$  \_\_\_\_\_ Variance:  $\sigma^2 =$  \_\_\_\_\_ Standard deviation:  $\sigma =$  \_\_\_\_\_

You can use a calculator to find the variance and the standard deviation. You can create a list of your data set, as seen in the steps to the right.

**Example 2** – The table displays the numbers of U.S. hurricane strikes by decade from the years 1851 to 2000.

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Mean =  $\bar{X}$  = \_\_\_\_\_

Standard Deviation =  $\sigma_x$  = \_\_\_\_\_

Homework:

Find the mean, variance, and standard deviation for each data set.

6. 78 90 456 673 111 381 21

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
	Add $(x - \bar{x})^2$ column:	
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	

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Mean:  $\bar{X}$  = \_\_\_\_\_ Variance:  $\sigma^2$  = \_\_\_\_\_ Standard deviation:  $\sigma$  = \_\_\_\_\_

7. 13 15 17 18 12 21 10

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
	Add $(x - \bar{x})^2$ column:	
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	

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Mean:  $\bar{X} =$  \_\_\_\_\_ Variance:  $\sigma^2 =$  \_\_\_\_\_ Standard deviation:  $\sigma =$  \_\_\_\_\_

9. 60 40 35 45 39

Data Values	$x - \bar{x}$	$(x - \bar{x})^2$
	Add $(x - \bar{x})^2$ column:	
<b>To find VARIANCE:</b>	Divide total by $n$ -size:	
<b>To find STANDARD DEVIATION:</b>	Square root the variance:	

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Mean:  $\bar{X} =$  \_\_\_\_\_ Variance:  $\sigma^2 =$  \_\_\_\_\_ Standard deviation:  $\sigma =$  \_\_\_\_\_