

Standard Deviation

Standard Deviation

“the average linear distance from the mean”

Variance sums the squares of the deviations,
hence gives the average “area” distance from the
mean

Standard Deviation

Defined as the Square Root of the variance

Calculated like variance with the additional step of taking the square root

Scores	Deviations ($X - \text{Mean}$)	Squared Deviations	
1	1 - 3 -2	4	
2	2 - 3 -1	1	
3	3 - 3 0	0	
4	4 - 3 +1	1	
5	5 - 3 +2	4	
		<hr/>	
		10	$10/5 = 2$
Mean = 3			Variance = 2

Scores	Deviations ($X - \text{Mean}$)		Squared Deviations	
1	1 - 3	-2	4	
2	2 - 3	-1	1	
3	3 - 3	0	0	
4	4 - 3	+1	1	
5	5 - 3	+2	4	
			<u>10</u>	
Mean = 3				$10/5 = 2$ Variance = 2

Standard Deviation = Square Root of Variance
 = Square Root of 2
 = **1.414** or **1.4** (rounded to tenths)

Notations:

s.d. sometimes used for standard deviation

s = standard deviation of a Sample

σ = standard deviation of a Population

Where is the usefulness of the Standard Deviation?

> Gives a relative location from the mean

Example: How did you do relative to everyone else on the tests?

Test	Mean	Std Dev	Your Score
Math	82	6	80
Verbal	75	3	75
Science	60	5	70
Logic	70	7	77

Test	Mean	Std Dev	Your Score
Math	82	6	80
Verbal	75	3	75
Science	60	5	70
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Math: $80 - 82 = 2$ points BELOW mean

Std Dev = 6 points, therefore your score is

2/6 std dev below the mean, or

0.33 std dev below the mean

<u>Test</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Your Score</u>	
Math	82	6	80	-0.3 sd
Verbal	75	3	75	
Science	60	5	70	
Logic	70	7	77	

Verbal: You scored at the mean,

$$75-75 = 0 \text{ pts} / 3 \text{ sd} = \mathbf{0 \text{ s.d.}}$$
 above the mean

Test	Mean	Std Dev	Your Score	
Math	82	6	80	-0.3 sd
Verbal	75	3	75	0.0 sd
Science	60	5	70	
Logic	70	7	77	

Science: You scored 10 points above the mean

$$70 - 60 = 10 \text{ points}$$

$$10 \text{ pts} / 5 \text{ sd} = \mathbf{+2.0} \text{ sd above the mean}$$

<u>Test</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Your Score</u>	
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Science	60	5	70	+2.0 sd
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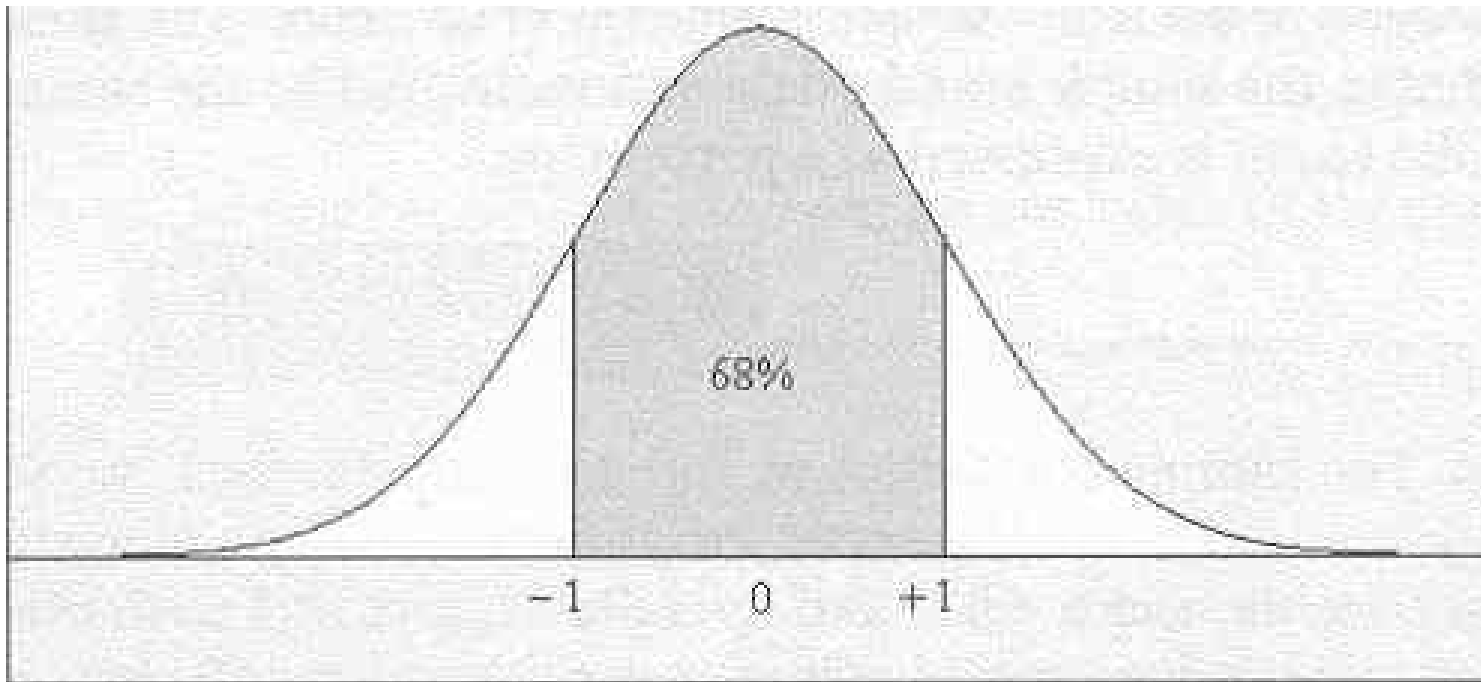
Logic: You scored 7 points above the mean

$$77 - 70 = 7 \text{ points}$$

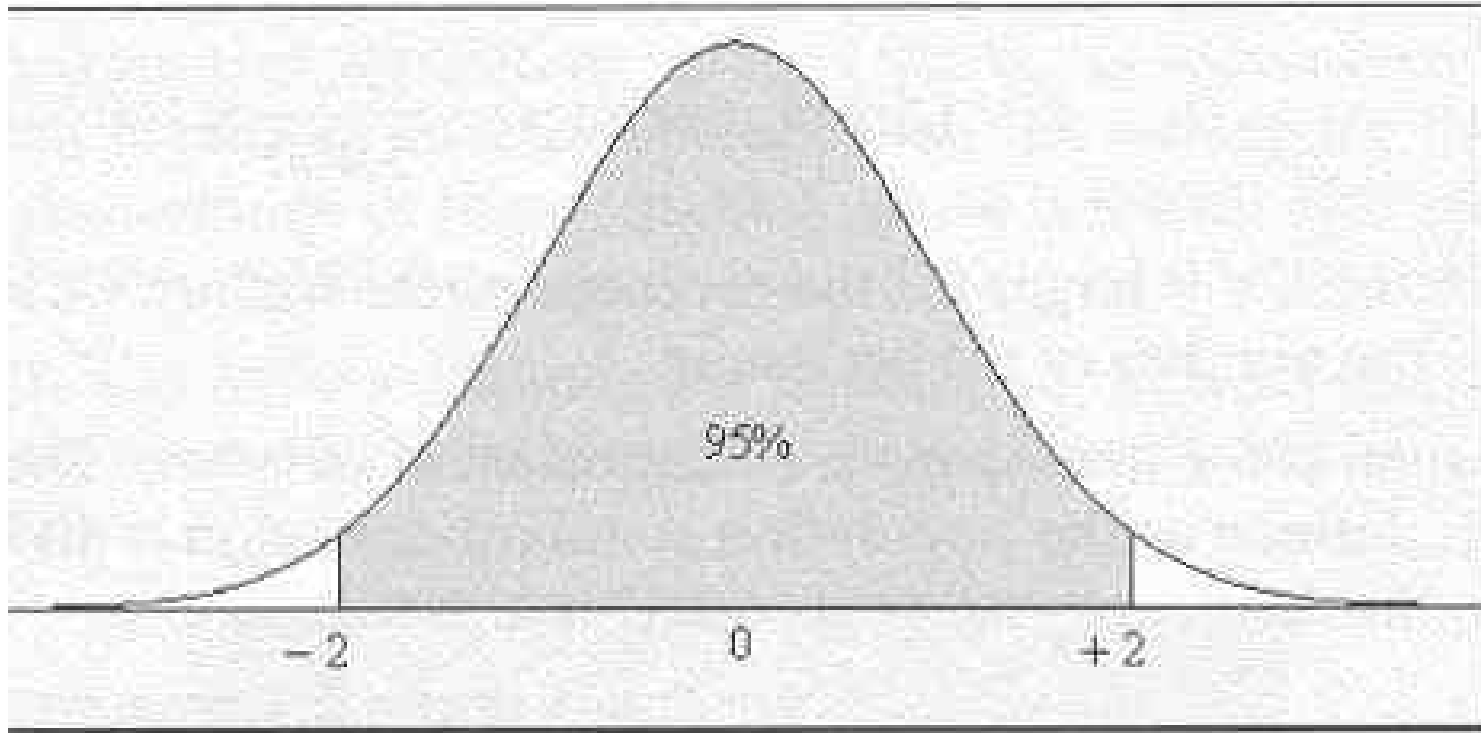
$$7 \text{ pts} / 7 \text{ sd} = \mathbf{+1.0} \text{ sd above the mean}$$

<u>Test</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Your Score</u>	
Math	82	6	80	-0.3 sd
Verbal	75	3	75	0.0 sd
Science	60	5	70	+2.0 sd
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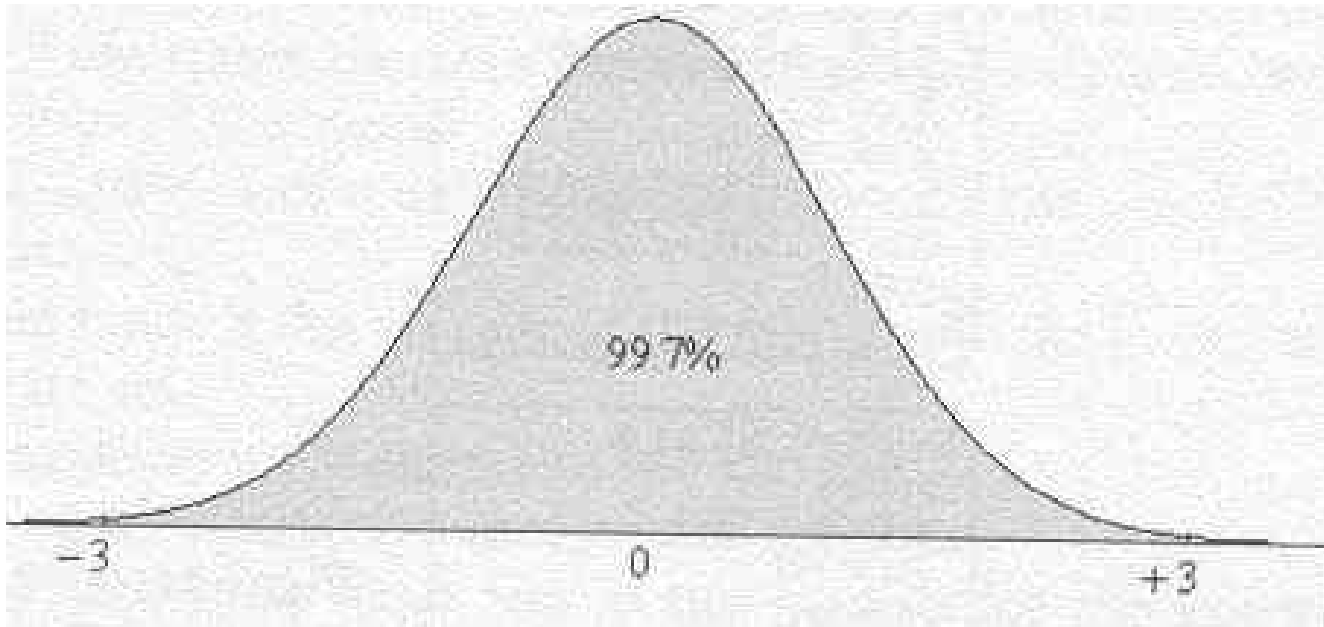
Conclusion: Your best score, relative to other students' scores on the test, was in Science (2 std dev above the mean)



In a standard bell curve approximately **68%** of scores will fall **within ONE standard deviation** of the Mean.



Approx. **95%** of scores will fall within 2 standard deviations of the mean



Approx. **99.7%** of scores will fall within 3 standard deviations of the mean