

# Measures of variation

- Averages from scores with low variability are more reliable than those with high variability.
- **Range:** Difference between the highest and lowest scores in a distribution. Like with the mean, high and low scores could present a deceptively large range.

Hey diddle diddle,  
the median's the middle;

YOU ADD AND DIVIDE FOR THE MEAN.

The mode is the one that appears the most,  
and the range is the difference between.

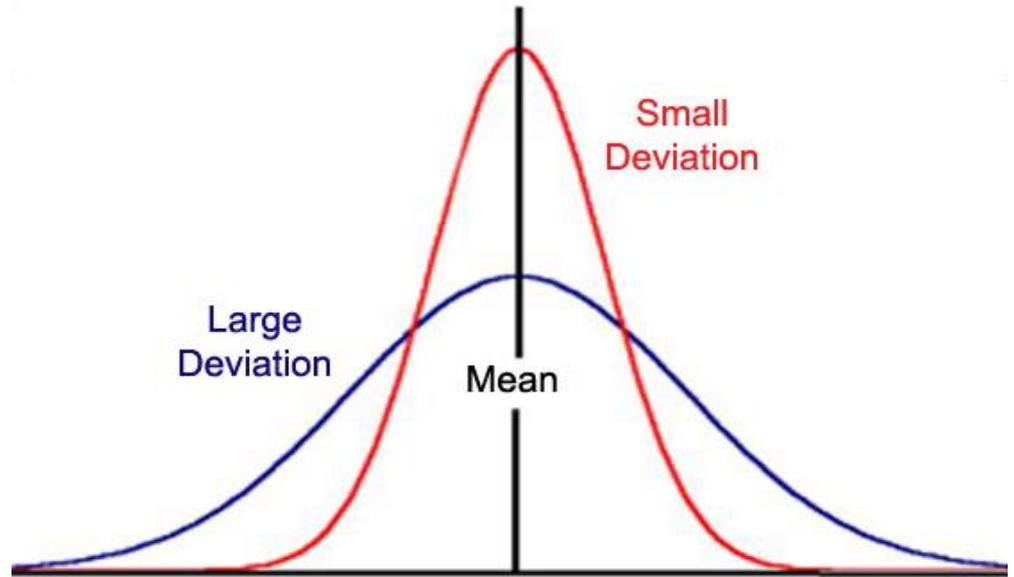
[www.PrometheanPlanet.com](http://www.PrometheanPlanet.com)

Promethean Planet is an online community for teachers in the 21st century classroom.

# Measures of Variation

**Standard Deviation:**  
A computed measure of **how much scores vary around the mean.**

**Standard Deviation** uses information from **each score**, so it better represents data.



# Standard Deviation

- SCORES
- Score-Mean (Score-Mean)<sup>2</sup>

18

-6

36

20

-4

16

24

0

0

25

1

1

33

9

81

134

$\frac{134}{5}$

**=**

**26.8**

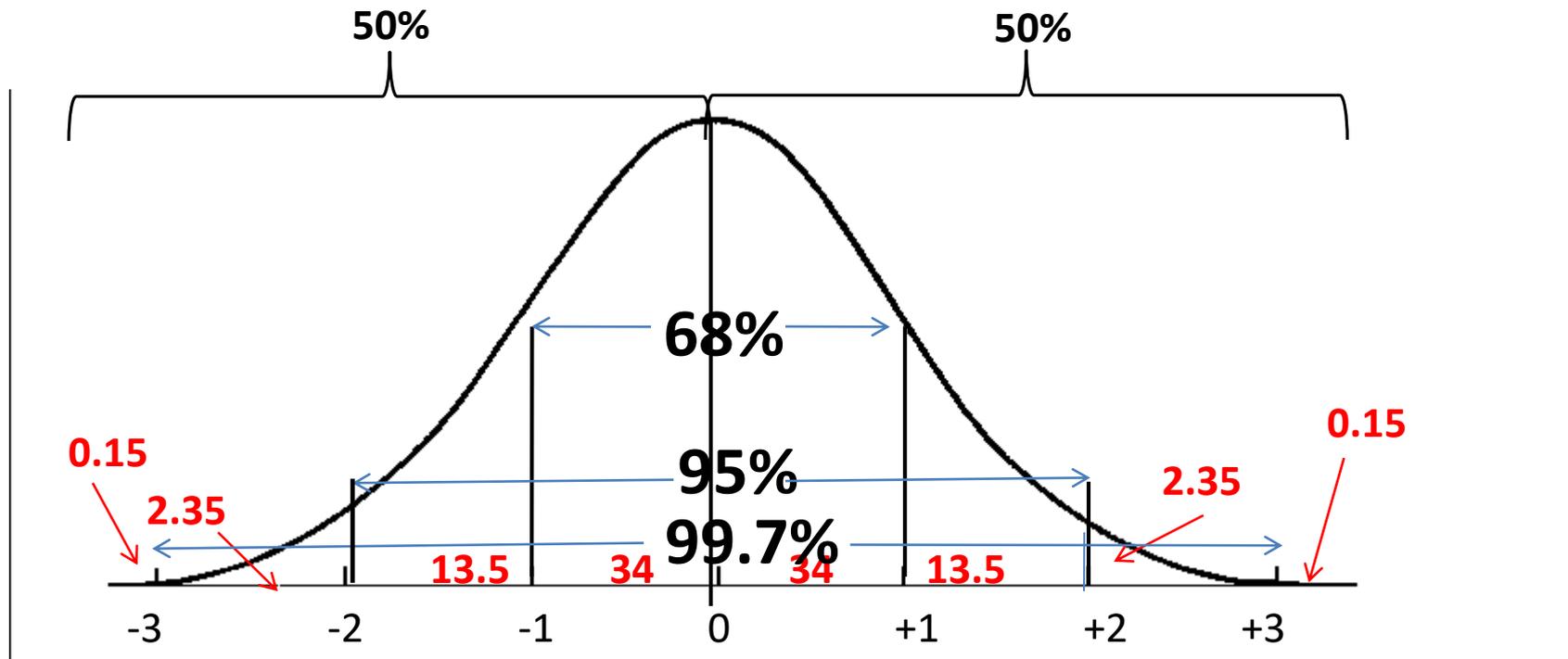
$\sqrt{26.8}$

MEAN: 24

**Variance: Gauges a spread of scores within a sample**

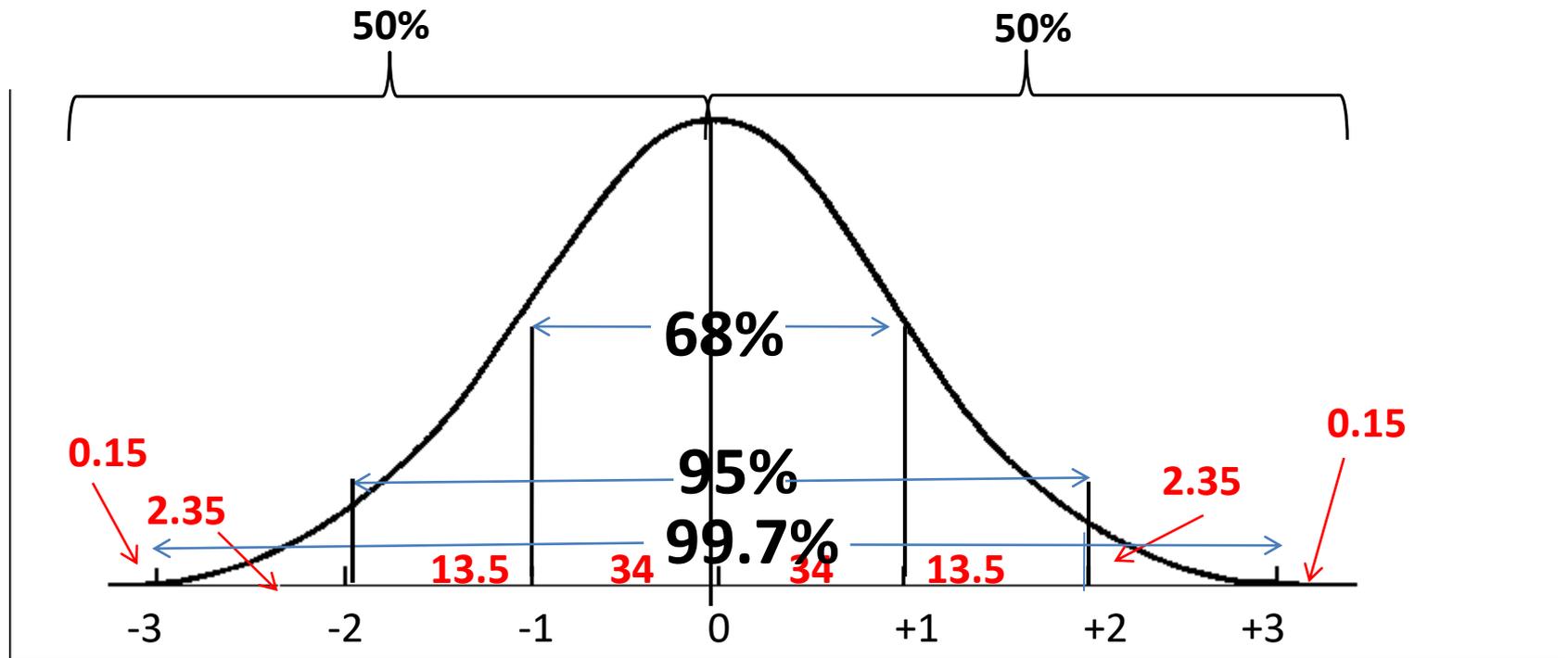
- **26.8 is the “variance”**
- **Standard deviation is the “square root of the variance.” (SD=5.17)**

# Normal Curve



- Each mark represents one deviation away from the mean.
- Numbers in red are the percentage of people whose score falls within each standard deviation.
- 68% of people will fall within 1 standard deviation from the mean.
- 95% of people will fall within 2 standard deviations from the mean.

# Normal Curve



Assume you took the SAT and scored 2 standard deviations above the average. You would have scored better than \_\_\_\_\_% of the population of test-takers.

Assume that you scored better than 15% of the population of test takers. How many standard deviations away from the mean would you be?



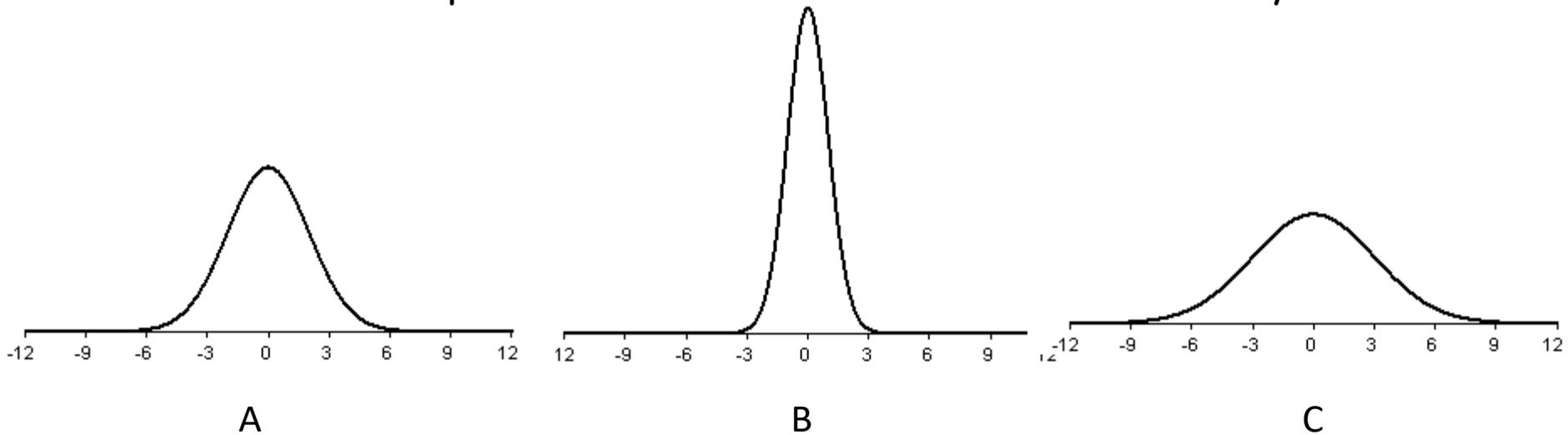
1. Tina's score on her midterm exam was at the 50th percentile. The grades were normally distributed. The exam average was 78 and the standard deviation was 3. What was Tina's score on the exam?  
A. 90      B. 50      C. 84      D. 78
2. Jane recently had a baby. She named him Tyler. Jane was told that the weights of babies born in this hospital are normally distributed and the mean is 7 lbs. 8 oz., with a standard deviation of 4 oz. Tyler's weight at birth was in the 16th percentile. How much did Tyler weigh when he was born?  
A. 7 lbs, 4 oz      B. 7 lbs, 8 oz      C. 7 lbs, 10 oz      D. 7 lbs, 12 oz
3. A shop foreman found it took 40 minutes on average to complete a task with a standard deviation of 5, and the times for completing the task are normally distributed. What percentage of workers will take 50 minutes or more to complete the task?
4. The scores from the AP Physics exam had an average of 82, with a standard deviation of 3. People who scored within 2 standard deviations of the mean had a score between \_\_\_\_\_ and \_\_\_\_\_

# ESTIMATING VARIANCE

The three curves below represent standard deviations of 1, 2 and 3.

Which curve below would represent a standard deviation of 1? How do you know?

Which curve would represent a standard deviation of 3? How do you know?



THE GREATER THE VARIANCE IN RESULTS, THE GREATER THE STANDARD DEVIATION.

[Standard deviation, the normal curve and baseball.](#)

# Weighing the odds...

- 2 High School punters
  - Kicker A:
    - mean distance: 40.0 yds
    - Standard deviation:  $\pm 16$  yds.
  - Kicker B:
    - mean distance: 34.5 yds.
    - Standard deviation:  $\pm 4$  yds.
- Which player do you play?
  - Kicker B – team will know what to expect

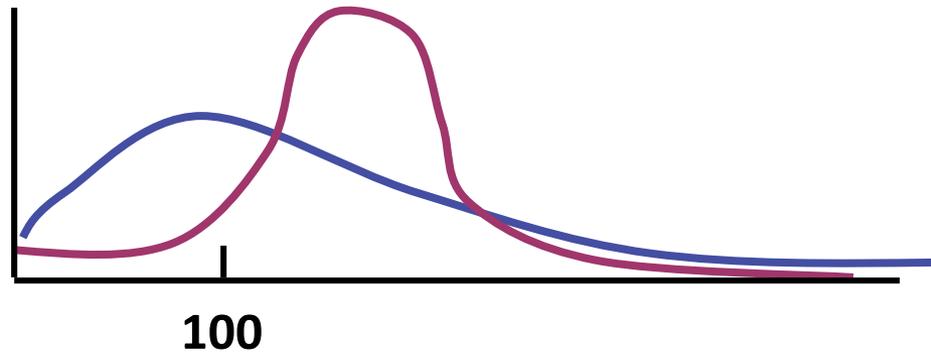


**\*\*Standard Deviation can be used to measure consistency.\*\***

# Applying the concepts

Try, with the help of this rough drawing below, to describe intelligence test scores at a high school and at a college using the concepts of range and standard deviation.

-  Intelligence test scores at a high school
-  Intelligence test scores at a college



# Want to take that class?

- So, if you were told that the mean average in a class was 85%, with a standard deviation of 5, would you feel confident that you would get a "B"?
- *The smaller the standard deviation, the more closely the scores are packed near the mean, and the steeper the curve would appear.*
- What percentage of students got a B or A? 84%
- What would the standard deviation be if every score was the mean score? 0