7.1 Graphs of Normal Probability Distributions

Essential Questions:

Can you compare apples and oranges?

Focus Points:

- Graph a normal curve and summarize its important properties.
- Apply the empirical rule to solve real-world problems.

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Normal distributions are one of the most important continuous probability distributions.
AKA: Gaussian

These distrbutions are so vital that some mathematicians refer to it as a "knife to a Boy Scout in Statistics."

Normal distributions are all about μ and σ. The graph is called the normal curve and described as bell-shaped curve.

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IMPORTANT PROPERTIES OF A NORMAL CURVE

1. The curve is **bell-shaped**, with the highest point over the mean, μ.
2. The curve is **symmetrical** about a vertical line through μ.
3. The curve approaches the horizontal axis but never touches or crosses it!
4. The inflection (transition) points between cupping upward and downward occur above **μ ± σ's**.
5. The **area** under the entire curve is always 1.

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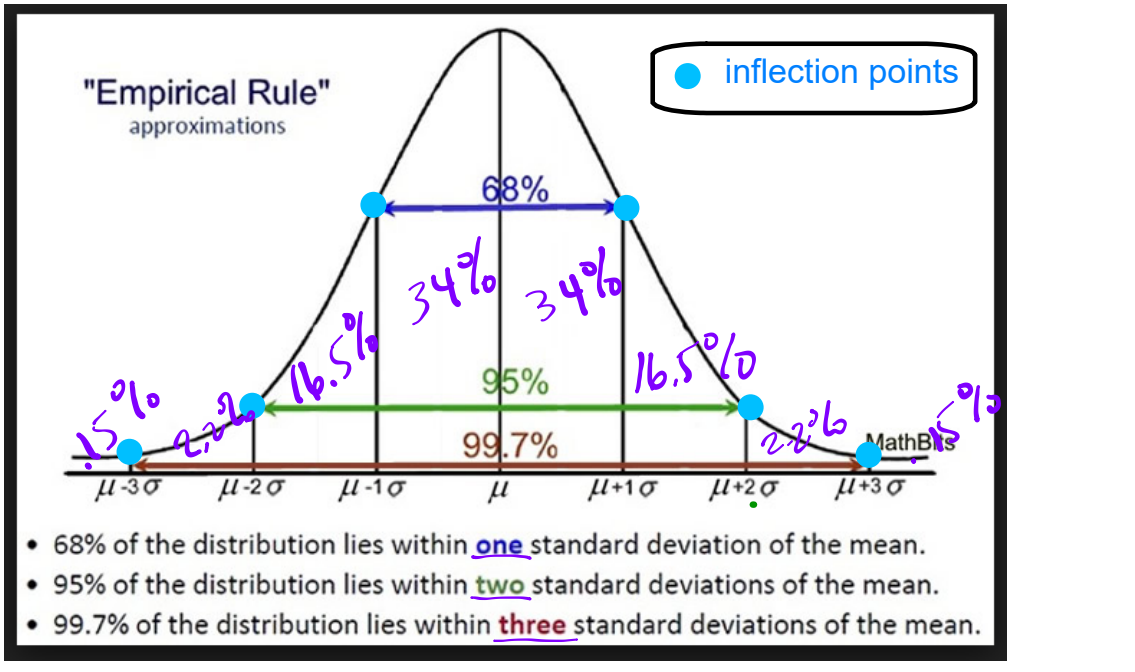

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Example 1: μ and σ on a Normal Curve

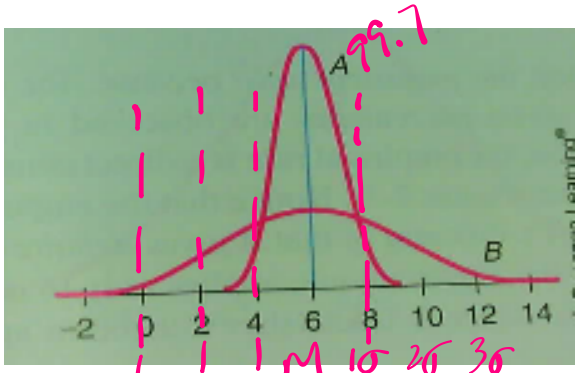
Determine the mean and standard deviation of graphs A and B.

μA: 6

μB: 6

σA: σ = .67

σB: σ = 2



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Normal curves are also called density curves because they are always above the horizontal axis and the area under the curve is always 1.

The normal density function is

$$f(x) = \frac{e^{\left(-\frac{1}{2}\right)\left(\frac{x-\mu}{\sigma}\right)^2}}{\sigma\sqrt{2\pi}}$$

** You do not need to memorize this!!**

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EMPIRICAL RULE

For a distribution that is symmetrical and bell-shaped:

- Approximately 68% of the data values will lie within 1 standard deviation on each side of the mean.
- Approximately 95% of the data values will lie within 2 standard deviations on each side of the mean.
- Approximately 99.7% (or almost all) of the data values will lie within 3 standard deviations of each side of the mean.

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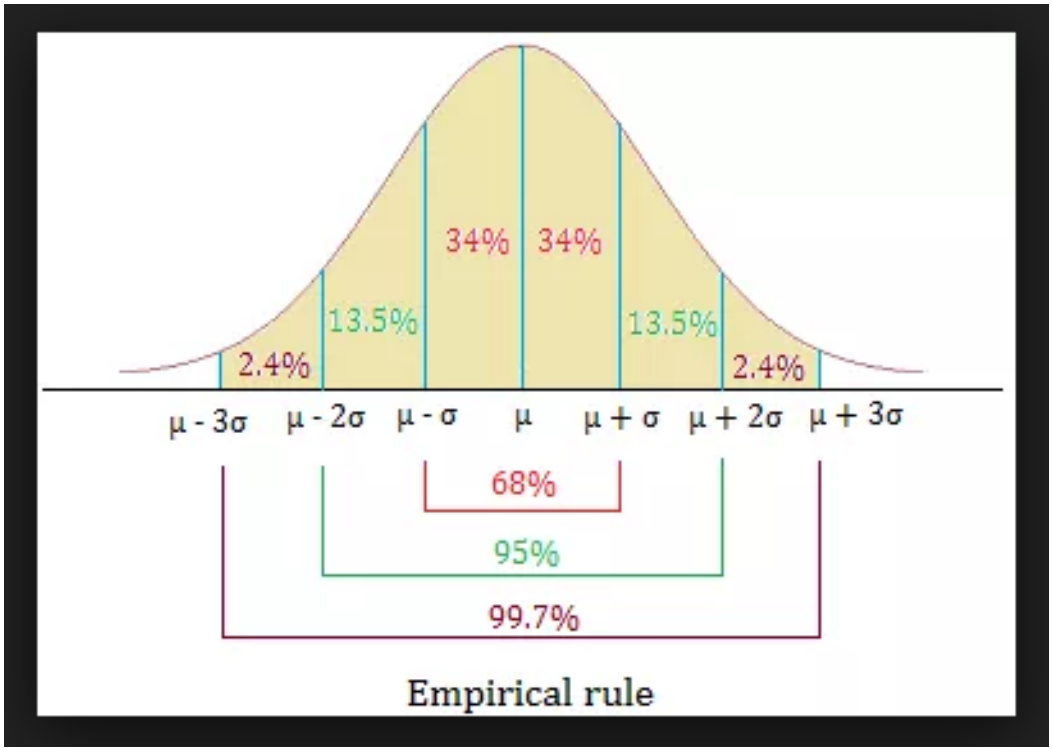

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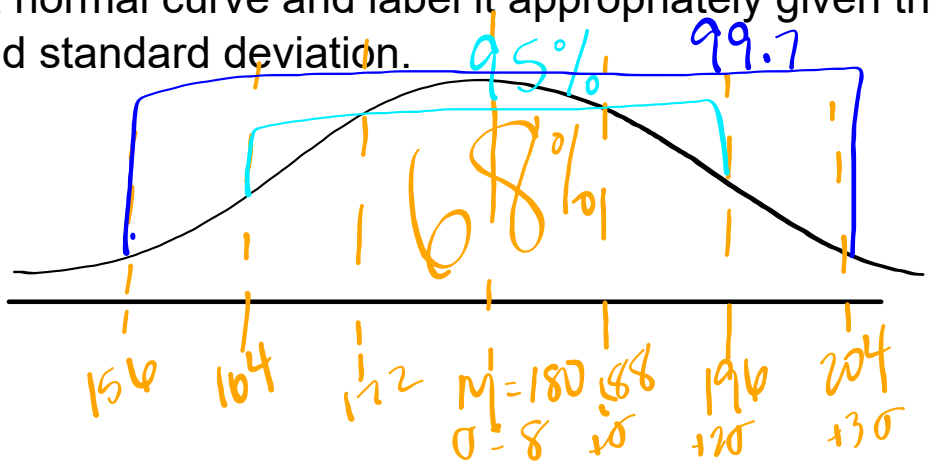
Example 2: Empirical Rule

The yearly corn yield per acre on a particular farm is normally distributed with mean μ = 180 bushels and standard deviation σ = 8 bushels.

Sketch a normal curve and label it appropriately given the mean and standard deviation.



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WHAT DOES A NORMAL DISTRIBUTION TELL US?

If a continuous random variable has a normal distribution, then

- the area under the entire distribution is 1.
- the area over a specific interval of values from a to b is the probability that a randomly selected value falls between a and b.
- the distribution is symmetrical and mound-shaped and is centered over μ.
- most of the data (99.7%) range from μ ± 3σ.

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HW: pg. 297: 1, 3, 5, 7, 9, 11

1. a) No, skewed left b) No, it crosses the x-axis c) No, 3 peaks d) No, curve not smooth

3. Figure 7-9 has a larger standard deviation with a mean of 10. Figure 7-10 has a mean of 4.

5. a) 50% b) 68% c) 99.7%

7. a) 50% b) 50% c) 68% d) 95%

9. a) From 1207 to 1279 b) From 1171 to 1315 c) From 1135 to 1351

11. a) From 1.70 mA to 4.60 mA b) From 0.25mA to 6.05 mA

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