Learning Objectives

- **Review** calculation of *standard deviation*
- **Define** the *normal curve*
- **Interpret** *z-scores* (aka, *standard scores*)
- **Calculate** *z*-scores:
  - With known population mean and standard deviation
  - From a sample

The Road to ***s***

6 steps for calculating Standard Deviation:

1. Calculate sample mean ($\overline{X}$)
2. Subtract mean from X_i for ***deviation scores***
3. Square deviation scores
4. Sum squared deviation scores (***SS****)*
5. Divide by *N* (or *N*-1) for ***variance*** (***s*²**)
6. Square root for ***standard deviation*** (***s***)

Pop Quiz

What is it?

$$\frac{\Sigma X}{N}$$

$$\Sigma(X_i - \bar{X})^2$$

$$\sqrt{\frac{SS}{N-1}}$$

$$\sum X^2 - \frac{(\sum X)^2}{N}$$

Pop Quiz

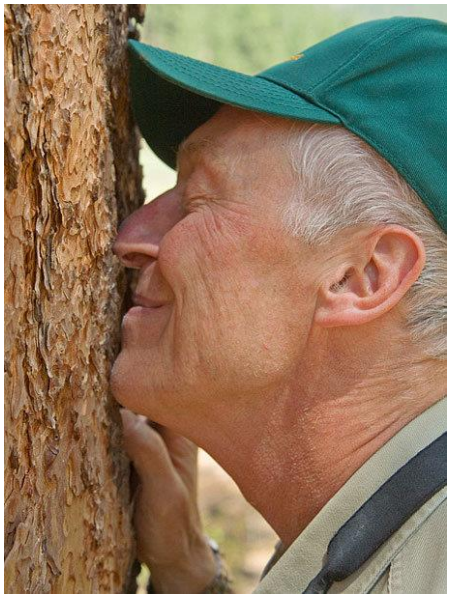
Say it!

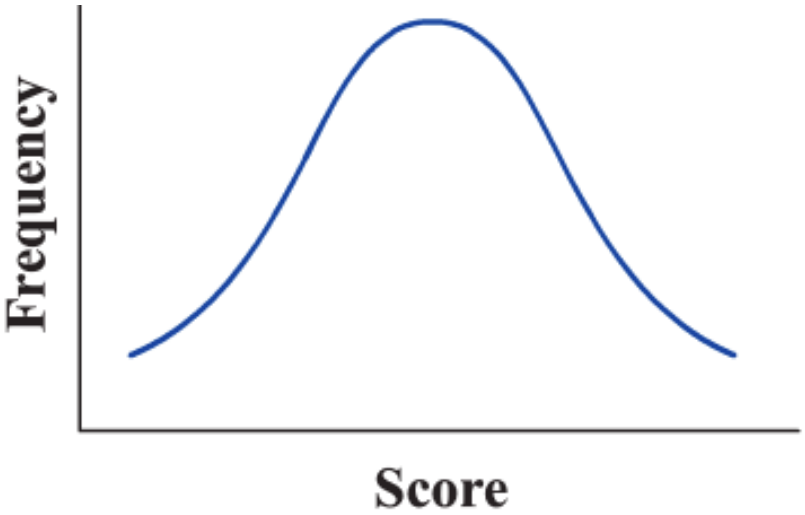
Σ	$\bar{X}$	μ
σ	β	α

Normal Curve

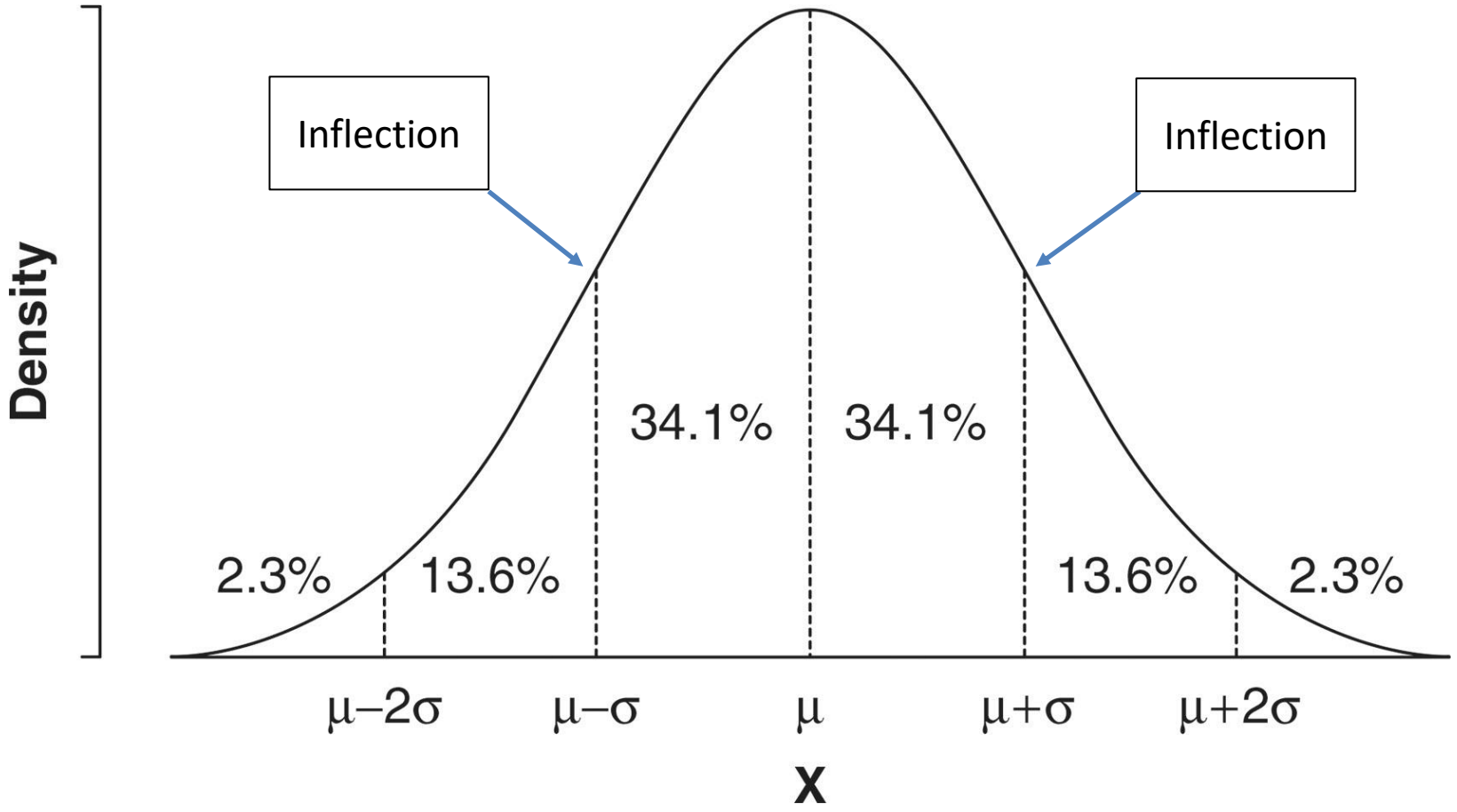
The normal curve is like…[the smell of pine trees on the first warm day of spring]

- Symmetric (not skewed)
- Unimodal
- Perfectly variable
- Asymptotic tails
- Known!

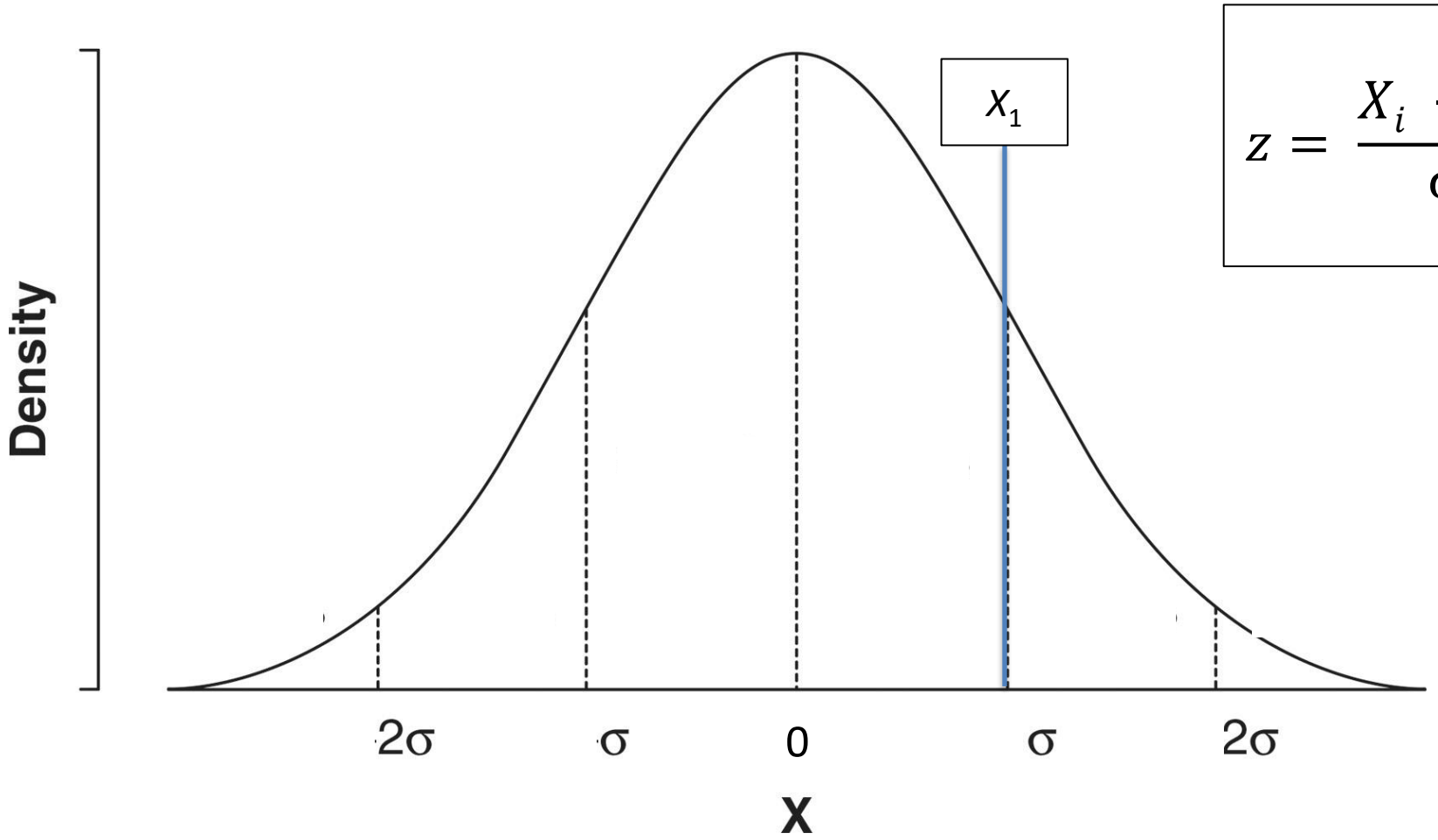




Area Under the Curve



***z*-scores** show how many σ‘s an observation is from μ



z-scores

z-scores are a ***transformation***

- $\bar{X}$ has been subtracted from each obs.
  - $\bar{X}/\mu$ is now equal to 0
  - Process known as "centering" the data
- Each obs. divided by standard deviation
  - σ is now equal to 1
  - Known as "standardizing" the data

- Standard scores are *comparable* to each other
  - They now share the same $\bar{X}$ and σ

Calculating *z*-scores

from a known pop.

- μ_F = 162cm; σ_F = 7.1cm
- μ_M = 175cm; σ_M = 7.4cm

$$z = \frac{X_i - \mu}{\sigma}$$

Where X_{AR} = 166cm
μ_M = 175cm
σ_M = 7.4cm

$$z = \frac{166 - 175}{7.4} \longrightarrow z = \frac{-9}{7.4} \longrightarrow z = -1.22$$

How much area is under the curve?

What percentile am I?

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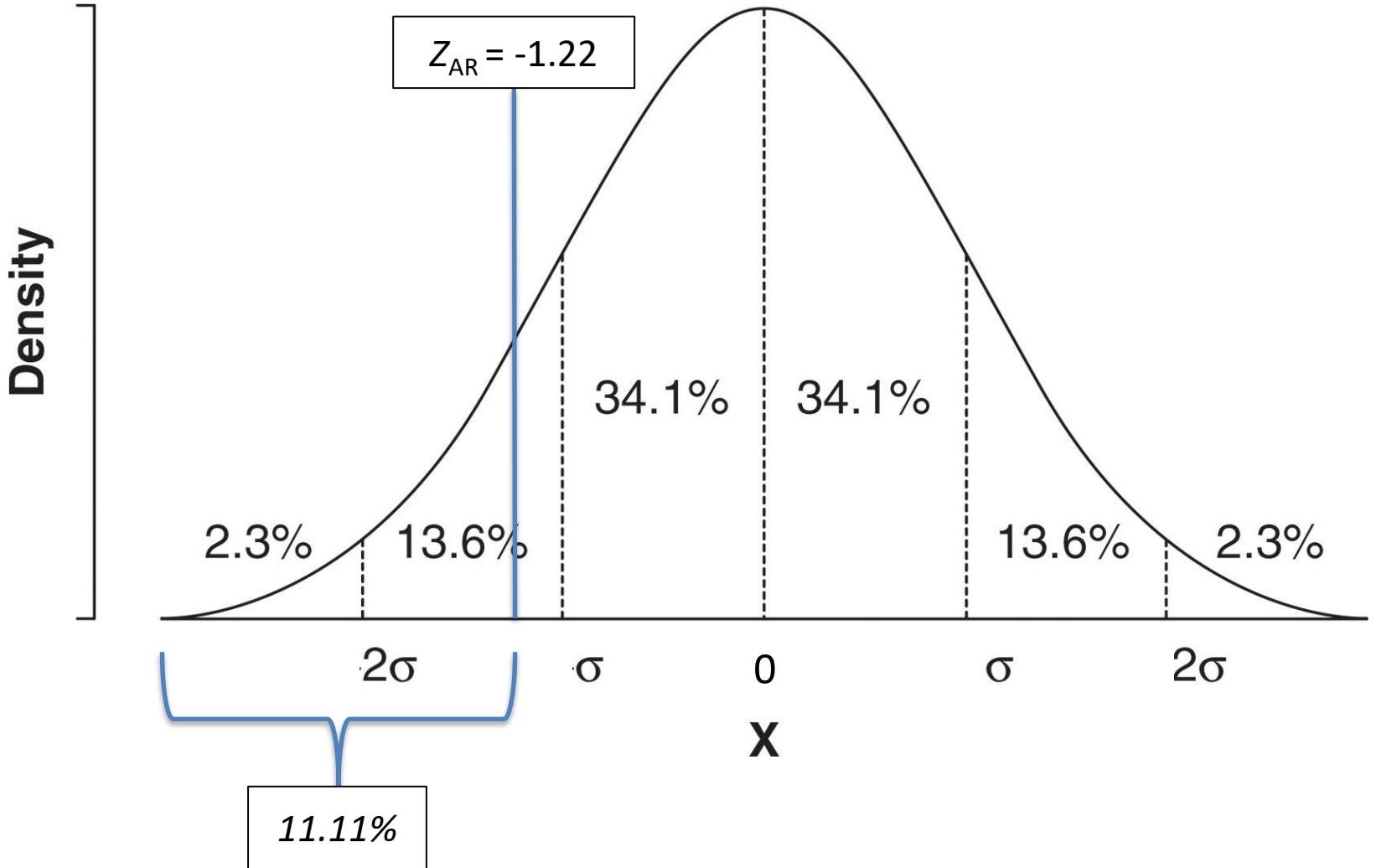

Calculating & Comparing *z*-scores

	Your Mark	Class Mean	Class Standard Dev.
Math	68	60	6
Psychology	70	65	4

$$z = \frac{X_i - \bar{X}}{s}$$

- Did you perform better, relatively speaking, in Math or Psychology?

Converting *z*-scores to Raw Scores

from a known pop.

- μ_F = 162cm; σ_F = 7.1cm

Where z_1 = **2.12**
μ_F = 162cm
σ_F = 7.1cm

$$z = \frac{X_i - \mu}{\sigma}$$

$$2.12 = \frac{X - 162}{7.1} \rightarrow 2.12*7.1 = X - 162 \rightarrow 15.052 + 162 = X$$

X = 177.05