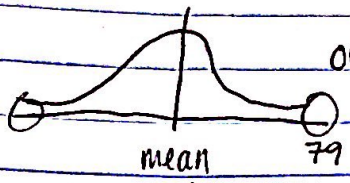
(L-25)

Stat 7 : class 6

10-15



"mean is pulled by the tail"

$\begin{bmatrix} -3 \\ -2 \\ 5 \end{bmatrix}$ mean = 0

$\begin{bmatrix} y_1-\bar{y} \\ \vdots \\ y_n-\bar{y} \end{bmatrix}$ $\uparrow n \downarrow$ mean = 0

absolute value

$\begin{bmatrix} 3 \\ 2 \\ 5 \end{bmatrix}$ mean = 3.3

$\begin{bmatrix} |y_1-\bar{y}| \\ \vdots \\ |y_n-\bar{y}| \end{bmatrix}$ mean $\frac{1}{n}\sum_{i=1}^{n} |y_i-\bar{y}|$

C mean absolute deviation

squaring

$\begin{bmatrix} 9 \\ 4 \\ 25 \end{bmatrix}$ mean = 12.7

$\begin{bmatrix} (y_1-\bar{y})^2 \\ \vdots \\ (y_n-\bar{y})^2 \end{bmatrix}$ mean $= \frac{1}{n}\sum_{i=1}^{n} (y_i-\bar{y})^2$

* pay attention to units!

take the $\sqrt{\ }$

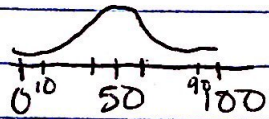
$\sqrt{12.7} = 3.6$

$$\frac{1}{n-1}\sum_{i=1}^{n}(y_i-\bar{y})^2 = \text{sample variance } (s)$$

$$s=\sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i-\bar{y})^2} = \text{sample standard deviation (SD)}$$

Properties of SD: *s can't be negative

Graphical Interpretation of SD

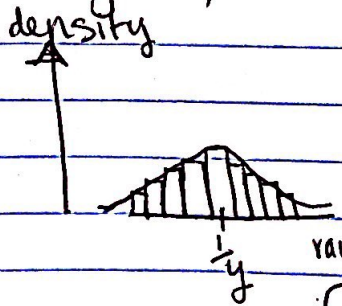


SD 1 : 49-51 too small
SD 40: 10-90 too big
SD 15: 35-65 ✓

empirical rule: start at mean, go {1, 2, 3} SD either way: you will capture about {68%, 95%, 99.7%} of data

* L-28 SD formula / R-22

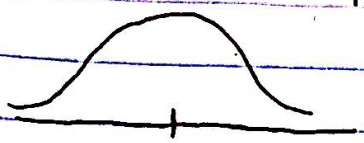
Histogram, Density Scale



$$f(y)=\frac{1}{s\sqrt{2\pi}}\exp\left[-\frac{1}{2}\left(\frac{y-\bar{y}}{s}\right)^2\right]$$

normal curve

SD = 0.29 cm



mean: 4.0 cm

What % of the butterflies had a wing length ≤ 3.56 cm?

$\begin{bmatrix} 3.3 \\ 3.5 \\ 3.6 \\ \vdots \\ 4.5 \end{bmatrix}$ n=24

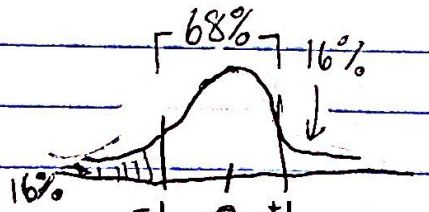
exact: $\frac{2}{24} = \frac{1}{12} = 8.3\%$

$$\int_{-\infty}^{c} e^{-\frac{1}{2}y^2}\, dy$$

density scale

numerical integration

★L-34 & L-35 - Areas under the normal curve



Standard normal curve

* every normal curve satisfies the emprical rule exactly

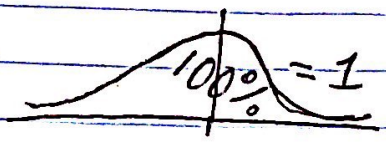
-1*.00 = (1 + .00)

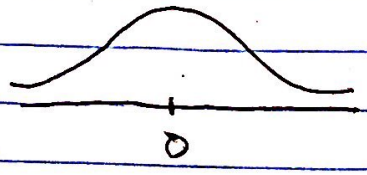
$\begin{bmatrix} 7 \\ \vdots \\ 7 \end{bmatrix}$

SD = 0

mean = 7

2 properties of the normal curve:

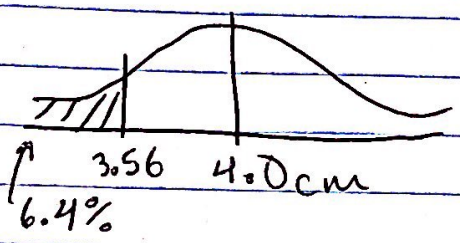
① 

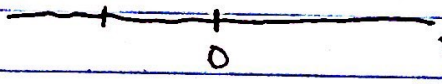
② 

symmetric

cumulative probability $p(Z \leq z)$ → area under curve

SD = 0.29cm





To convert from raw units (y) to standard units (z), ask: How far is y from $\bar{y}$, relative to the SD s?

pure #, without units ↗

$$z = \frac{\#-\text{mean}}{SD} = \frac{y-\bar{y}}{s}$$

$$\frac{3.56\,cm - 4.0\,cm}{0.29\,cm} = \frac{-0.44}{0.29} \doteq -1.52$$