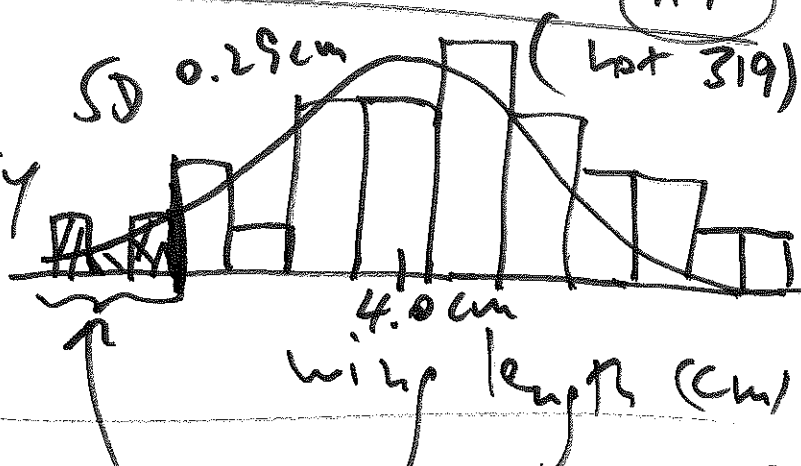


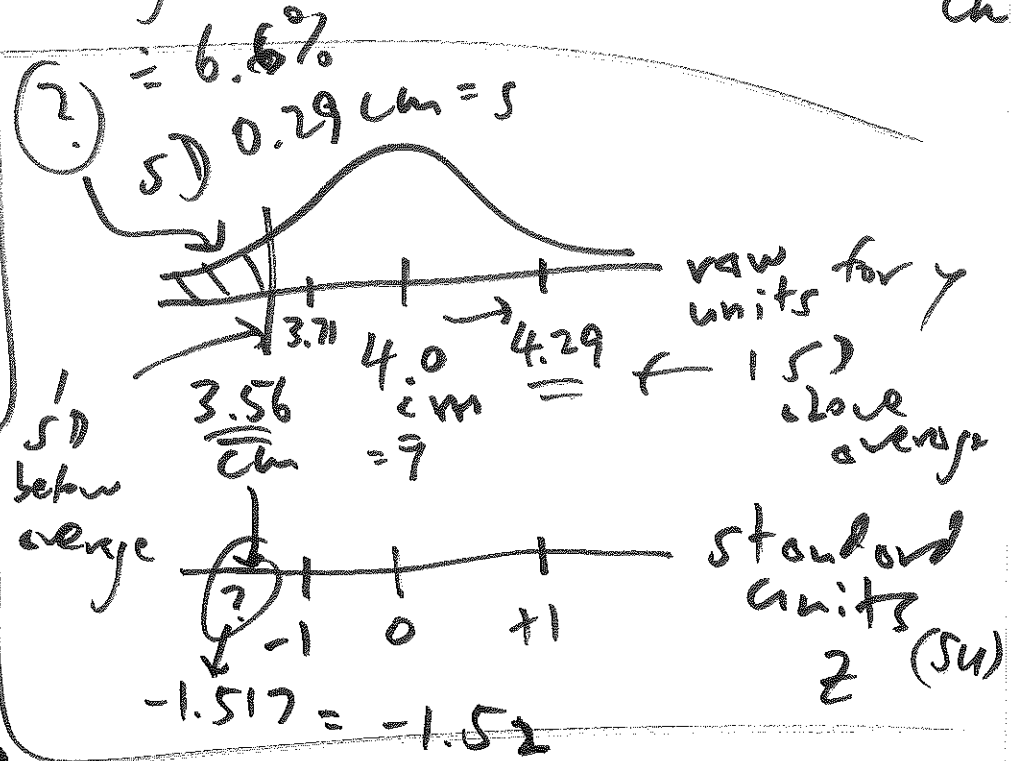
This time: normal curve  
 next time: experimental design  
 read: DD ch. 1-3(A)  
 read: ch. 1-6(B)  
 LN pp. 1-94  
 today: LN pp. L-30  
 AM 57  
 17 Apr 17  
 new due date for HW 1: Fri 21 Apr 11:59 PM  
 get course materials packet soon if you don't already have it: discussion section 2 (this week) is in there & I can't do any more photocopying)  
 in office hours: wed 3-5pm SG BE 119 (lat 319)  
 canvas.uesc.edu  
 Q: What density % of butterflies in data set had wing length  $\leq 3.56$  cm?  
 A<sub>1</sub>: (exact) relative freq from data:  $\frac{2}{24} =$   
 A<sub>2</sub>: (exact) area under hist  $\leq 3.56$  cm =  $\frac{2}{24} = 8.3\%$



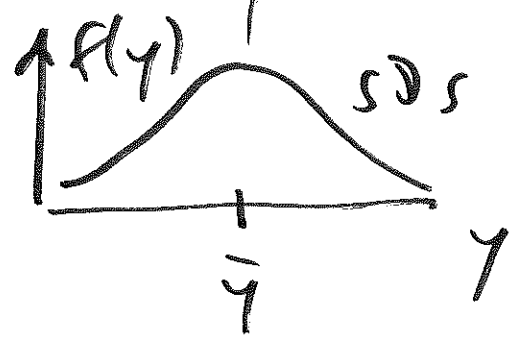
quiet let  $A_3$ : (approximate) work ②

out area under {bell curve that best approximates histogram} to left of 3.56 cm

bell curve =  
normal curve =  
Gaussian dist.



aside: normal curve density formula



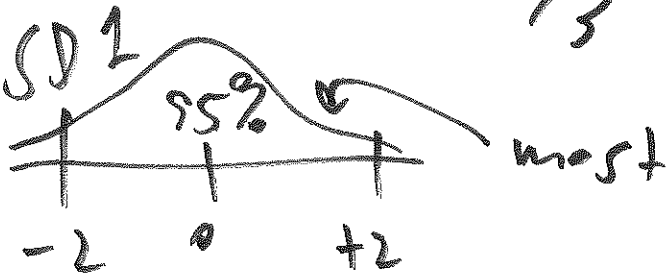
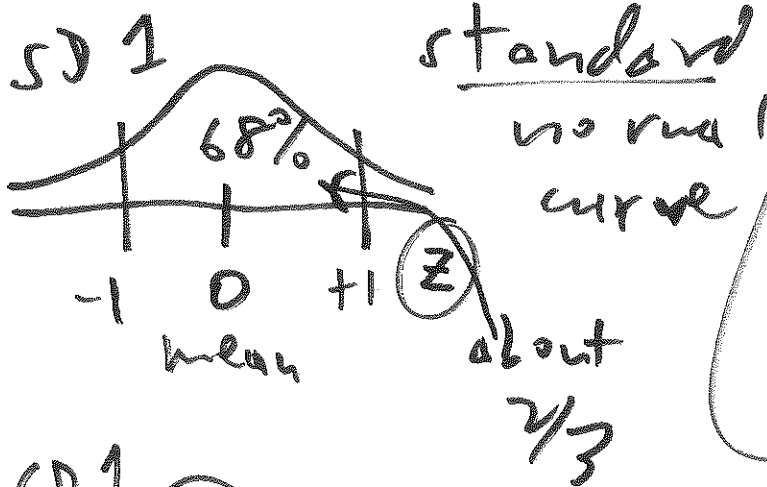
$$f(y) = \frac{1}{s\sqrt{2\pi}} \exp\left[-\frac{1}{2s^2}(y-\bar{y})^2\right]$$

not integrable in closed form

Isaac Newton  
 Gottfried Leibniz

numerical integration  
 formula sheet: ①-②③+②⑧

Fact: All normal curves satisfy <sup>③</sup>  
the Empirical Rule exactly



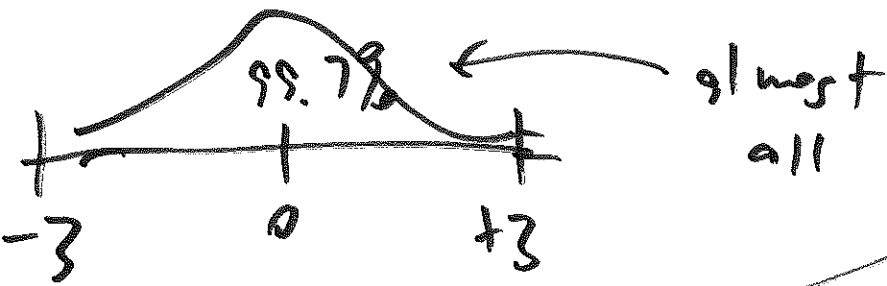
SD =  $\sqrt{\frac{1}{n-1} \sum (y_i - \bar{y})^2}$

negative SDs impossible

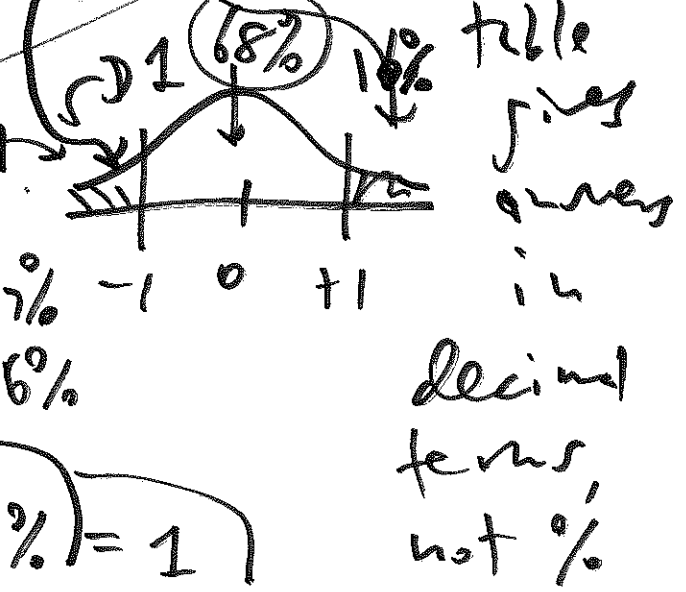
SD 0 ?

$\begin{pmatrix} 4 \\ 4 \\ \vdots \\ 4 \end{pmatrix}$

SD 0



$0 \leq (SD) < \infty$

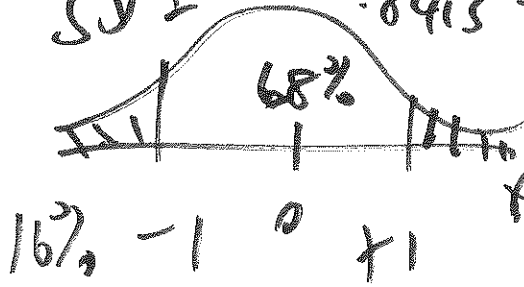


Facts about normal curves on density scale

- ① it's symmetric
- ② total area under curve = 100% = 1

.1587  
 "   
 15.87%  
 = 16%

SD 1  $\cdot 8413 = 84\%$



$100\% - 84\% = 16\%$

Convert: 9

from  
raw  
units

to standard units:  $su = \frac{x - \text{mean}}{SD}$

$$z = \frac{y - \bar{y}}{s}$$

$$\frac{3.56\% - 4.0\%}{0.29\%}$$

z scores (su)  
are  
unitless

area under  
normal curve

$$= \frac{-0.44}{0.29}$$

$$= -1.517$$

= normal  
approximation

to actual  
rel. freq.

6.6%

8.3%

normal approx. rather crude

convert: from  
standard  
to raw units:

$$y = \bar{y} + s \cdot z$$

L-69 R-41 suggestion: read Science ⑤  
article R-41 → R-50 now, 4 years in

week 10

to decrease uncertainty ↔ (get more food data)