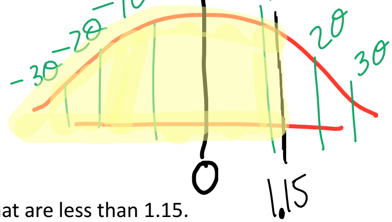


You need the curves from yesterday

Examples: you MUST draw a curve for each one!

1) Find the area under the standard normal curve to the left of z = 1.15

Chart → 1.15 $\boxed{0.8749}$

2) Find the proportion of observations from the standard normal curve that are less than 1.15.

0.8749 × 10,000 observations

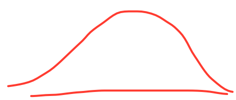
3) Find the probability of randomly selecting an individual from a normal population whose z-score is 1.15 or less.

0.8749

4) What percent of z-scores are less than or equal to 1.15?

87.49%

ASSESSING NORMALITY



approx symm $N(\mu, \sigma)$ (population) mean SD

Method 1: Construct a histogram, stem and leaf plot or box plot to determine if the shape is approximately bell shaped with symmetry about the mean. This is fairly easy because if you load the data into your calculator, you can check a histogram very quickly.

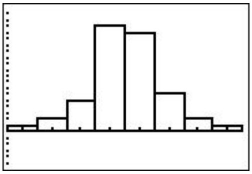
Method 2: Check the normal probability plot (on TI-83). This is an easy and quick way to check for normality. You are shooting for a normal probability plot that has a linear trend to it.

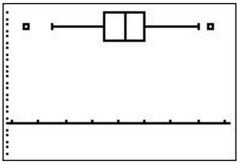
Method 3: You can improve upon the accuracy of methods 1 and 2 by checking to see if the 68-95-99.7 rule applies (approximately) to the data. Find the mean, and standard deviation of the data. Find out if approximately 68% of the data points are within 1 standard deviation of the mean, 95% are within 2 standard deviations, and approximately 99.7% are within 3 standard deviations. The last method is cumbersome, so only use it as a back-up plan.

Example: The following are the heights of 50 of my former male students, randomly selected from my classes. Are male student heights at DHS normally distributed?

68, 68, 73, 74, 75, 68, 68, 66, 70, 72, 69, 63, 68, 69, 68, 65, 68, 67, 69, 70, 71, 68, 66, 72, 69, 69, 70, 67, 64, 69, 70, 71, 68, 68, 67, 67, 69, 65, 68, 70, 69, 67, 66, 61, 68, 69, 69, 71, 72, 70

Method 1: See if you can create these in the calculator.

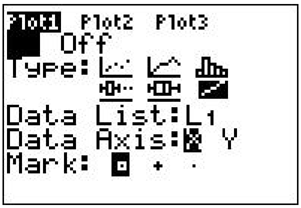


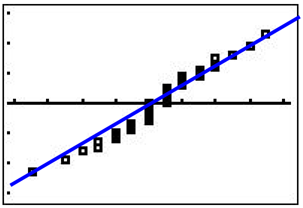


make sure you can create these in your calculator.

Since the histogram looks approximately bell shaped and the boxplot looks somewhat symmetric, we can say the data comes from a normal distribution.

Method 2:

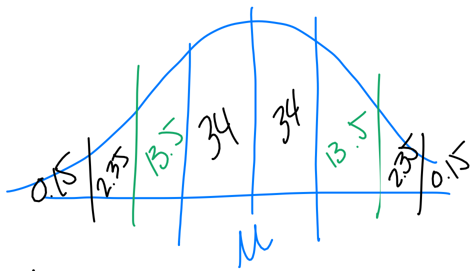




Since the normal probability plot looks approximately linear, we can say the data comes from a normal distribution.
Note: The line that is drawn, does not appear on the TI-83

Method 3:

1-Var Stats
$\bar{x}$=68.56
Σx=3428
Σx^2=235352
Sx=2.588514664
σx=2.56249878
↓n=50



$\bar{x} \pm 1s = 68.56 \pm 2.59 = (65.97, 71.15)$

Percent of data falling in this interval: 68%

Min
Q1
Med
Q3
Max

$\bar{x} \pm 2s = 68.56 \pm 5.18 = (63.38, 73.74)$

Percent of data falling in this interval: 95%

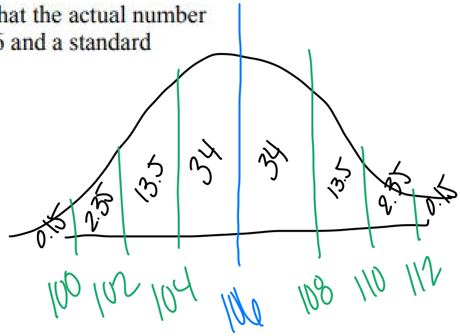
#s must fall into these intervals

$\bar{x} \pm 3s = 68.56 \pm 7.77 = (60.79, 76.33)$

Percent of data falling in this interval: 99.7%

Since the above percentages approximately fit the 68-95-99.7 rule, we can say the data comes from an approximately normal distribution.

1. A machine is used to put nails into boxes. It does so such that the actual number of nails in a box is normally distributed with a mean of 106 and a standard deviation of 2.



a) What percentage of boxes contain

%

a. More than 104 nails? 84%
b. More than 110 nails? 2.5%
c. Less than 108 nails? 84%
d. Less than 100 nails? .15%
e. Between 102 and 112 nails? 97.35%
f. Between 100 and 106 nails? 49.85%

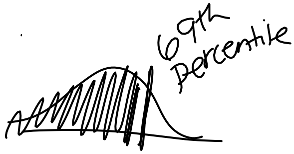
b) What is the z-score for a box containg

a. 101 nails −2.5
b. 103 nails −1.5
c. 107 nails 0.5

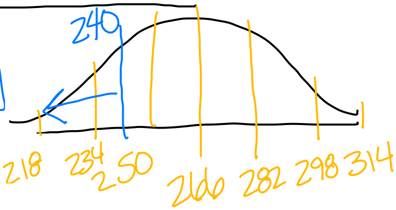
$$\frac{101-106}{2} = -2.5$$

c) What is the percentile for a box containing

a. 101 nails = 0.0062 → 0.62%
b. 103 nails = 0.0668 → 6.68%
c. 107 nails 0.6915 → 69.15%



The length of (human) pregnancies is approximately Normally distributed with a mean of 266 days and a standard deviation of 16 days.



a) What percent of pregnancies last less that 240 days (about 8 months)?

→ NormCDF(−∞, −1.63, 0, 1) = 0.052 → $\boxed{5.2\%}$ (LB, UB, μ, SD)

$$\frac{240-266}{16} = -1.63$$

b) What percent of pregnancies last between 240 days and 270 days?

NormCDF(−1.63, 0.25, 0, 1) = 0.547 (LB, UB, mean, SD)

$\boxed{54.7\%}$

$$\frac{270-266}{16} = 0.25$$

c) How many days do the top 20% of pregnancies last?

80th percentile 0.8

z=0.84

InvNorm(0.8, 266, 16) = 279.4 (area, μ, SD)

$\boxed{\approx 280 \text{ days}}$

$$0.84 = \frac{x-266}{16}$$

Scores on the SAT Verbal test follow approximately the N(505,110) distribution.

1. What proportion of students make less than a 600?

NormCDF(−∞, 0.86, 0, 1) → $\boxed{0.805}$ (LB, UB, mean, SD)

2. What proportion of students make more than a 600?

1 − 0.805 = $\boxed{0.195}$

3. What proportion of students make more 450?

NormCDF(−0.5, ∞, 0, 1) = $\boxed{0.6915}$ (LB, UB, mean, SD)

4. What proportion of students make between a 400 and a 625?

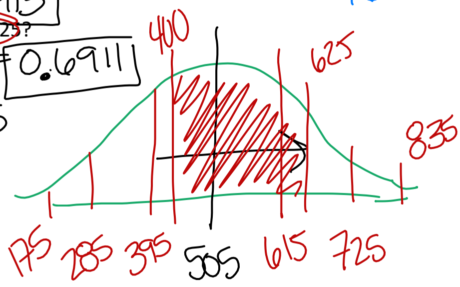
NormCDF(−0.95, 1.09, 0, 1) = $\boxed{0.6911}$ (LB, UB, mean, SD)

$$\frac{600-505}{110} = 0.86$$

$$\frac{450-505}{110} = -0.5$$

$$\frac{400-505}{110} = -0.95$$

$$\frac{625-505}{110} = 1.09$$



Lesson 2.2 – Density Curves and Normal Distributions

Big Ideas:

Density curves
*Always ↑ x-axis
*Area = 1
*Uniform
*height 1/k

0 k

Skew Right
med < mean

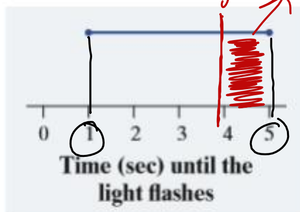
Symm
med ≈ mean

Skew left
med > mean

Normal Curve
b/t 1σ = 68%
b/t 2σ = 95%
b/t 3σ = 99.7%

Check Your Understanding:

1. An Internet reaction time test asks subjects to click their mouse button as soon as a light flashes on the screen. The light is programmed to go on at a randomly selected time after the subject clicks "Start." The density curve models the amount of time the subject has to wait for the light to flash.



4 secs

a. What height must the density curve have? Justify your answer. 1/4 $4 \times \frac{1}{4} = 1$ Area

b. About what percent of the time will the light flash more than 3.75 seconds after the subject clicks "Start"? $5 - 3.75 = 1.25$

$1.25 \times \frac{1}{4} = 0.3125 \rightarrow 31.25\%$

c. Calculate and interpret the 38th percentile of this distribution.

$0.38 = \frac{1}{4} \cdot w$ $w = 1.52$

38% of the time, the light flashes w/i 1.52 secs of starting.

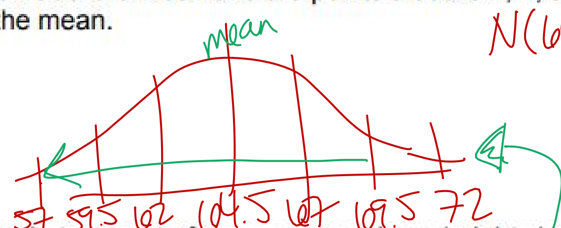
+1 sec

2.52 secs

2. The distribution of heights of young women aged 18 to 24 is approximately Normal with mean μ = 64.5 inches and standard deviation σ = 2.5 inches.

a. Sketch the Normal curve that approximates the distribution of young women's height. Label the mean and the points that are 1, 2, and 3 standard deviations from the mean.

N(64.5, 2.5)



b. About what percent of young women have heights less than 69.5 inches? Show your work.

97.5%

c. Is a young woman with a height of 62 inches unusually short? Justify your answer.

No, b/c only 1SD away from mean of 64.5in, 16% of women are shorter than 62in.