Find the **probability** mean and standard deviation for the following data.

2, 4, 5, 6, 5, 5, 5, 2, 2, 4, 4, 3, 3, 1, 2, 2, 3, 4, 6, 5

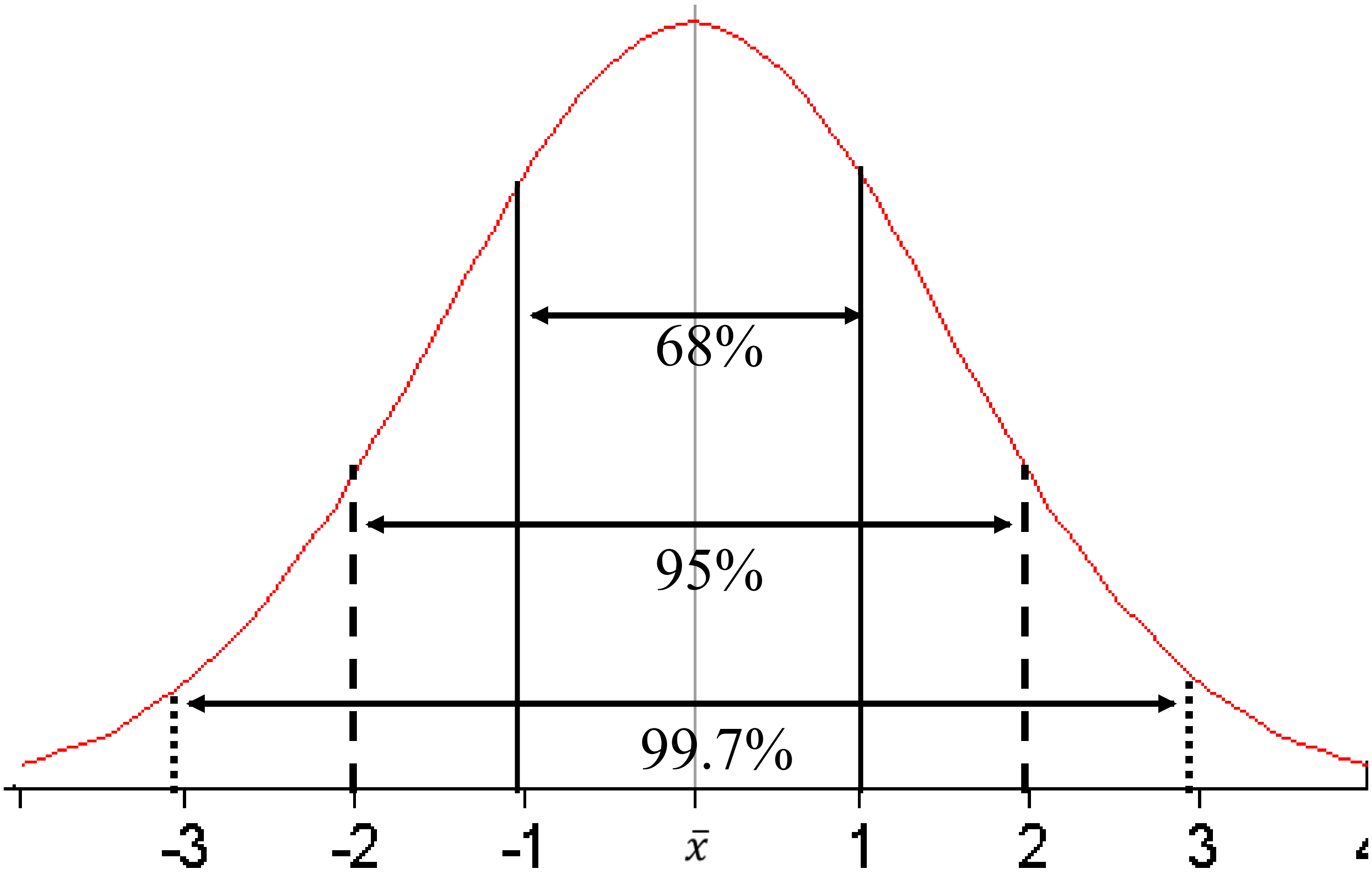
Hint: First create a probability distribution.

Unit 6: Data Analysis

EMPIRICAL RULE

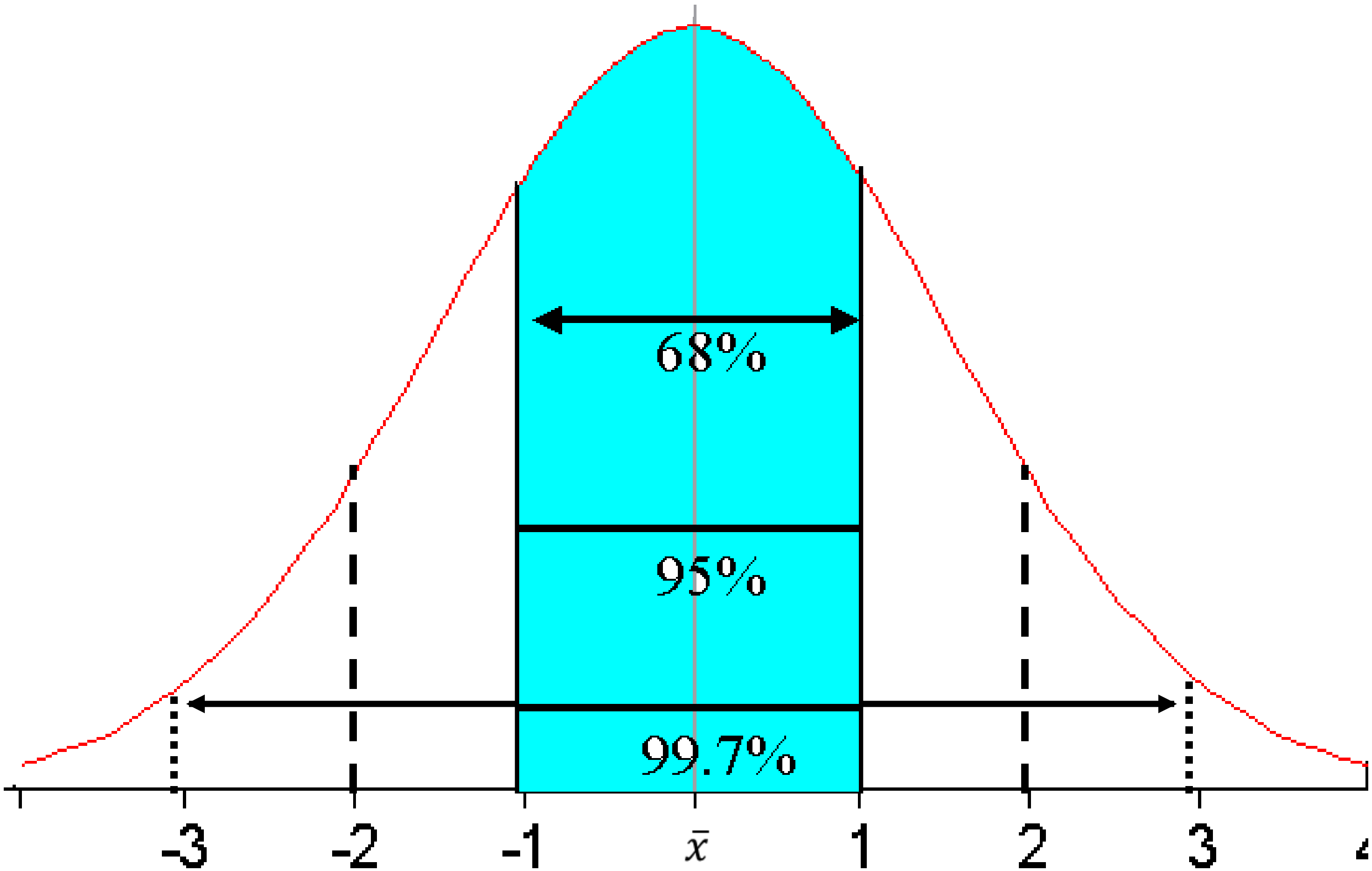
What does a population that is normally distributed look like?

Empirical Rule



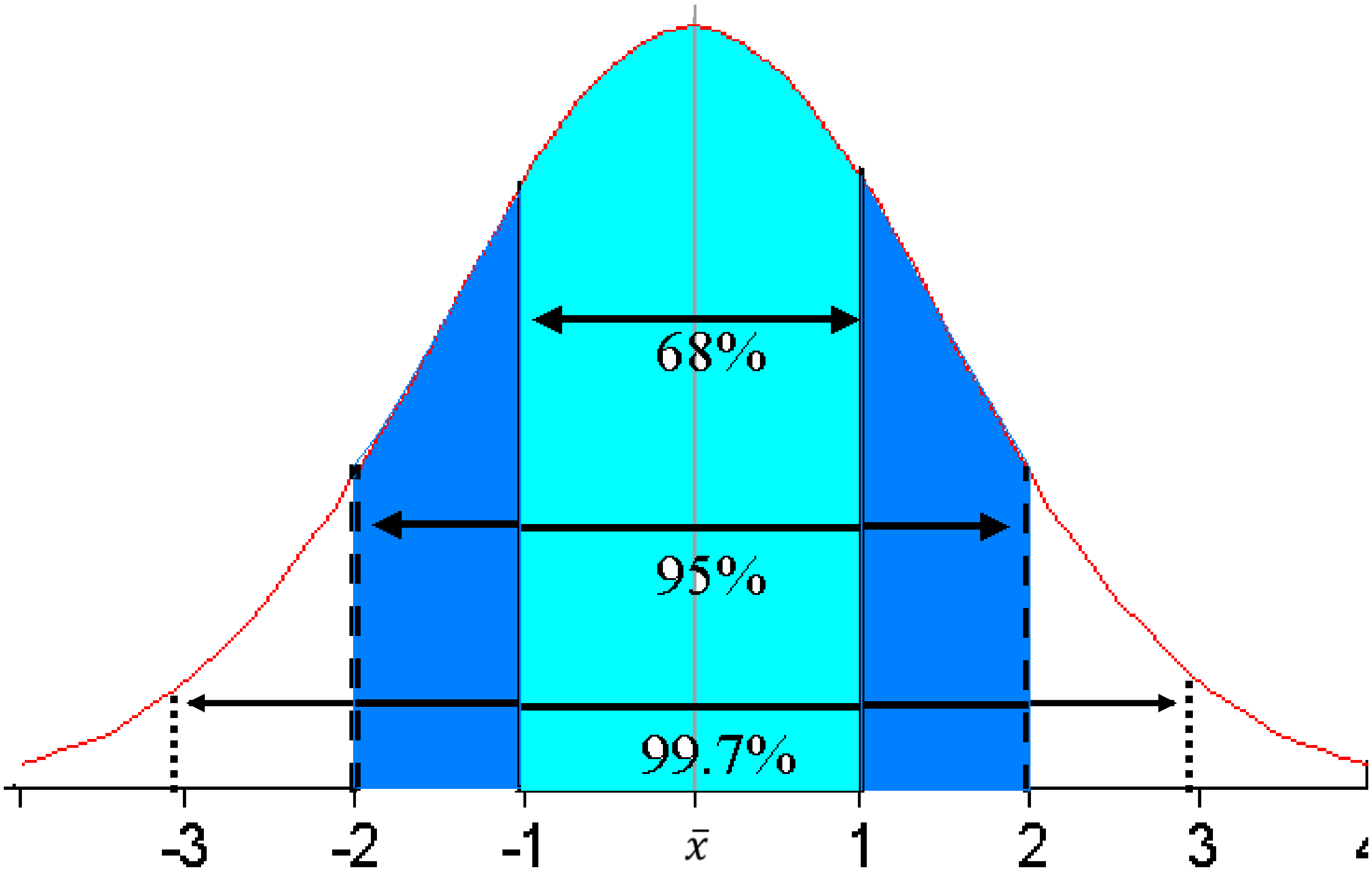
68-95-99.7% RULE

Empirical Rule



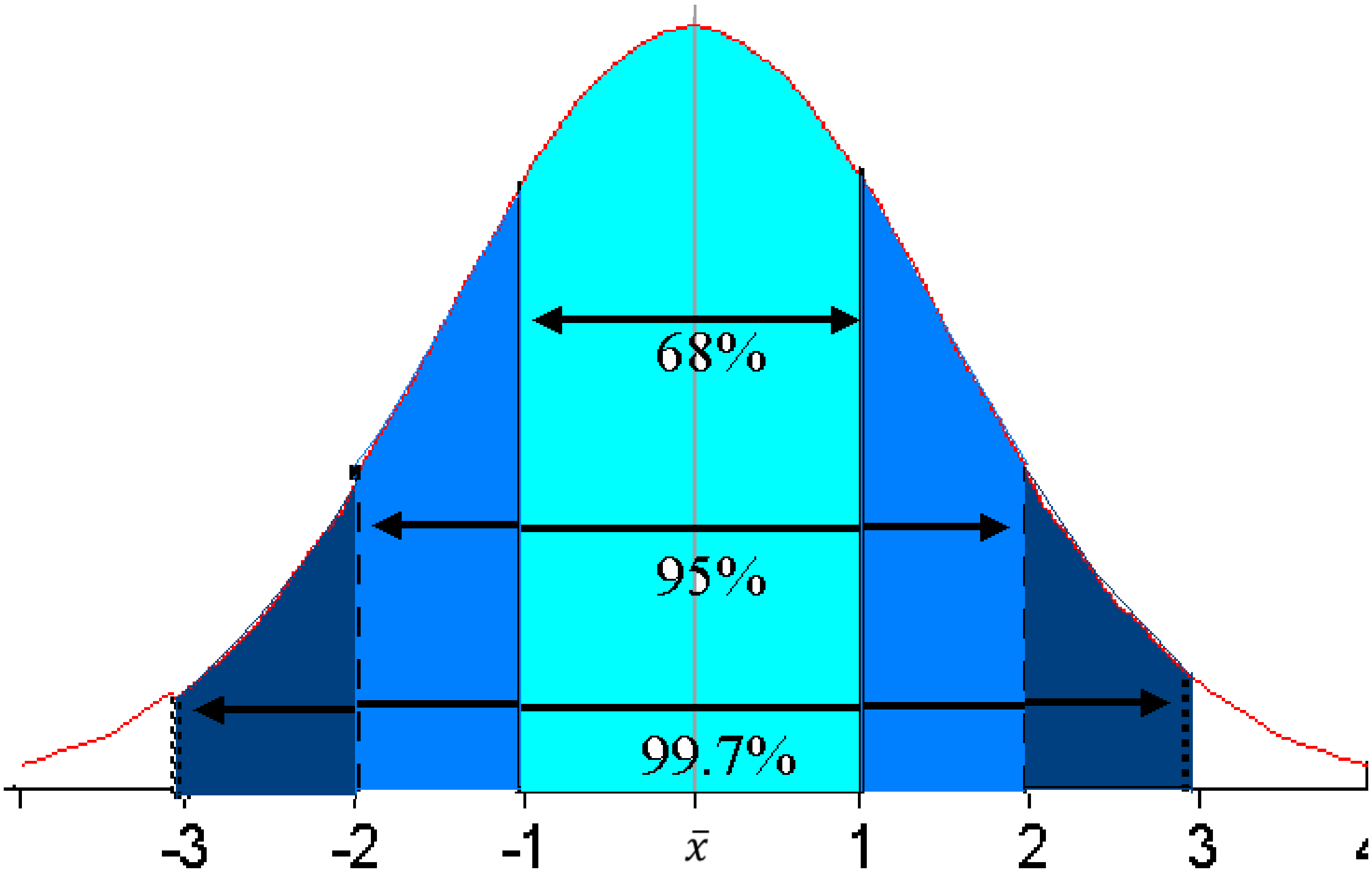
68-95-99.7% RULE

Empirical Rule



68-95-99.7% RULE

Empirical Rule



68-95-99.7% RULE

Empirical Rule—restated

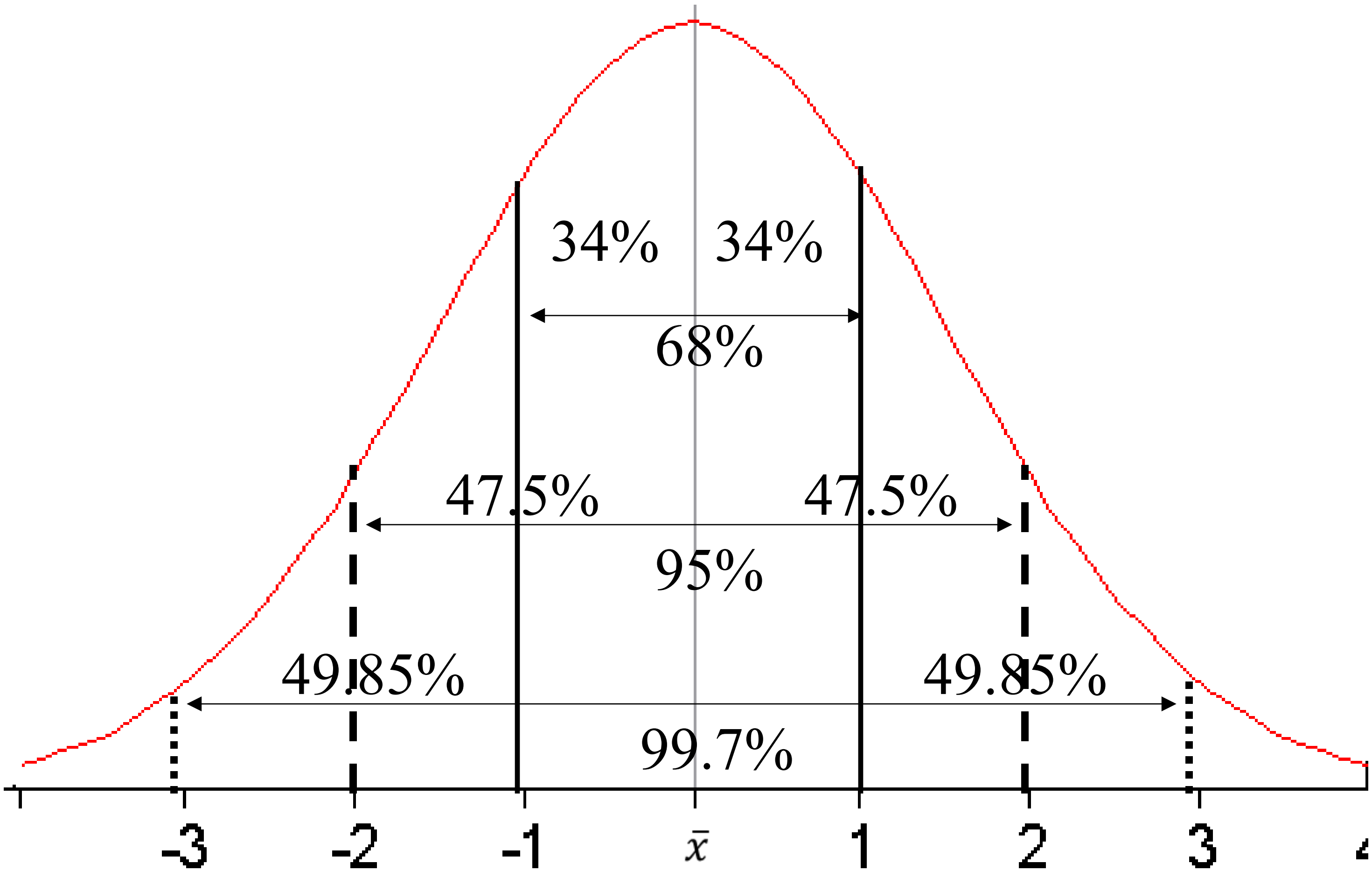
68% of the data values fall within **1** standard deviation of the mean in either direction

95% of the data values fall within **2** standard deviation of the mean in either direction

99.7% of the data values fall within **3** standard deviation of the mean in either direction

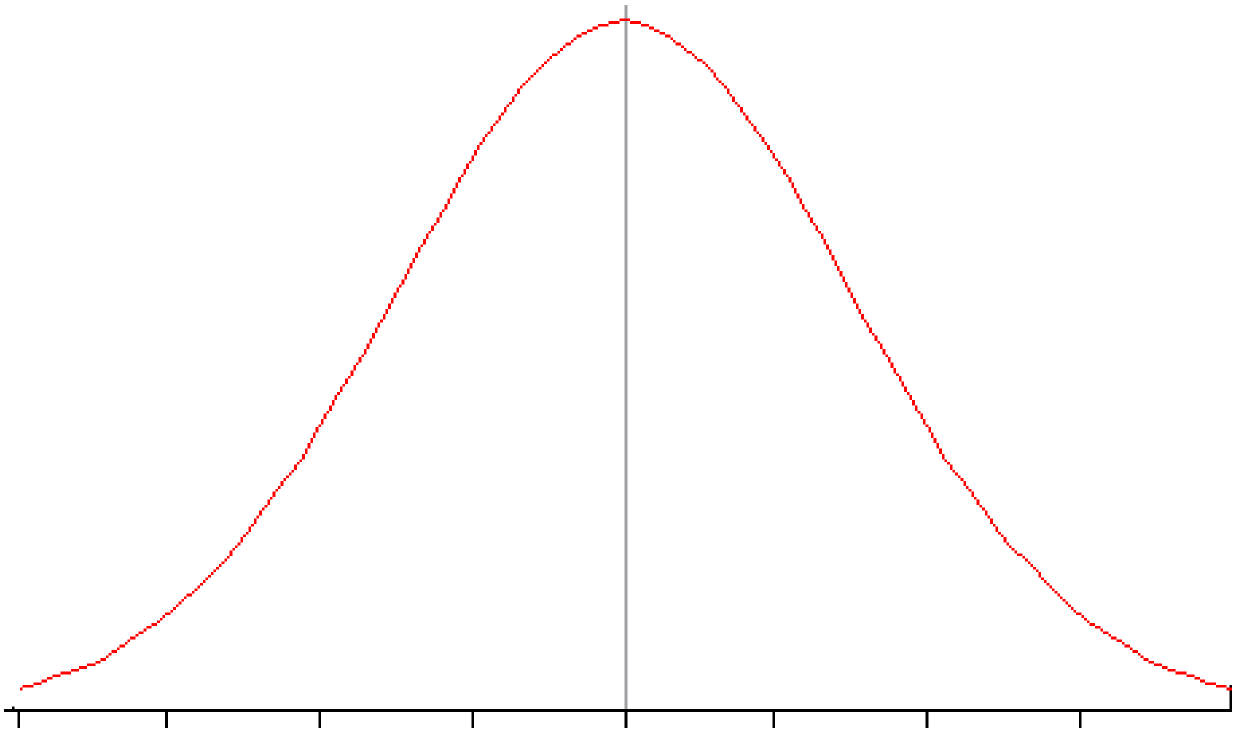
Remember values in a data set must appear to be a normal bell-shaped histogram, dotplot, or stemplot to use the Empirical Rule!

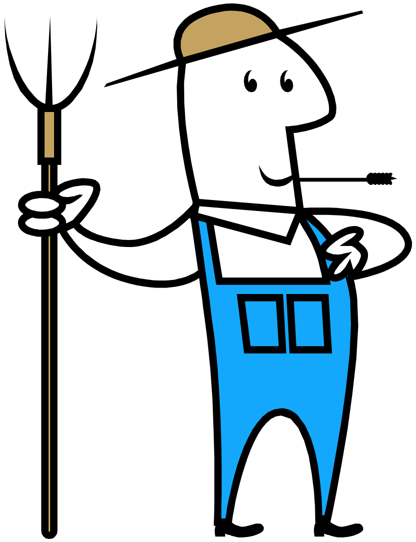
Empirical Rule



Average American adult male height is 69 inches (5’ 9”) tall with a standard deviation of 2.5 inches.

What does the normal distribution for this data look like?





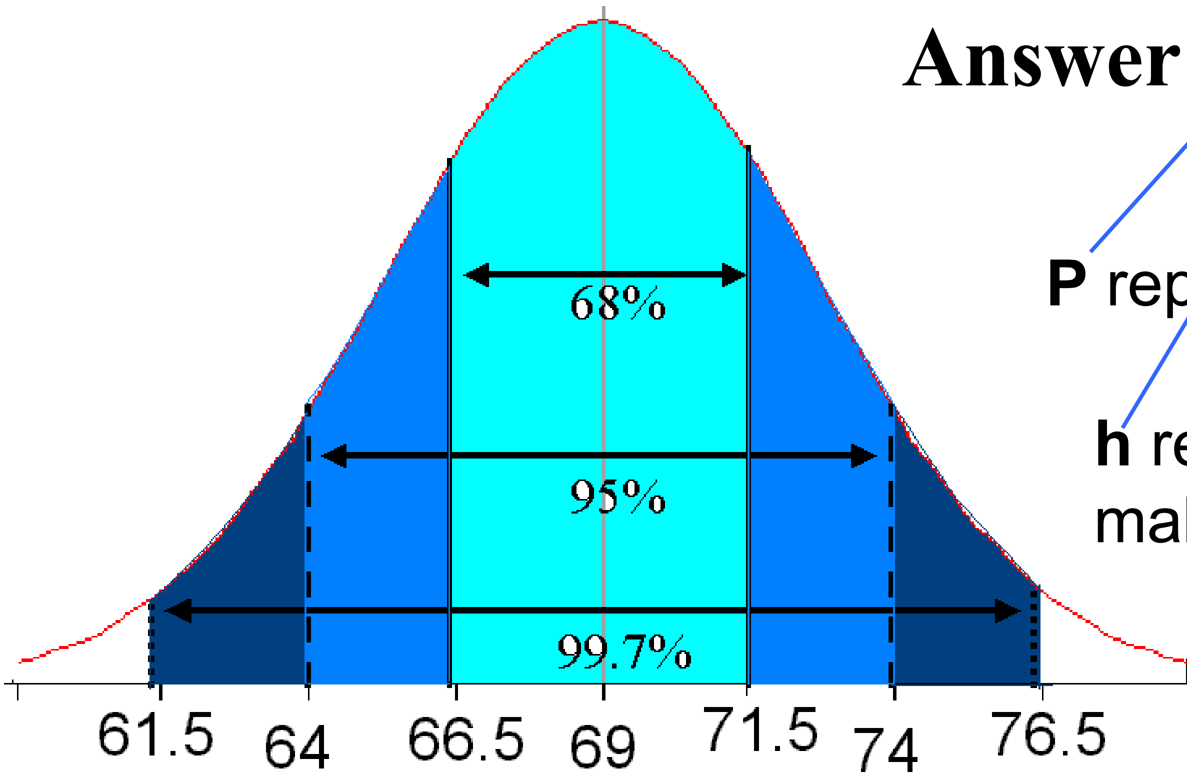
Empirical Rule-- Let H~N(69, 2.5)

What is the likelihood that a randomly selected adult male would have a height less than 69 inches?

Answer: P(h < 69) = .50

P represents **Probability**

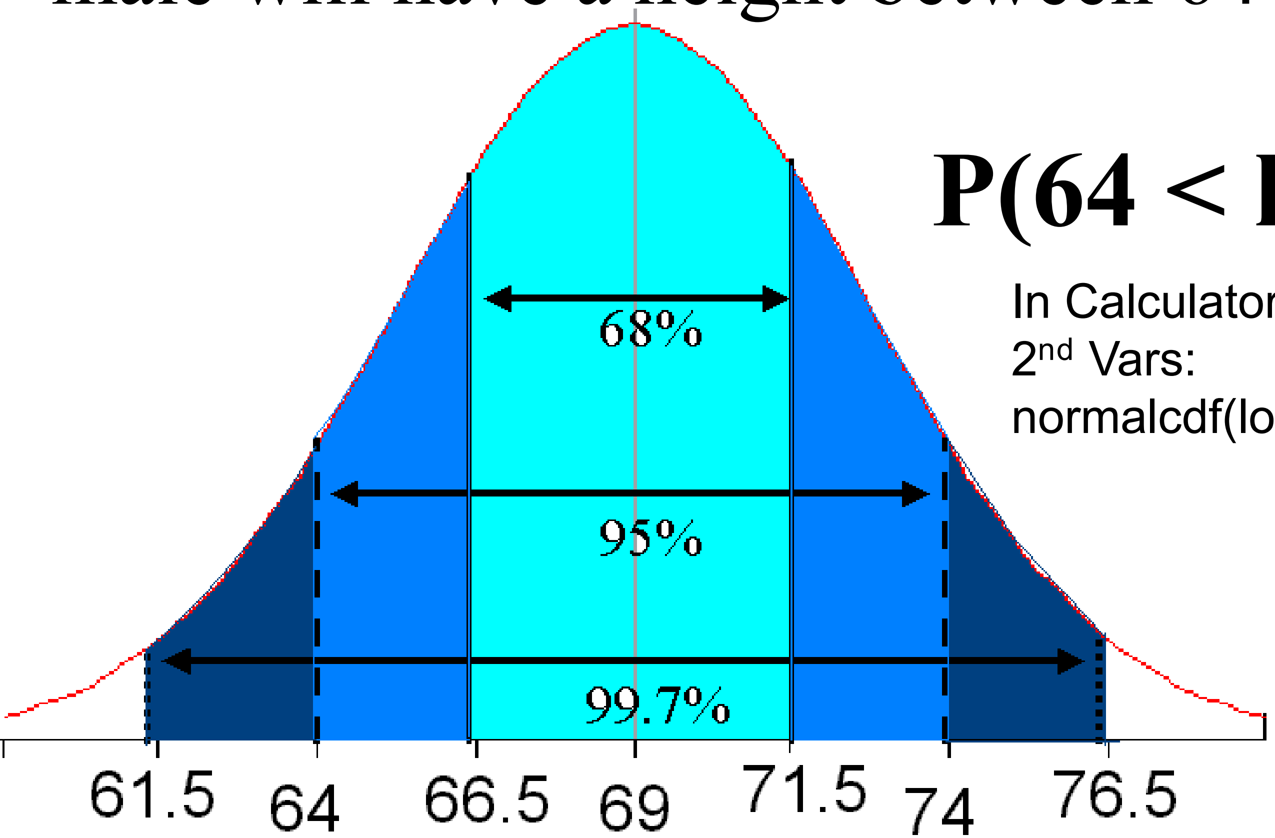
h represents one adult male **height**



Using the Empirical Rule

Let H~N(69, 2.5)

What is the likelihood that a randomly selected adult male will have a height between 64 and 74 inches?



P(64 < h < 74) = .95

In Calculator:
2nd Vars:
normalcdf(lower, upper, mean, std. dev.)

Using the Empirical Rule

Let H~N(69, 2.5)

What is the likelihood that a randomly selected adult male will have a height between 64 and 74 inches?

In Calculator:

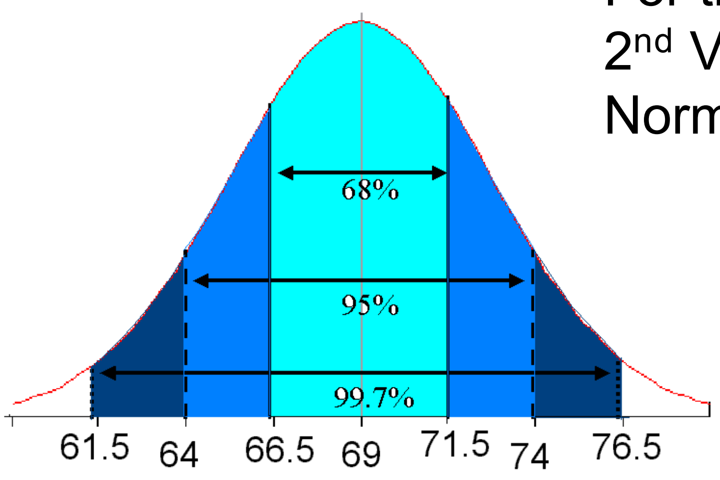
2nd Vars

normalcdf(lower, upper, mean, std. dev.)

For this example:

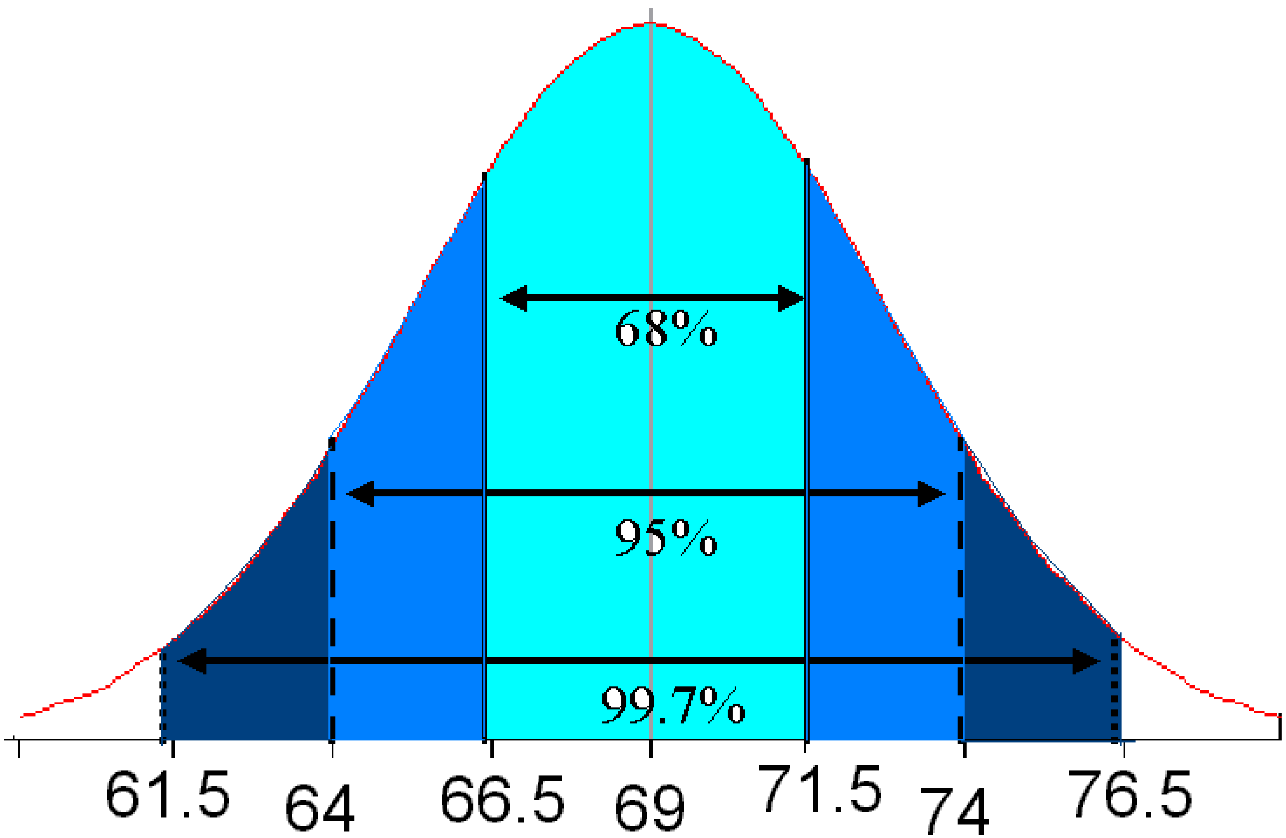
2nd Vars

Normalcdf(64, 74, 69, 2.5) = .95



Using Empirical Rule-- Let H~N(69, 2.5)

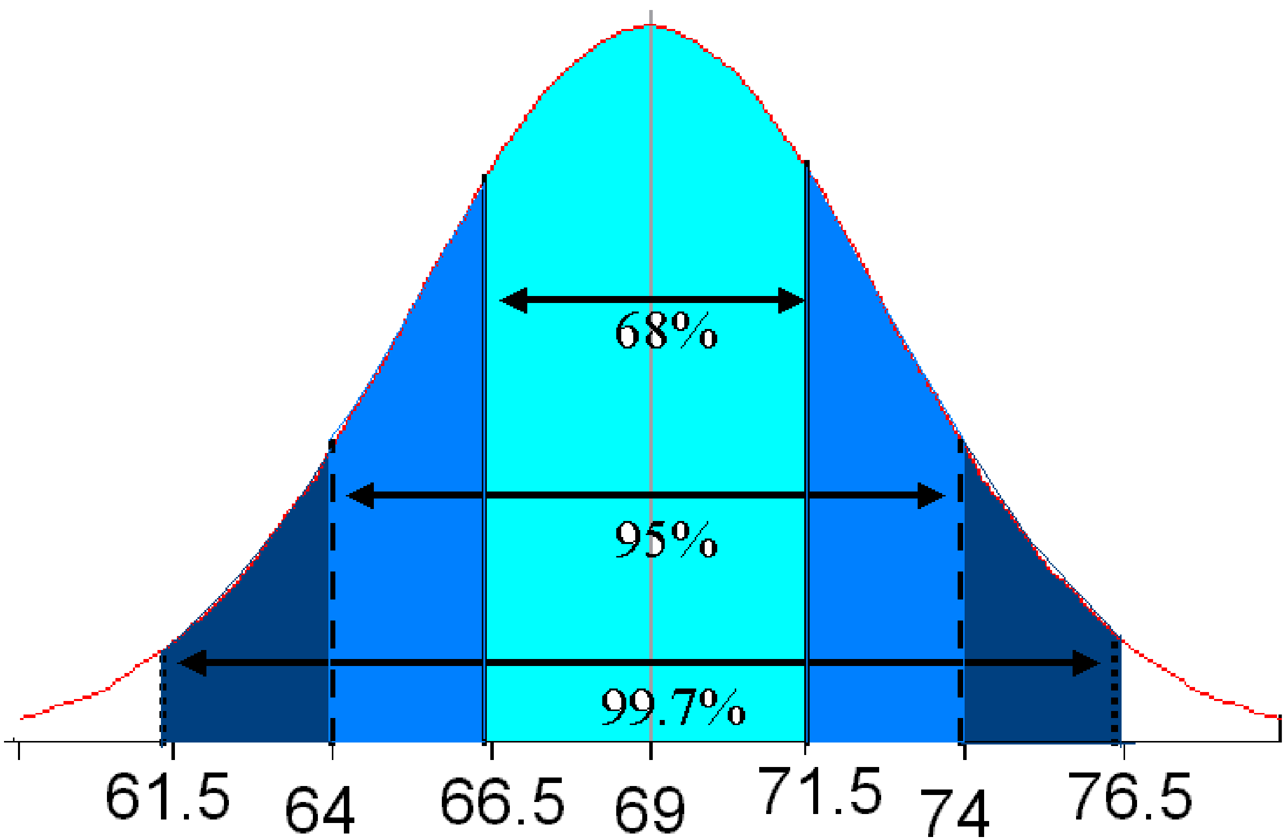
What is the likelihood that a randomly selected adult male would have a height of less than 66.5 inches?



= .16

Using Empirical Rule--Let H~N(69, 2.5)

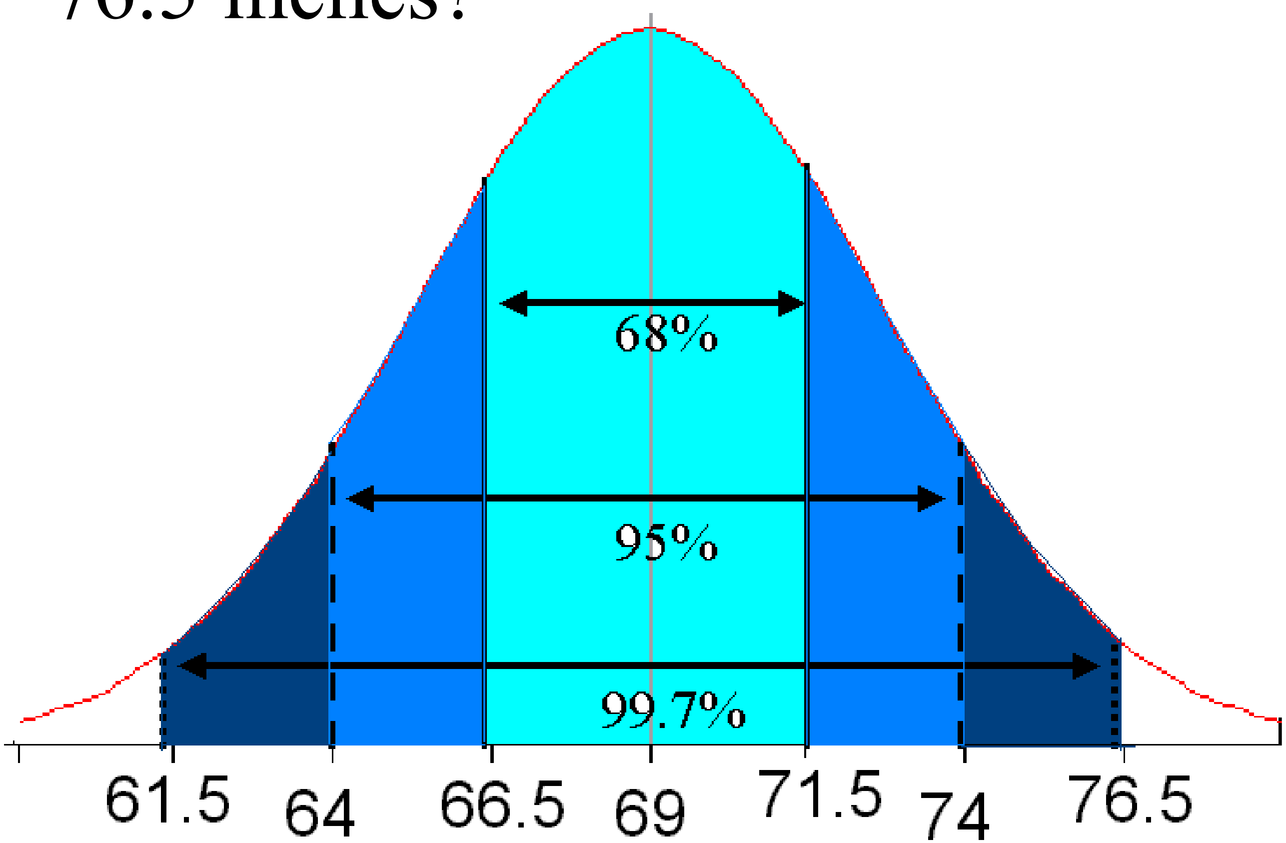
What is the likelihood that a randomly selected adult male would have a height of greater than 74 inches?



= .025

Using Empirical Rule--Let H~N(69, 2.5)

What is the probability that a randomly selected adult male would have a height between 64 and 76.5 inches?



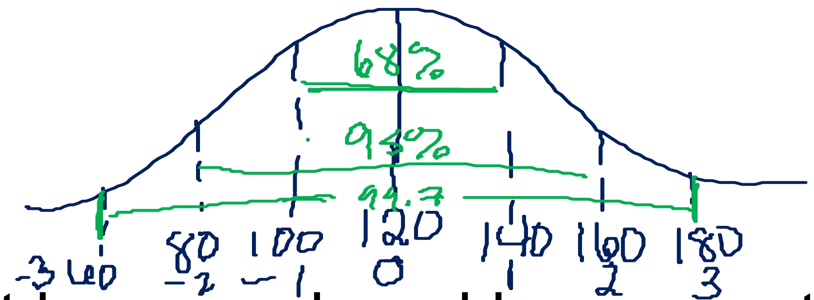
= .9735

Assignment: Complete Normal Distribution Practice Worksheet

Math 3Homework Extended QuestionApril 25,2012

A set of 1000 values has a normal distribution. The mean data is 120, and the standard deviation is 20.

1.Create the normal distribution for this data.



2.Get out homework and have questions ready.

1. How many values are within one standard deviation of the mean?

68%

1000 · .68 = 680

2. 110 - 130

38.3%

2nd: VARS normalcdf(lower, upper, mean, sd)

110 130 120 20

.383

t	P
0.0	0.000
0.1	0.080
0.2	0.159
0.3	0.236
0.4	0.311
0.5	0.383

t	P
0.6	0.451
0.7	0.516
0.8	0.576
0.9	0.632
1.0	0.683
1.1	0.729

t	P
1.2	0.770
1.3	0.807
1.4	0.838
1.5	0.866
1.6	0.891
1.65	0.900

t	P
1.7	0.911
1.8	0.929
1.9	0.943
1.96	0.950
2.0	0.955
2.1	0.964

t	P
2.2	0.972
2.3	0.979
2.4	0.984
2.5	0.988
2.58	0.990
2.6	0.991

t	P
2.7	0.993
2.8	0.995
2.9	0.996
3.0	0.997
3.5	0.9995
4.0	0.9999

$\bar{x} \pm t\sigma$

4. Find the interval about the mean that includes 90% of the data.

→ .90

$120 \pm 1.65(20)$ 87 – 153

5. Find the interval about the mean that includes 77% of the data.

→ .77

$120 \pm 1.2(20)$

96 – 144

$\bar{x} = 86$, $\sigma = 3$

a. normalcdf(lower, upper, mean, std. dev.)

$X > 79$ → 79, 1000, 86, 3

1000 ← randomly big #

.9902

↳ 99.02%

b. normalcdf(0, 79, 86, 3) = .0098

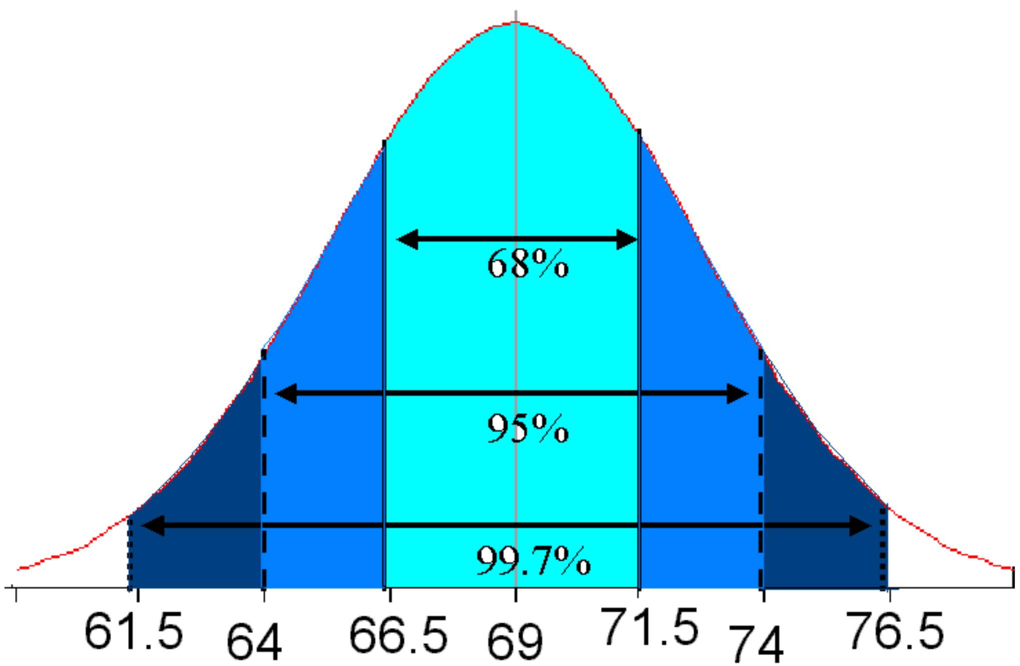
$X < 79$

1%

Unit 6: Data Analysis

Z-SCORE

Z-Scores are standardized standard deviation measurements of how far from the center (mean) a data value falls.



Ex: A man who stands 71.5 inches tall is 1 standardized standard deviation from the mean.

Ex: A man who stands 64 inches tall is -2 standardized standard deviations from the mean.

Standardized Z-Score

To get a Z-score, you need to have 3 things

1) Observed actual data value of random variable x

2) Population mean, μ also known as expected outcome/value/center

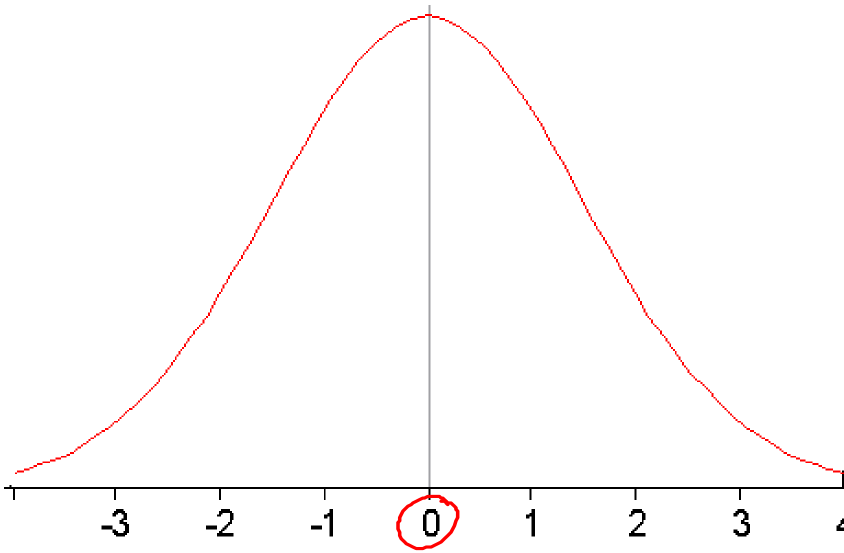
3) Population standard deviation, σ

Then follow the formula.

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

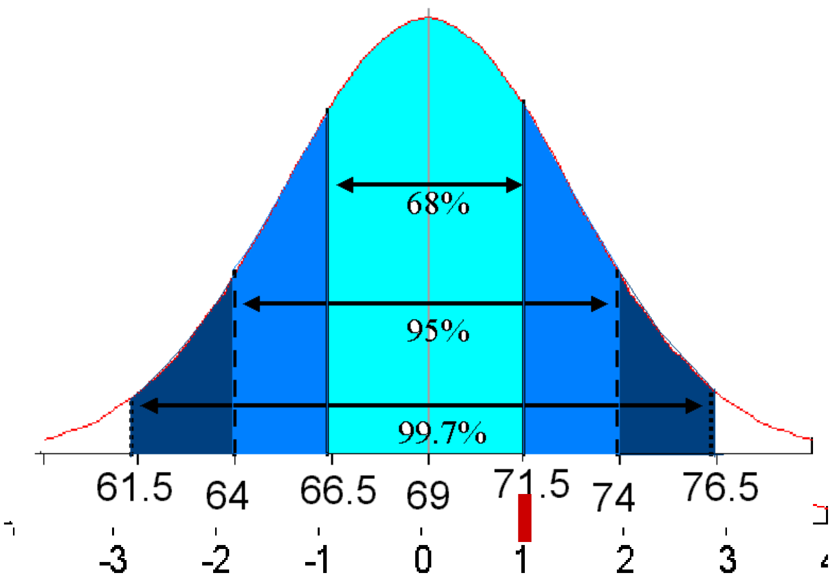
Empirical Rule & Z-Score

About 68% of data values in a normally distributed data set have z-scores between –1 and 1; approximately 95% of the values have z-scores between –2 and 2; and about 99.7% of the values have z-scores between –3 and 3.



Z-Score & Let H ~ N(69, 2.5)

What would be the standardized score (z-score) for an adult male who stood 71.5 inches?



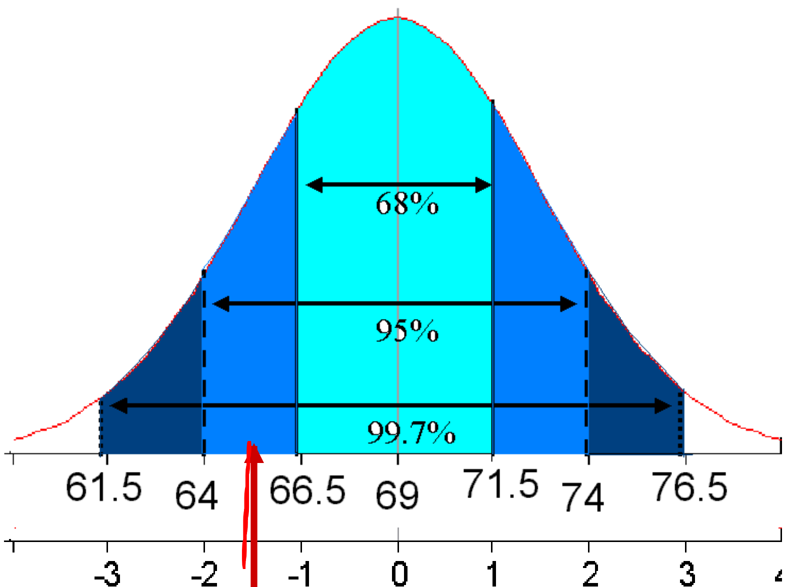
$$Z = \frac{X - \mu}{\sigma}$$

$$\frac{71.5 - 69}{2.5} = 1$$

H ~ N(69, 2.5)   Z ~ N(0, 1)

Z-Score & Let H ~ N(69, 2.5)

What would be the standardized score for an adult male who stood 65.25 inches?



h = 65.25 as z = -1.5

$$z = \frac{65.25 - 69}{2.5}$$

$$z = \frac{-3.75}{2.5}$$

$$z = -1.5$$

Comparing Z-Scores

Suppose Bubba's score on exam A was 65, where Exam A ~ N(50, 10). And, Bubbette score was an 88 on exam B, where Exam B ~ N(74, 12).

Who outscored who? Use Z-score to compare.

Bubba $z = (65-50)/10 = 1.500$

65-50/10
65 - 50/10

Bubbette $z = (88-74)/12 = 1.167$

Comparing Z-Scores

Heights for traditional college-age students in the US have means and standard deviations of approximately 70 inches and 3 inches for males and 165.1 cm and 6.35 cm for females. If a male college student were 68 inches tall and a female college student was 160 cm tall, who is relatively shorter in their respected gender groups?

$\frac{X - \mu}{\sigma}$ (data → X, mean → μ, st. dev. → σ)

-.667 > -.803

Male $z = (68 - 70)/3 = -.667$

Female $z = (160 - 165.1)/6.35 = -.803$

Reading a Z Table

$P(z < -1.91) =$ .0281 $P(z \leq -1.74) =$ .0409

z	.00	.01	.02	.03	.04
-2.0	.0228	.0222	.0217	.0212	.0207
-1.9	.0287	.0281	.0274	.0268	.0262
-1.8	.0359	.0351	.0344	.0336	.0329
-1.7	.0446	.0436	.0427	.0418	.0409

Reading a Z Table

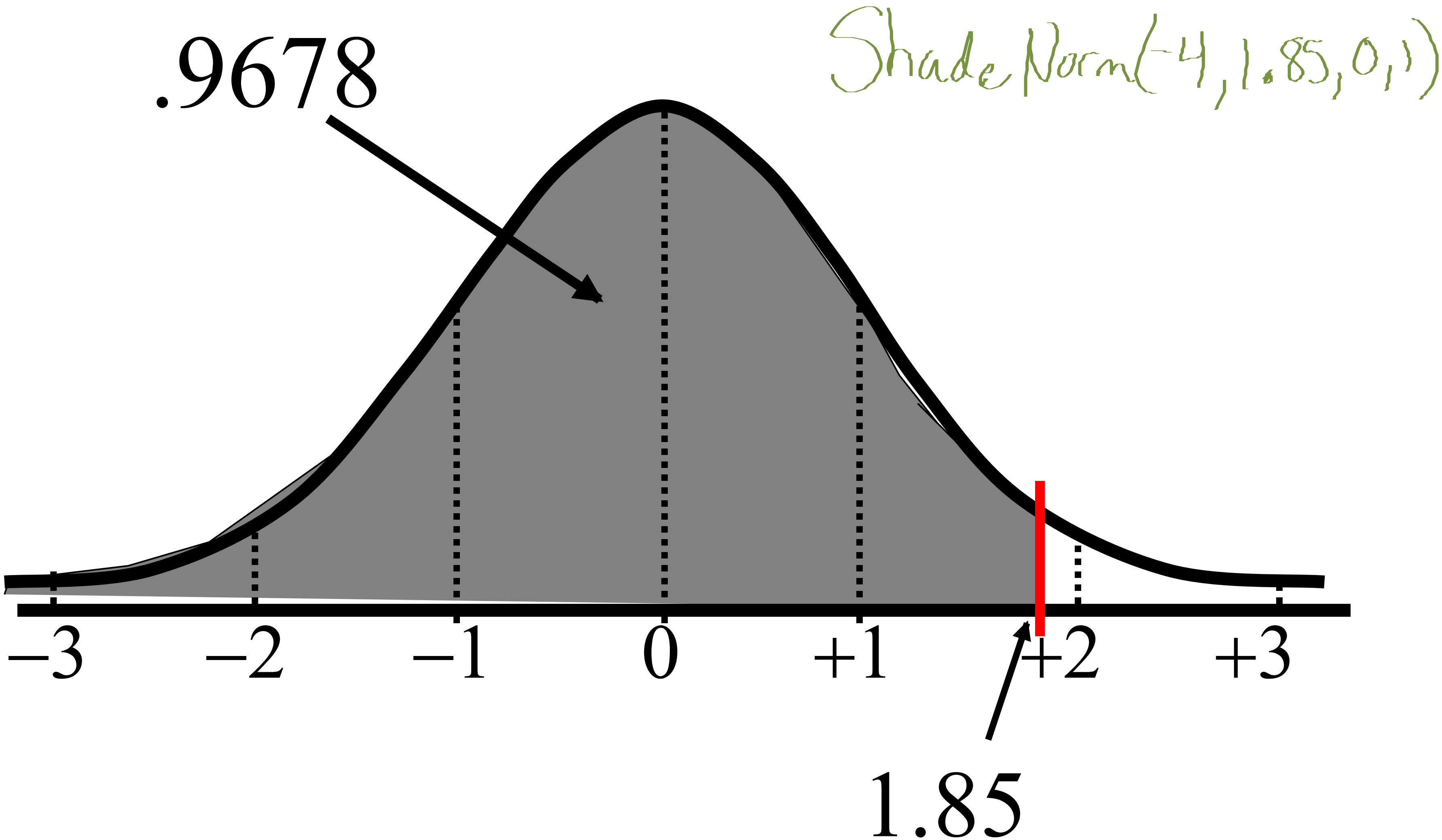
$P(z < 1.81) =$ .9649 $\quad P(z \leq 1.63) =$ .9484

z	.00	.01	.02	.03	.04
1.5	.9332	.9345	.9357	.9370	.9382
1.6	.9452	.9463	.9474	.9484	.9495
1.7	.9554	.9564	.9573	.9582	.9591
1.8	.9641	.9649	.9656	.9664	.9671

Find P(z < 1.85)

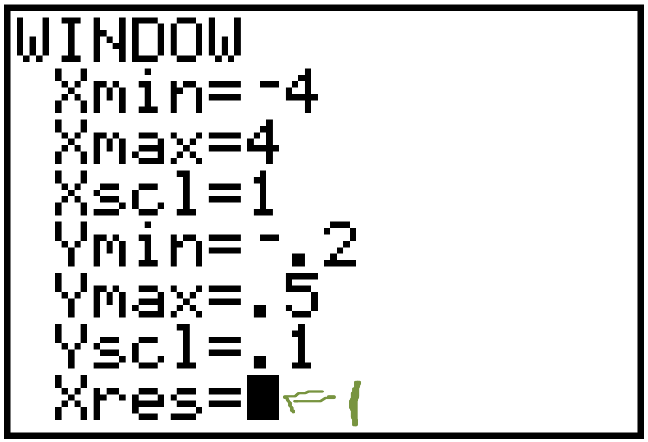
From Table:

.9678

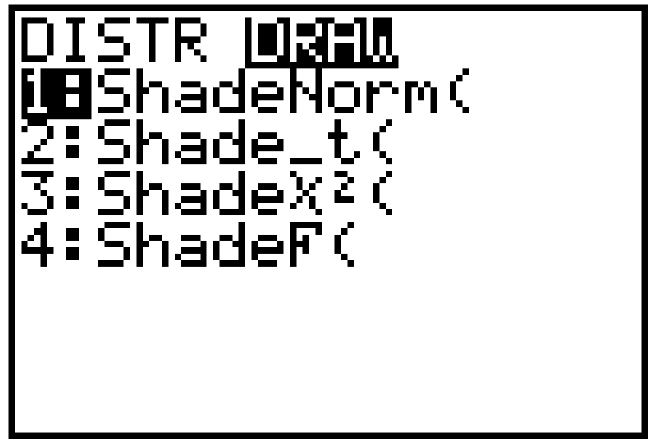


Using TI-83+

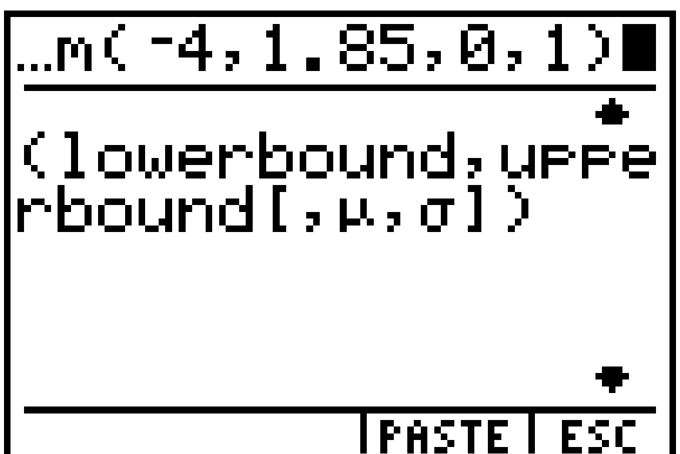
1st: WINDOW

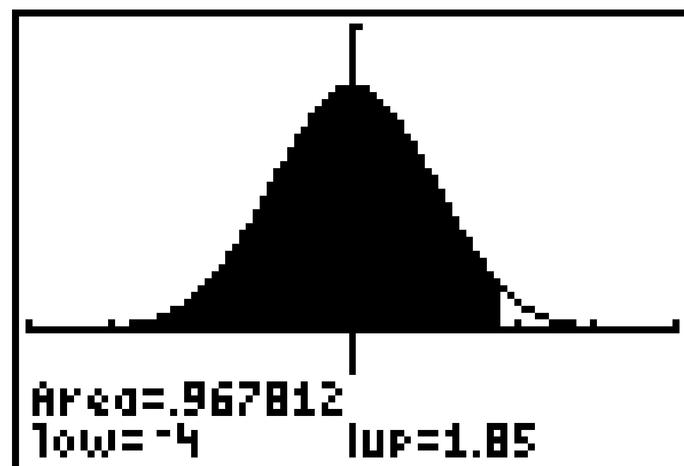


2nd: 2nd Vars DRAW 1: ShadeNorm(



3rd: ShadeNorm(lower, upper, mean, std. dev)





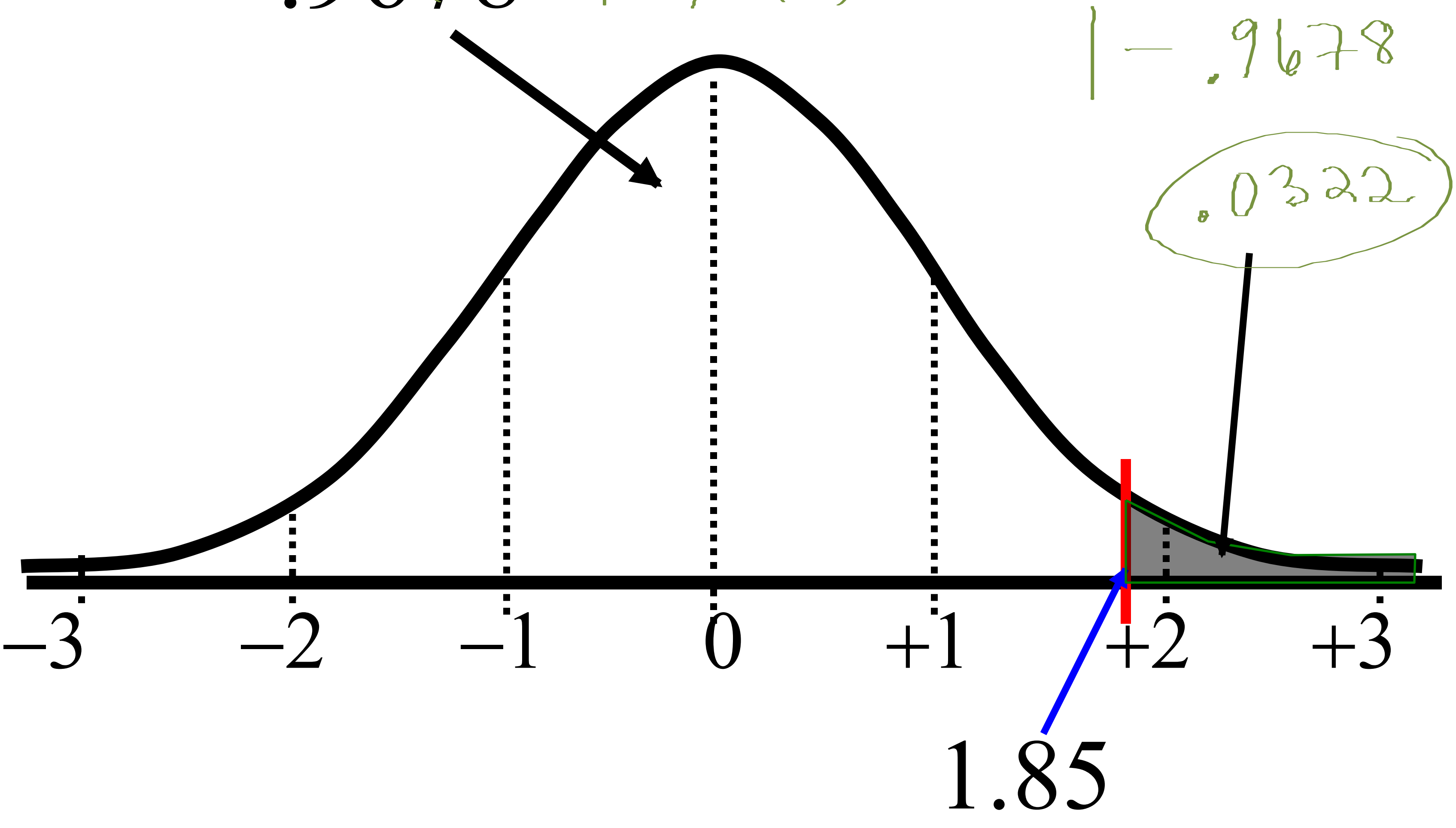
4th: 2nd PRGM 1: ClrDraw

Find P(z > 1.85)

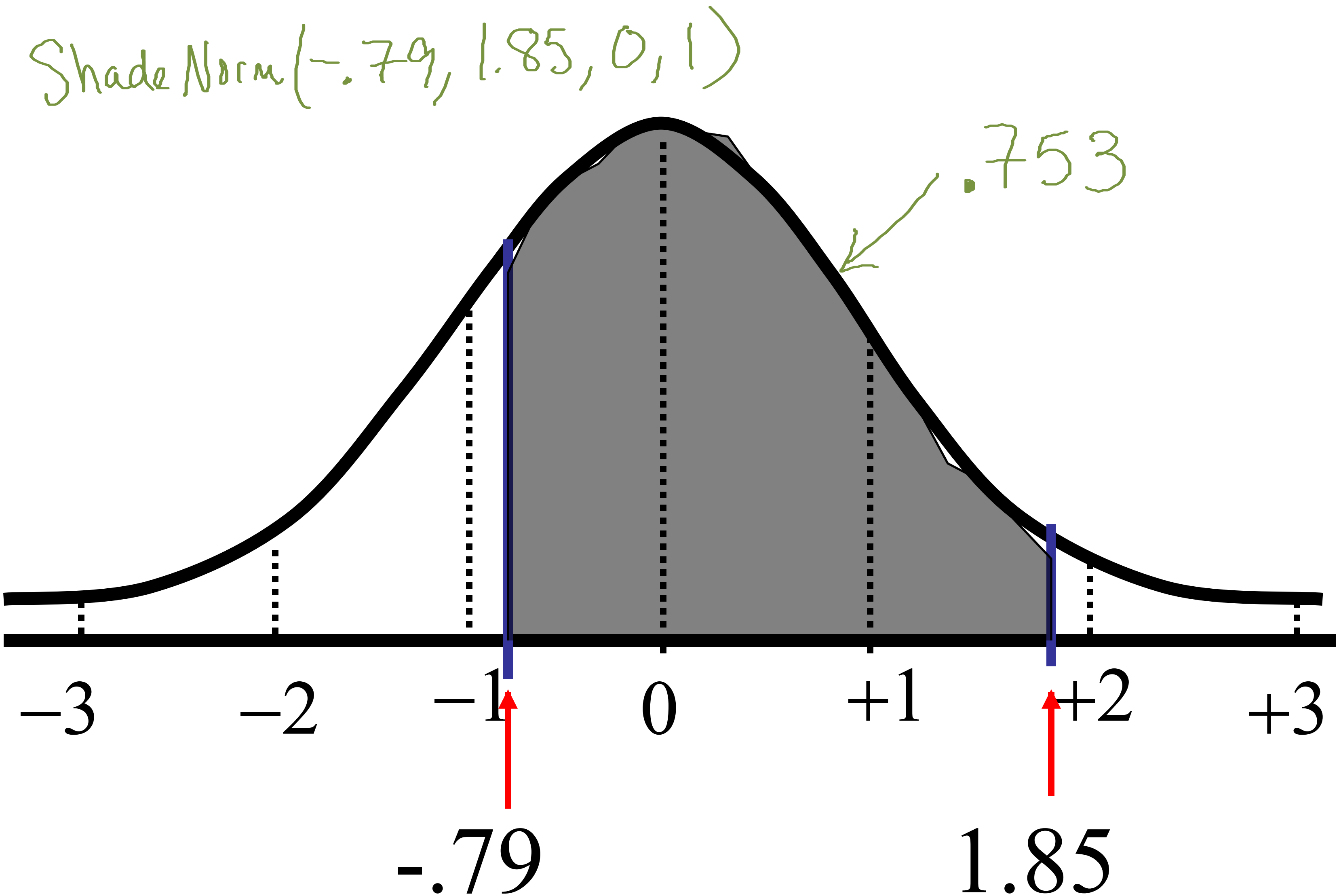
From Table:

ShadeNorm(1.85, 4, 0, 1)

.9678



Find P(-.79 < z < 1.85)



What if I know the probability that an event will happen, how do I find the corresponding z-score?

1) Use the Z Tables and work backwards. Find the probability value in the table and trace back to find the corresponding z-score.

2nd Vars -> 3:

2) Use the InvNorm command on your TI by entering in the probability value (representing the area shaded to the left of the desired z-score), then 0 (for population mean), and 1 (for population standard deviation).

$P(Z < z^*) = .8289$
What is the value of z^*?

z	.03	.04	.05	.06
0.7	.7673	.7704	.7734	.7764
0.8	.7967	.7995	.8023	.8051
0.9	.8238	.8264	.8289	.8315

$P(Z < z^*) = .8289$ has the value of $z^* = .95$

Therefore, $P(Z < .95) = .8289$.

$P(Z < z^*) = .80$

What is the value of **z^***?

z	.03	.04	.05	.06
0.7	.7673	.7704	.7734	.7764
0.8	.7967	.7995	.8023	.8051
0.9	.8238	.8264	.8289	.8315

$P(Z < .84) = .7995$ and $P(Z < .85) = .8023$, therefore $P(Z < z^*) = .80$ has the value of z^* approximately .84**??**

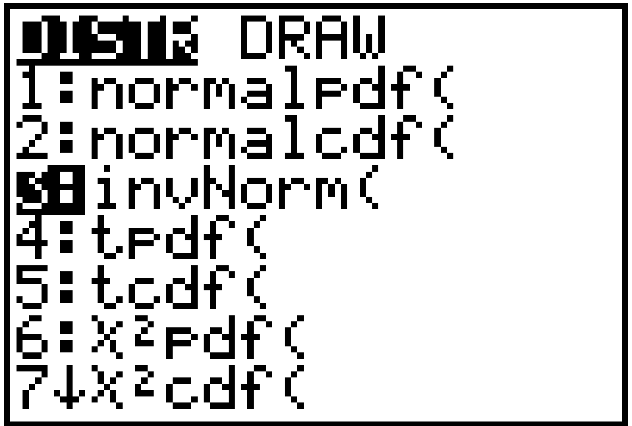
$P(Z < z^*) = .77$

What is the value of **z***?

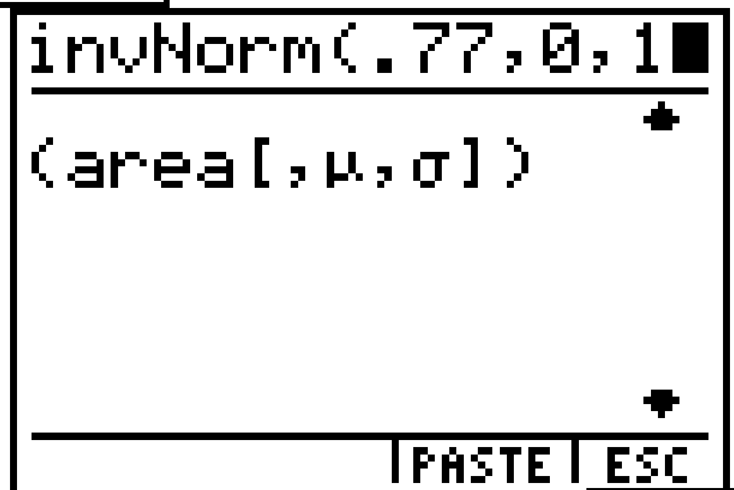
z	.03	.04	.05	.06
0.7	.7673	.7704	.7734	.7764
0.8	.7967	.7995	.8023	.8051
0.9	.8238	.8264	.8289	.8315

What is the approximate value of z*?

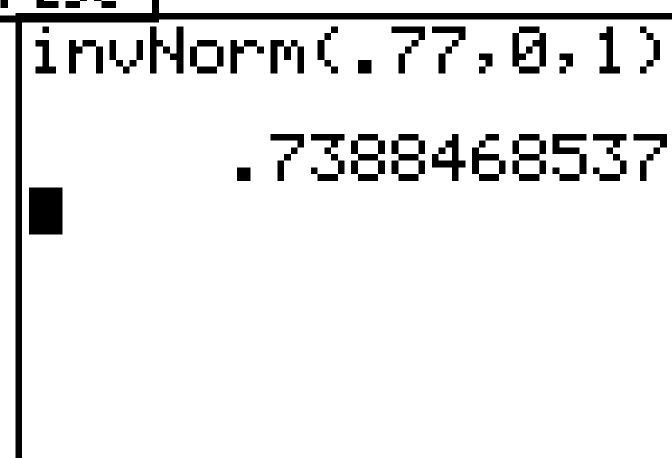
Using TI-83+



DISTR DRAW
1:normalpdf(
2:normalcdf(
3:invNorm(
4:tpdf(
5:tcdf(
6:χ²pdf(
7↓χ²cdf(



invNorm(.77,0,1
(area[,μ,σ])
PASTE
ESC



invNorm(.77,0,1)
.7388468537