Last Name _____ First Name _____ UIN _____141- _____

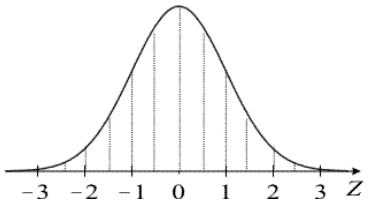
A continuous probability distribution is represented by a probability density function, *f*. The area between the graph of *f* and the *x*-axis from $x = a$ to $x = b$ gives the probability that the random variable *X* is between *a* and *b*.

IMPORTANT: While the directions say to "shade" the Venn diagrams, this only a suggestion and any shading will not be graded. Put your initials here to show you have read this: ____

Part I

1. The standard normal curve has $\mu = 0$ and $\sigma = 1$.
Z is used to represent the standard normal curve instead of *X* in this special case.

On the normal curve to the right, shade the area where $-0.5 < Z < 0.5$.

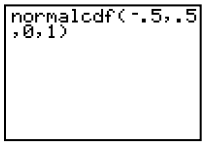


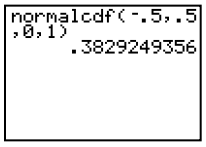
The normalcdf function on your calculator is used to evaluate probabilities involving normal curves.

$$P(a < X < b) = \text{normalcdf(a, b, } \mu, \sigma)$$

To find $P(-0.5 < Z < 0.5)$, use the calculator command normalcdf(−0.5, 0.5, 0, 1)

i. Go to DISTR. (above the VARS button) → **ii.** Choose 2: **normalcdf**. Input the left endpoint, right endpoint, μ, and σ. → **iii.** Press ENTER to evaluate.





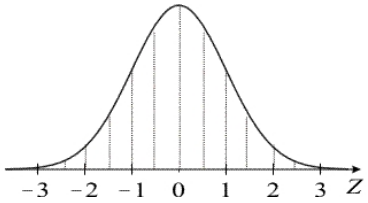
Rounded to 4 decimal places, $P(-0.5 < Z < 0.5)$ = _____

For the remainder of this activity, round all of your answers to 4 decimal places.

2. On the normal curve to the right, shade the area where $Z > 1.5$.

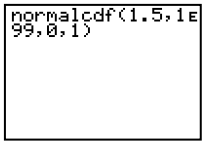
a. What is the left endpoint of the shaded region? Z = _____

b. What is the right endpoint of the shaded region? Z = _____



The TI-83/84 calculators do not have a key for infinity. Use 1×10^{99} as an approximation. This gives answers accurate enough for 4 decimal places.

A short cut for 1×10^{99} on the calculator is to use 1EE99. The EE is above the comma button and will appear as 1E99 on the calculator, as shown.

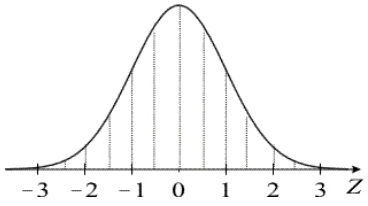


c. $P(Z > 1.5)$ = normalcdf(_____, _____, _____, _____) = _____

3. On the normal curve to the right, shade the area where $Z < 2$.

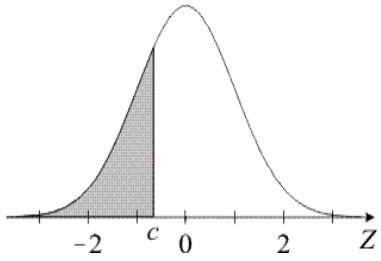
a. What calculator command will give $P(Z < 2)$?
_____(_____ , _____ , _____, _____)

b. $P(Z < 2)$ = _____



Part II

1. a. In the drawing on the right, the shaded region has an area of 0.25. This means that 25% of the area under the normal curve lies to the left of *c*.



Fill in the blank below with the correct inequality (< or >) that represents this situation.

$$P(Z \_\_\_\_ c) = 0.25$$

Here, you are given the probability (area) for the shaded region and want to determine the value of the random variable, *c*.

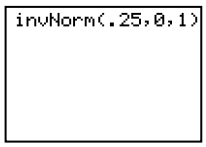
To find the value of *c*, the calculator has a function to "invert the normal curve" called **invNorm**. To use invNorm, enter in the area to the LEFT of the unknown value followed by μ and σ. The calculator will return the value of the random variable.

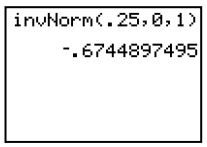
invNorm(area to LEFT of unknown value, μ, σ)

For the situation above, you were given the area to the left of *c* on the standard normal curve.
To find *c*, use the calculator command

$$c = \text{invNorm}(0.25, 0, 1)$$

i. Go to DISTR. (above the VARS button) → **ii.** Choose 3: **invNorm**. Input the area to the left of the value you are finding, μ, and σ. → **iii.** Press ENTER again to evaluate.





b. Rounded to 4 decimal places, *c* = _____.

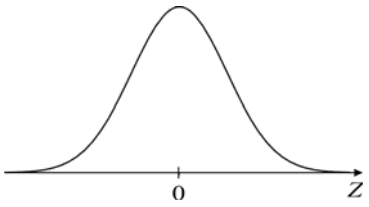
Note: It makes sense that *c* is a negative number since it lies to the left of the mean, which is 0. Negative numbers are possible when finding values of the random variables, not probabilities.

If you are given the area to the right of an unknown value, you must find the area to the LEFT before using the invNorm function.

2. Find the value of *b* such that $P(Z > b) = 0.10$.

a. Is the area to the left or to the right of $Z=b$ equal to 0.10? *Hint*: Look at the inequality. _____

b. On the figure, mark the *approximate* location of *b* where 10% of the area under the normal curve lies to the right of *b*. Shade this area.

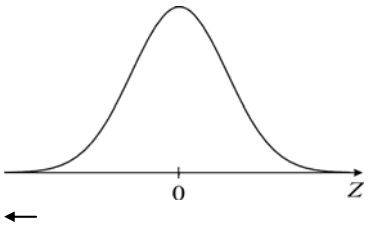


c. What is the area to the *left* of *b*? _____
Hint: The total area under a normal curve is 1.

d. What calculator command will find *b*? _____(_____, _____, _____)

e. *b* = _____

3. Find the value of a such that $P(-a < Z < a) = 0.60$.



a. On the figure shade a region centered above the mean that represents 60% of the area. (Your shading will be approximate.) Label the left and right endpoints as $-a$ and a.

In order to find a, you need the *total* area to the left of this boundary value.

b. Since the total area under the curve is 1, what is the total area of the unshaded regions? _____

c. Since the normal curve is symmetric and you are looking at a symmetric region from $-a$ to a, the area of each unshaded "tail" must be the same. What is the area of each "tail"? _____

d. What is the total area to the left of a? _____

e. What calculator command will find a? _____

f. a = _____

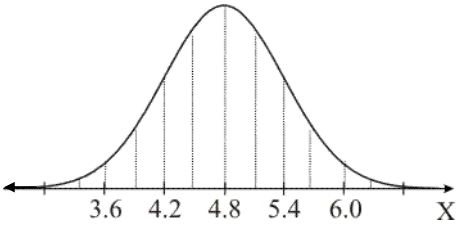
Part III

The LDL cholesterol level for a certain group of men is normally distributed with $\mu = 4.8$ and $\sigma = 0.6$. Let X represent this normal random variable.

1. What is the probability that a man from this group is at moderate risk for problems relating to his LDL cholesterol level? Moderate risk means an LDL level more than one standard deviation above the mean but less than two standard deviations above the mean.

a. What value of X corresponds to 1 standard deviation above the mean? _____

b. What value of X corresponds to 2 standard deviations above the mean? _____



c. Shade the area representing the probability of moderate risk in the figure above.

d. What is the calculator command to find the probability? normalcdf(_____, _____ , _____, _____)

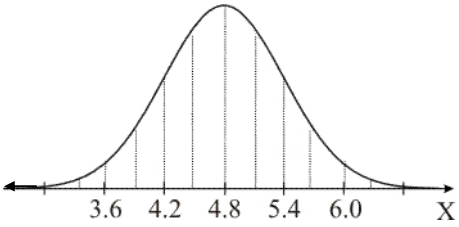
e. $P(5.4 < X < 6.0)$ = _____

2. What is the probability that a man is at low risk? Low risk means more than one standard deviation *below the mean*.

a. What value of X corresponds to 1 standard deviation *below* the mean? _____

b. Shade the area representing the probability of low risk.

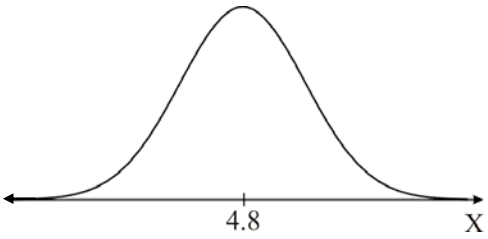
c. What is the calculator command to find the probability? _____



d. $P(X < 4.2)$ = _____

3. What LDL level would place a man in the 30th percentile?
The 30th percentile is the level that has 30% of the population below (to the left on a graph) and 70% above (to the right on a graph).

a. On the figure, mark the approximate location of the LDL level that corresponds to the 30th percentile. Label this value *a*.

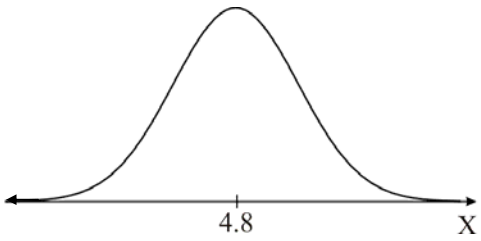


b. What is the calculator command to find *a*?
invNorm(_____, _____, _____)

c. *a* = _____

4. What LDL levels (min and max) would place you in the middle 75% of the population?

a. On the figure, shade a region centered above the mean that represents 75% of the area. (Your shading will be approximate.) Label the endpoints *min* and *max.*



b. Write the calculator command needed to find the minimum level and evaluate.

min = _____ = _____

c. Write the calculator command needed to find the maximum level and evaluate.

max = _____ = _____

Part IV

At a school 100 children are exposed to the flu. There is a 35% chance of getting the flu if you are exposed.

Since this is a binomial experiment, what is the mean number of children who get the flu? μ = _____

What is the standard deviation in the number of students who get the flu? σ = _____

What values of X correspond to between 32 and 38 students get the flu? X = ____, …. , ____

Use the normal curve approximation to the binomial distribution to find the probability that between 32 and 38 students get the flu. Begin with the calculator command:

P = _____ = _____