Clicker Question: Did you remember we have class on May 5^{th}?
(A) Yes (B) No (#11)

Please get your ID and pick up your exam

Key on Web Assign

Class on May 1 (#10) Final Review 5/6 @ 10A

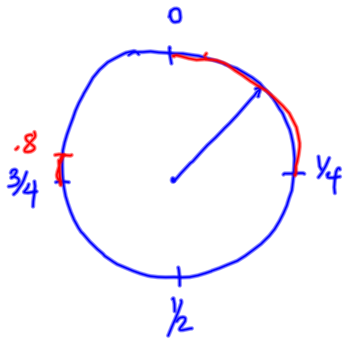
8.5 and 8.6: The Normal Distribution

Continuous random variables can take on any value.

Let t = time in seconds to run a race

Let w = weight of kitten in kg

Let L = length of a week-old bean plant



Let X = value where pointer lands.

$0 \leq X < 1$ and $P(0 \leq X < 1) = 1$

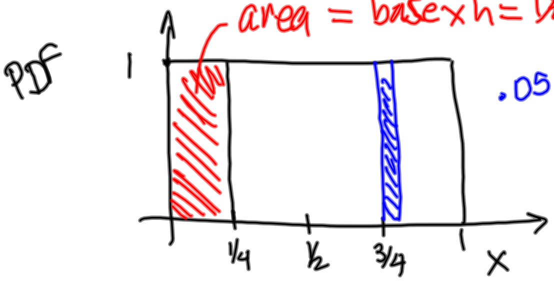
What is $P(X = \frac{1}{2})$? $= 0$

What is $P(0 \leq X < \frac{1}{4})$? $= \frac{1}{4}$

What is $P(0.75 \leq X \leq 0.80)$? $= 0.05$

How can we represent this graphically?

area = base x h = 1/4 x 1 = 1/4 = prob



.05 x 1 = 0.5 = prob

When we graph the probability distribution for a continuous variable we find a probability density function.

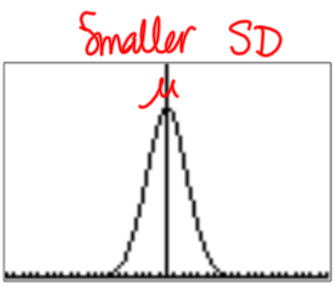
Many natural and social phenomena produce a continuous distribution with a bell-shaped curve. NORMAL

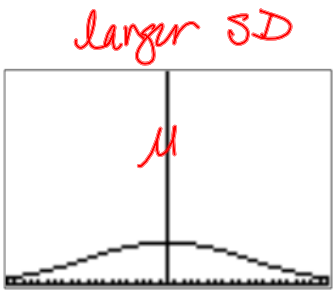
Every bell-shaped (NORMAL) curve has the following properties:

- Its peak occurs directly above the mean, μ
- The curve is symmetric about a vertical line through μ. The curve never touches the x-axis. It extends indefinitely in both directions.
- The area between the curve and the x-axis is always 1 (total probability is 1).

The shape of the curve is completely determined by μ (mean) and σ (SDev),

$$P(x)=\frac{1}{\sqrt{2\pi\sigma}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

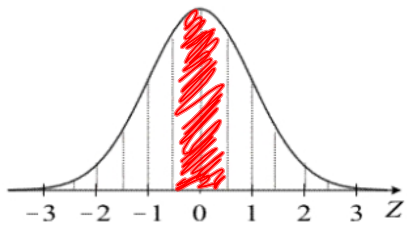




A continuous probability distribution is represented by a probability density function, f. The area between the graph of f and the x-axis from $x = a$ to $x = b$ gives the probability that the random variable X is between a and b.

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.

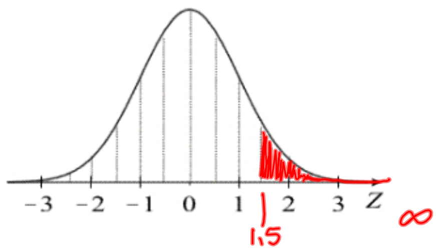
$$\boldsymbol{P(a < X < b) = \text{normalcdf}(a, b, \mu, \sigma)}$$

optional when $\mu=0$ and $\sigma=1$

$P(-0.5 < Z < 0.5) = \text{normalcdf}(-0.5, 0.5, 0, 1) =$ 0.3829

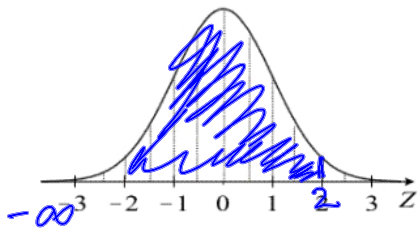
What is $P(Z > 1.5)$?

normalcdf(1.5, 1E99, 0,1) = 0.0668



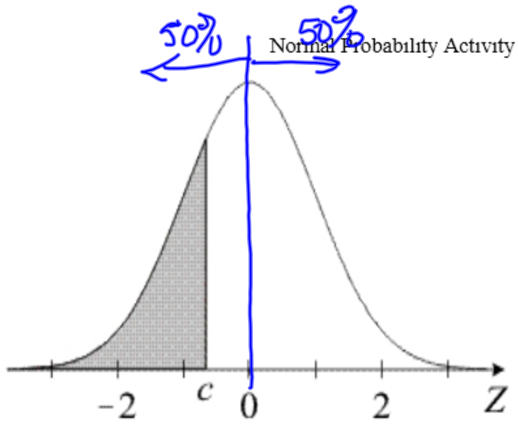
What is $P(Z < 2)$?

normalcdf(−1E99, 2, 0,1) = .9772



15a Math 141 Normal Probability Activity

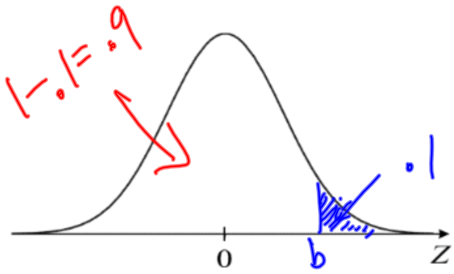
In the drawing on the right, the shaded region has an area of 0.25. To find the value of c, the calculator has a function to "invert the normal curve" called **invNorm**.



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

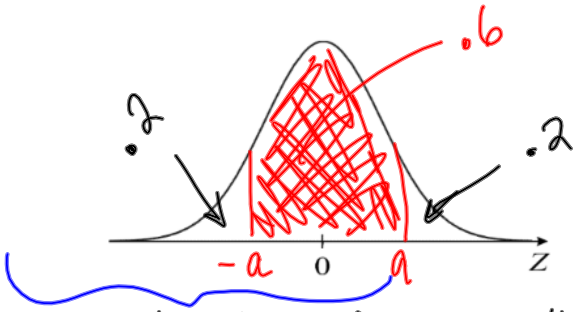
$c =$ invNorm(.25, 0, 1) = −.6745

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



invNorm(.9, 0, 1)= 1.2816

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



1−.6 = .4 not include

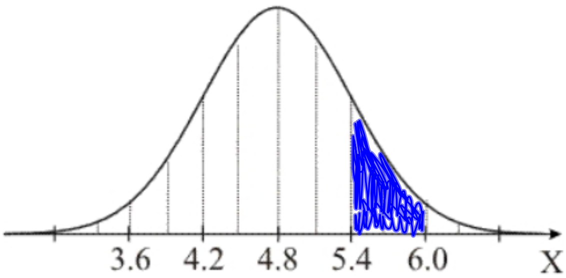
$\frac{.4}{2} = .2$

−a = invNorm(.2, 0, 1) = −.8416 ⟹ a = .8416

a = invNorm(.8, 0, 1) = .8416

ACTIVITY TIME!

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? 5.4

b. What value of X corresponds to 2 standard deviations above the mean? 6

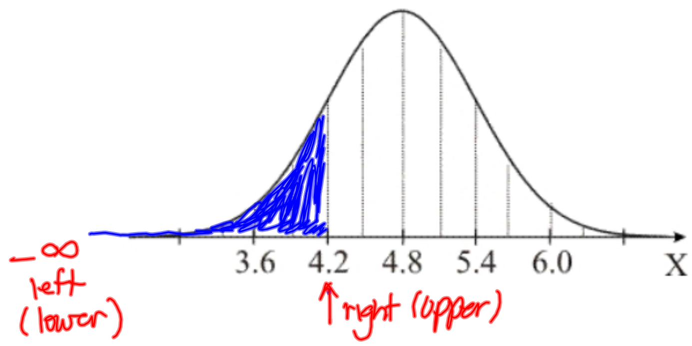
c. Shade the area representing the probability of moderate risk in the figure above.

d. What is the calculator command to find the probability?

normalcdf(5.4 , 6 , 4.8 , 0.6)

e. $P(5.4 < X < 6.0) =$ 0.1359 (at least) 4 decimal places

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? 4.2 = 4.8 − .6

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

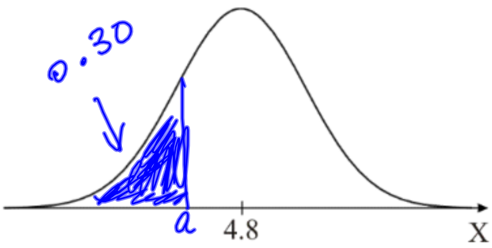
c. What is the calculator command to find the probability?

left, right, mean, SD

normalcdf(-1E99 , 4.2 , 4.8 , 0.6)

d. $P(X < 4.2) =$ 0.1587 4 decimal places

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).



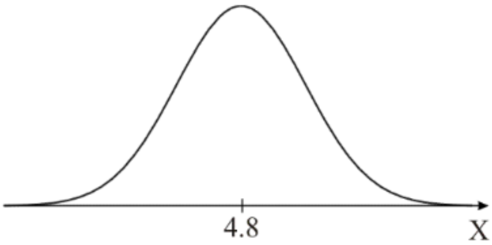
a. On the figure, mark the approximate location of the LDL level that corresponds to the 30th percentile. Label this value a.

b. What is the calculator command to find a?

invNorm(.3 , 4.8 , .6)

a = 4.4854

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 = ______________________________________

= ___________