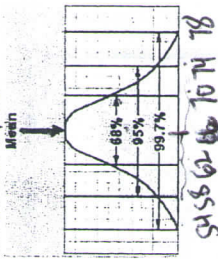




Example 1 Suppose the heights of a population have a mean of 66 inches and a standard deviation of 4 inches. Find the heights between which we can expect:

- a. 68% of the people to be **62-70 in**
- b. 95% of the people to be **58-74 in**
- c. 99.7% of the people to be **54-78 in**



Obviously we want to be able to calculate ALL percentages (not just certain ones). Your calculator has a function that helps us to do this.

Using the TI-84 for Normal Distribution

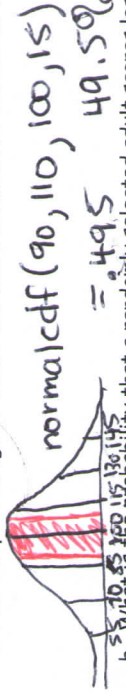
1. Turn on the calculator by pressing the ON button (lowest left hand button).
2. Press 2nd and then VARS, this will pick DISTR.
3. If you are interested in the area under the normal curve with degrees with mean μ and standard deviation σ :
 - a) For $P(a \leq x \leq b)$, select normalcdf(, then enter a, b, μ , σ). Press ENTER.
 - b) For $P(a \leq x)$, select normalcdf(, then enter a, 10[^]99, μ , σ). Press ENTER.
 - c) For $P(x \leq b)$, select normalcdf(, then enter (-) 10[^]99, b, μ , σ). Press ENTER.
4. If you want to find the z-score with area of p to the left, then select invNorm(, then enter p). Press ENTER.
5. To find the x value with area p to the left when $x \sim N(\mu, \sigma)$, select invNorm(, and then enter p, μ , σ). Press ENTER.

Note: The “(-)” is indicating the button on the bottom row of the calculator, next to the “.”.

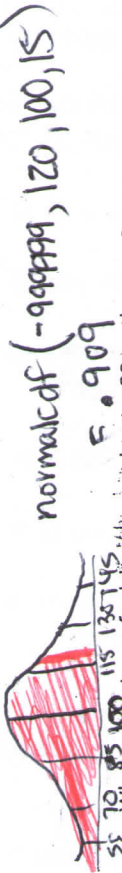
Always start by drawing a sketch of the normal distribution with which you are working. Shade in the relevant area (probability), and label the mean, standard deviation, lower bound and upper bound that you are given or are trying to find.

Example 2 Suppose IQ scores for adults are normally distributed with a mean of 100 and a standard deviation of 15.

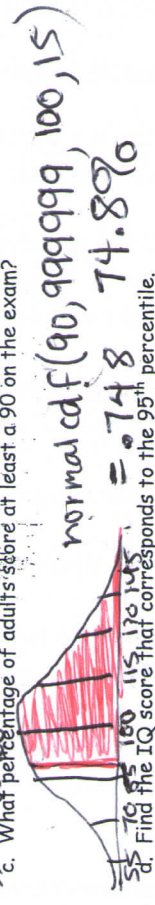
- a. Find the percentage of adults who score between 90 and 110 on the exam.



- b. What is the probability that a randomly selected adult scores less than 120 on the exam?



- c. What percentage of adults score at least a 90 on the exam?



$invnorm(.95, 100, 15) = 124.7$

- e. Find the IQ score that separates the top 15% of all IQ scores from the rest.

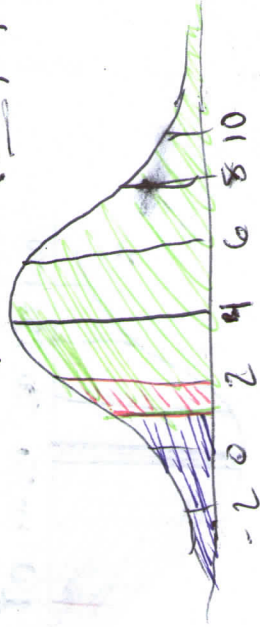
$invnorm(.85, 100, 15) = 115.5$
 ⇒ 85% below

Example 3 Suppose data is normally distributed with a mean of 4 and a standard deviation of 2. Find:

- a. $P(1 \leq x \leq 2)$
 $normalcdf(1, 2, 4, 2) = .092$
- b. $P(x \geq 1)$
 $normalcdf(1, 99999, 4, 2) = .933$
- c. $P(x \leq 1)$
 $normalcdf(-99999, 1, 4, 2) = .067$

- d. the x-value with an area of 0.25 to the left

$invnorm(.25, 4, 2) = 2.65$



Example 4 The Bank of Powell is reviewing its service charges and interest-paying policies on checking accounts. The bank has found that the average daily balance on personal checking accounts is \$550 with a standard deviation of \$150. The average daily balances have been found to be normally distributed.

a. What percentage of customers carry average daily balances in excess of \$800?

$$P(X > 800) = \text{normalcdf}(800, 999999, 550, 150) = .048 \quad 4.8\%$$

b. What percentage of customers carry average daily balances of \$200 or lower?

$$P(X \leq 200) = \text{normalcdf}(-999999, 200, 550, 150) = .0098 \quad .98\%$$

c. What percentage of customers carry average daily balances of \$600 or lower?

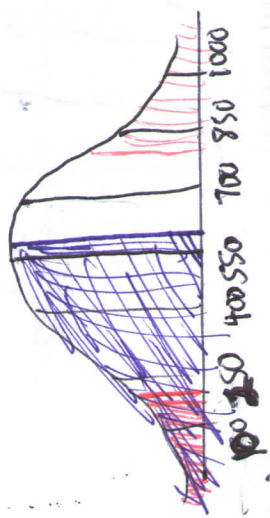
$$P(X \leq 600) = \text{normalcdf}(-999999, 600, 550, 150) = .631 \quad 63.1\%$$

d. What percentage of customers carry average daily balances between \$425 and \$600?

$$P(425 \leq X \leq 600) = \text{normalcdf}(425, 600, 550, 150) = .428 \quad 42.8\%$$

e. The bank is considering paying interest to customers carrying average daily balances in excess of a certain amount. If the bank does not want to pay interest to more than 5% of its customers, what is the minimum daily balance it should pay interest on?

$$\text{invnorm}(.95, 550, 150) = \$796.73$$



Remember ...

- > The `normalcdf` command is used for finding an area under the normal density curve. This area corresponds to the probability of randomly selecting a value between the specified lower and upper bounds.
- > Use the `invnorm` command when you are given a probability or percentage and asked to find an x-value or z-score. Your calculator requires you enter the cumulative area to the left of the desired value.