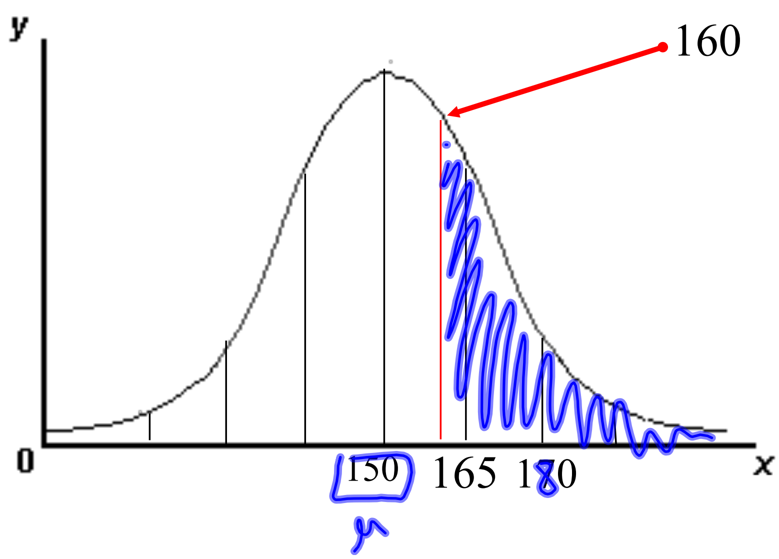
Day 3: The Standard Normal Distribution

What happens if the data in our problems doesn't fall exactly on a standard of deviation?

Eg 1) The heights of students are normally distributed with a mean of 150 cm and a standard deviation of 15 cm. How many standard deviations above the mean is a student with a height of 160cm? What percentage of the students have a height greater than 160 cm?



If you look at the curve we drew 160 does not fall on one of our standard deviation lines. What do we do?

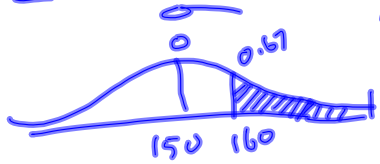
Normalize the curve by using the z - score formula.

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

μ (mu) - mean
σ (sigma) - standard deviation
x - measurement or data
z - z-score

Complete Example 1:

$$Z = \frac{x-\mu}{\sigma} = \frac{160-150}{15} = \boxed{\frac{10}{15}} = 0.67$$



Normalcdf(1st, 2nd)

Calculates area between 2 z-scores

**Note: z-score is a measure of the number of standard deviations above or below the mean. A negative z-score implies that it lies to the left of the mean. A positive z-score implies that it lies to the right of the mean.

Normalcdf($\frac{10}{15}$, 10)

larger than 10

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normalcdf(10/15▸
      .252492467
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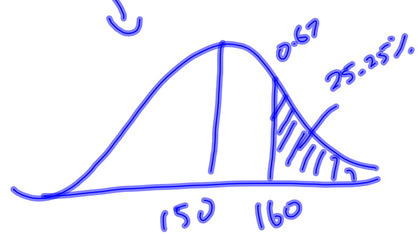
= 0.2525
= 25.25%



Normalcdf

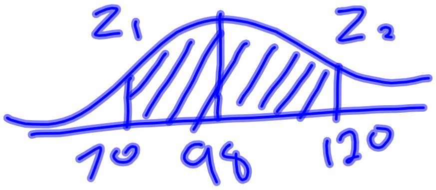
$\boxed{2^{nd}}$, $\boxed{\text{VARS}}$, $\boxed{2}$

Eg 5) The Bright light Company tested a new line of light bulbs and found their lifetimes to be normally distributed with a mean life of 98 hours and a standard deviation of 13hours.

σ $\qquad z = \frac{x - \mu}{\sigma}$

a) What percent of the light bulbs lasted between 70 hours and 120 hours.

① $z_1 = \frac{70-98}{13} = \frac{-28}{13}$

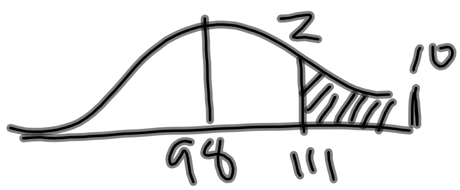


② $z_2 = \frac{120-98}{13} = \frac{22}{13}$

③ $\text{Normalcdf}\left(\frac{-28}{13}, \frac{22}{13}\right)$

$= 0.9391 \doteq 93.91\%$

b) What is the probability that a light bulb selected at random will last more than 111 hours?



① $z = \frac{111-98}{13} = \frac{13}{13}$

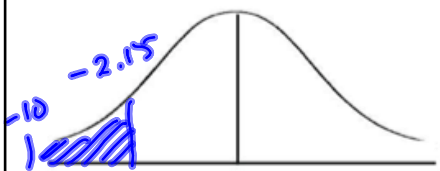
$= 1$

② $\text{Normalcdf}(1, 10)$

$= 0.1587$

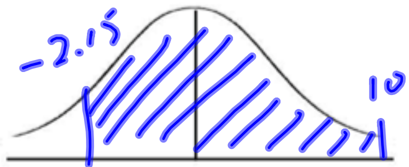
Determine the area under the curve for a standard normal distribution for each of the following z-score intervals. Then convert each of the areas to a percentage to the nearest hundredth.

a) $z < -2.15$

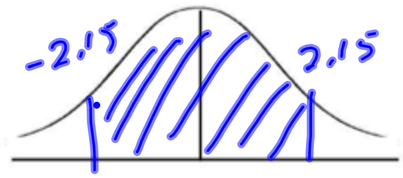


Normalcdf(-10, -2.15)
= 0.0158

b) $z > -2.15$

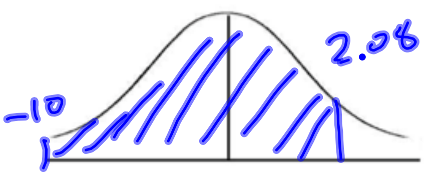


c) $-2.15 < z < 2.15$

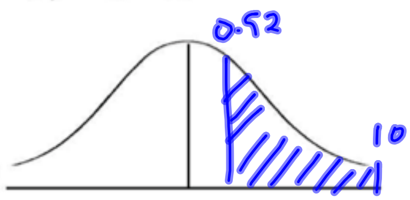


Determine, to four decimal places, the area under the curve for a standard normal distribution for each of the following z-score intervals.

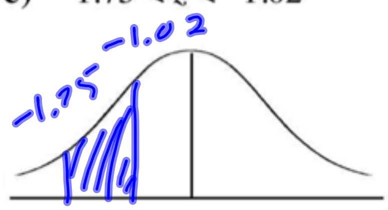
a) $z < 2.08$



b) $z > 0.92$

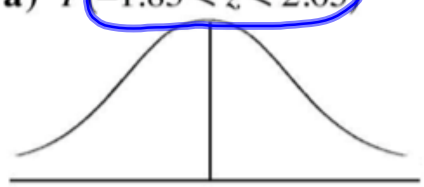


c) $-1.75 < z < -1.02$

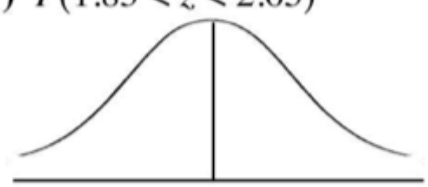


Determine the following probabilities to four decimal places.

a) $P(-1.83 < z < 2.65)$



b) $P(1.83 < z < 2.65)$



Assignment:
Pg. 233 #1-3, 7
Pg. 239 #1-3, 10, 12