FOM 11 **5.5 Z – Scores**

Since there are many different possible curves with different values of μ and σ, we can standardize the curve by transforming **each** score into a **z-score** (a measure of how many standard deviations a value is from the mean).

Standard Normal Distributions can be used in **every** problem for **any** data values.

Properties of a Standard Normal Distribution:

- Mean is 0.
- Standard Deviation is 1.
- Area under the curve is equal to 1.
- The graph is symmetrical about the mean.
- We use **z** instead of **x** to represent numbers along the horizontal axis.

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

$z = \frac{\text{term - mean}}{\text{standard deviation}}$

- A(z) is the **area under the curve to the left of z**.
- We can find the areas by using a graphing calculator or a z-table.

Example 1: If IQ scores are normally distributed with a mean of 100 and standard deviation of 15, determine:

a. the z-score for 120.

$z = \frac{x - \mu}{\sigma} = \frac{120 - 100}{15} = 1.33$

b. the probability that a randomly selected person has an IQ less than 120.

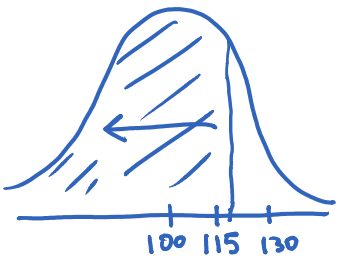
Find Area under the graph to left of 120 A(z)

$z = 1.33$

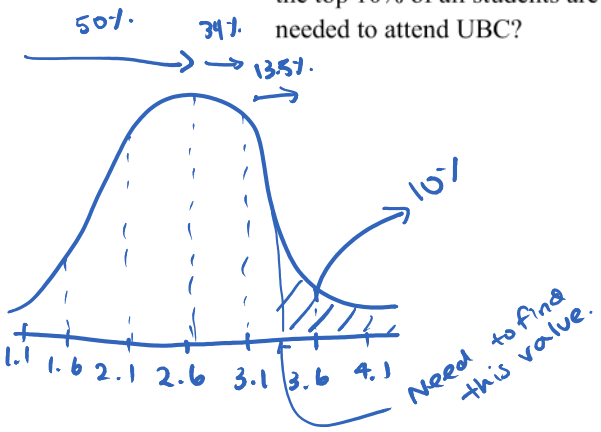
A(1.33) find in z-tables pg 592-593

A(1.33) = 0.9082

= 90.82 % Probability



Example 2: The GPA at GW Graham Secondary is 2.6, with a standard deviation of 0.5. If the top 10% of all students are eligible to attend UBC, what is the minimum GPA needed to attend UBC?



Remember z-score tables give area to left of z.

Find value that gives area to left of 90% (or closest to)

$A(z) = 0.9000$?

Closest $A(1.28) = 0.8997$

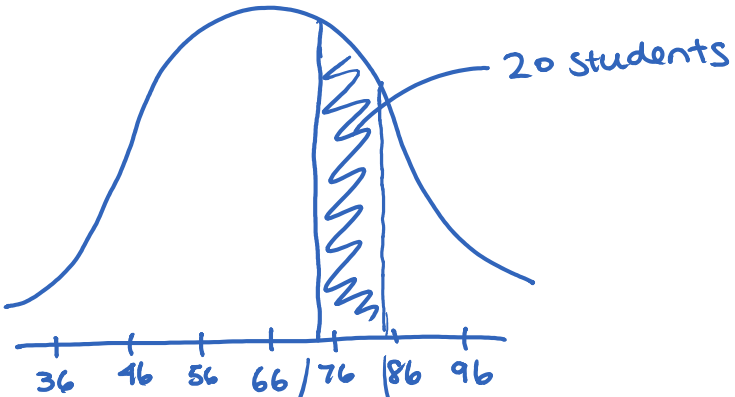
$z = 1.28$

$z = \frac{x - \mu}{\sigma}$ $0.5(1.28) = \frac{(x - 2.6)}{0.5}0.5$

$0.64 = x - 2.6$

$3.24 = x$ ← minimum GPA

Example 3: At a high school, the average grade for Science is 66, with a standard deviation of 10. If 20 students with grades between 73 and 85 receive B's, how many students are taking Science at the high school?



$z = \frac{73 - 66}{10}$

$= 0.7$

$z = \frac{85 - 66}{10}$

$= 1.9$

Percent between 73 & 85

$A(1.9) - A(0.7)$

$A(1.9) = 0.9713 = 97.13\%$

$A(0.7) = 0.7580 = 75.8\%$

$97.13 - 75.8 = 21.33\%$

$\frac{20 \text{ students}}{x} = \frac{0.2133}{1}$

$x = 93.765$

94 students take science.

omit

Example 4: A manufacturer of cell phones has determined a mean of 26 months before a need of repairs, with a standard deviation of 6 months. What length of time for this warranty should the manufacturer set so that less than 10% of all cell phones will need repairs during the warranty period?

Assignment: Pg. 264 #5-7(ac), 8, 9, 11, 13-15, 17, 20

HW p.264 #5-7(ac), 8, 9, 11, 15, 17