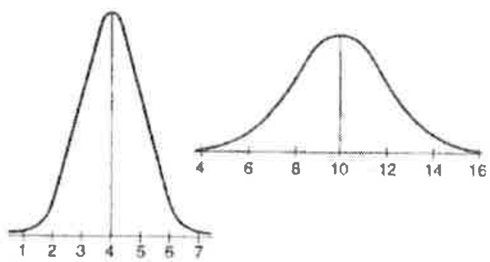
Chapter 5.2

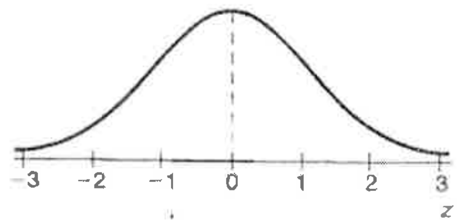
Normal Distributions: Finding Probabilities

NORMAL CURVE vs. STANDARD NORMAL CURVE

Normal Curves:
Show mean and standard deviation values



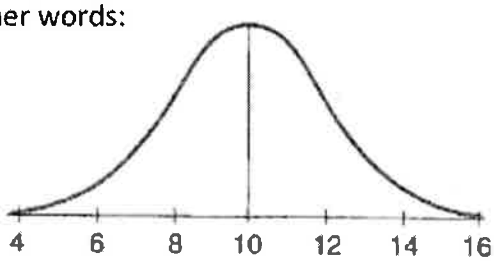
Standard Normal Curves:
Show Z-scores (#std dev from the mean)



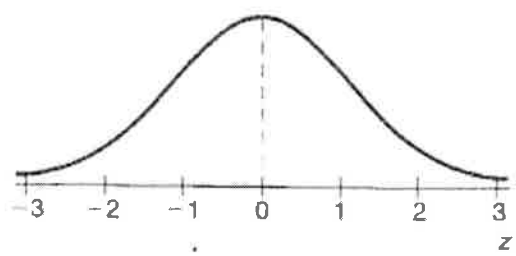
Can only estimate probabilities using empirical rule for SOME values of x.

Has a table of areas for EVERY Z value to reference to find probabilities.

In other words:



$P(8.2 \le x \le 12.5) =$



$P(-0.9 \le z \le 1.25) =$

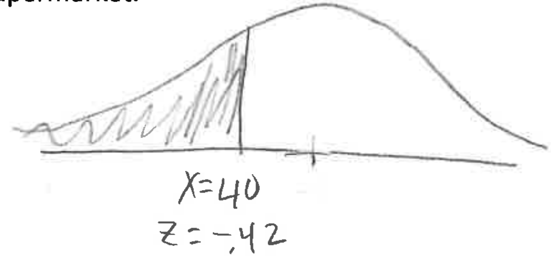
$$\boxed{z = \frac{x-\mu}{\sigma}}$$

In other words, you must convert raw scores (x-values) into z-scores before using the table to get the probabilities.

Example 1: A survey indicates that for each trip to the supermarket, a shopper spends 45 minutes with a standard deviation of 12 minutes in the store. The times are normally distributed and are represented by the variable x.

a) Find the probability that the customer spends less than 40 minutes in the supermarket.

$P(x < 40) =$ $P(z < -.42) = .3372$



$z = \frac{40-45}{12} = \frac{-5}{12} \approx -.42$

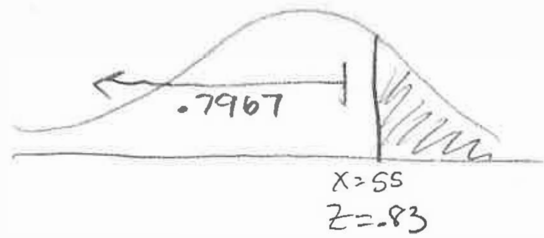
The probability that a customer spends less than 40 minutes in the supermarket is about 33.72%

(example 1 continued)… A survey indicates that for each trip to the supermarket, a shopper spends 45 minutes with a standard deviation of 12 minutes in the store. The times are normally distributed and are represented by the variable x.

b) Find the probability that the customer spends more than 55 minutes in the supermarket.

$P(x > 55) = P(z > .83) = 1 - .7967$

$= .2033 \approx 2033\%$



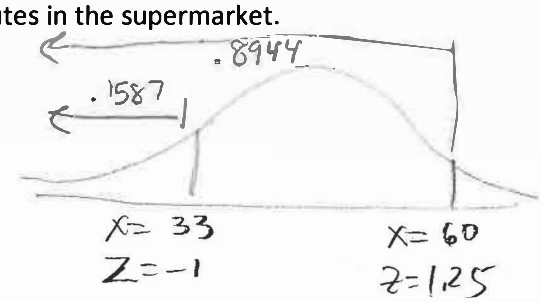
$z = \frac{55-45}{12} = \frac{10}{12} = .83$

The probability that a customer spends more than 55 minutes in the supermarket is about 20.33%.

c) Find the probability that the customer spends between 33 and 60 minutes in the supermarket.

$P(33 < x < 60) = P(-1 < z < 1.25)$

$= .8944 - .1587 = .7357$



$z = \frac{33-45}{12} = -1$

$z = \frac{60-45}{12} = \frac{15}{12} = 1.25$

There's a 73.57% probability that a customer will spend between 33 and 60 minutes in the supermarket.

Example 2: In a survey of US men, the heights in the 20 – 29 age group were normally distributed with a mean of 69.4 inches and a standard deviation of 2.9 inches. Find the probability that a randomly selected participant has a height that is:

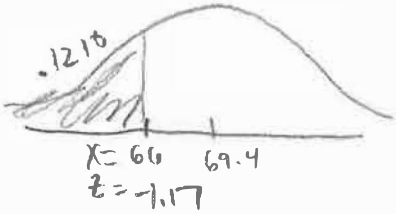
a) Less than 66 inches

$P(x < 66)$

$= P(z < -1.17) = .1210$

12.10% probability the participant is less than 66 inches tall.

$\frac{66-69.4}{2.9} = -1.17$



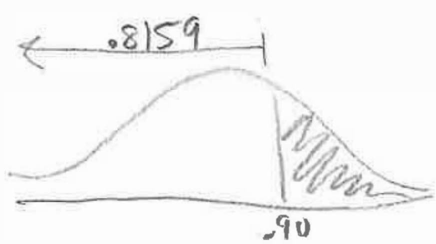
b) More than 72 inches

$P(x > 72) = P(z > .90)$

$= 1 - .8159$

$\frac{72-69.4}{2.9} = .90$ $= .1841$

14.81% probability the participant is taller than 72".



c) Between 66 and 72 inches

$P(66 < x < 72) = P(-1.17 < z < .90)$

$= .8159 - .1210$

$= .6949$

69.49% probability the participant is between 66" and 72" tall.