# Section 8-4

# Testing a Claim About a Mean: $\sigma$ Known



## Notation

$n$ = sample size

$\overline{x}$ = sample mean

$\mu$ = claimed population mean (from $H_0$)

$\sigma$ = known value of the population standard deviation

## Requirements for Testing Claims About a Population Mean (with $\sigma$ Known)

1) The sample is a simple random sample.

2) The value of the population standard deviation $\sigma$ is known.

3) Either or both of these conditions is satisfied: The population is normally distributed or $n > 30$.





## Test Statistic for Testing a Claim About a Mean (with $\sigma$ Known)

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

## Example:

**People have died in boat accidents because an obsolete estimate of the mean weight of men (166.3 lb) was used.**

**A random sample of $n = 40$ men yielded the mean $\bar{x} = 172.55$ lb. Research from other sources suggests that the population of weights of men has a standard deviation given by $\sigma = 26$ lb.**

**Test the claim that men have a mean weight greater than 166.3 lb.**





## Example:

**Requirements are satisfied: $\sigma$ is known (26 lb), sample size is 40 ($n > 30$)**

**We can express claim as $\mu > 166.3$ lb**

**It does not contain equality, so it is the alternative hypothesis.**

**$H_0$: $\mu = 166.3$ lb null hypothesis**

**$H_1$: $\mu > 166.3$ lb alternative hypothesis (and original claim)**

## Example:

**For a significance level to $\alpha = 0.05$**

**Next we calculate $z$**

$$z = \frac{\bar{x} - \mu_{\bar{x}}}{\frac{\sigma}{\sqrt{n}}} = \frac{172.55 - 166.3}{\frac{26}{\sqrt{40}}} = 1.52$$

**It is a right-tailed test, so *the critical region* is the area is to the right of $z$ = 1.52;**





## Example:

**The critical value $z$ = 1.645 And *Test statistic* $z$ = 1.52**
**i.e. the test statistic is to the left of the critical value**

**For the significance level of $\alpha = 0.05$, we fail to reject the null hypothesis.**

**i.e. we reject $H_1$; alternative hypothesis (and original claim)**