TESTS OF SIGNIFICANCE: Means

<table>
<tr><td>STEP I: Identify Procedure</td><td colspan="2"></td></tr>
<tr><td rowspan="2">A. Identify the population of interest and the parameter you want to draw conclusions about.</td><td colspan="2">One Sample: “We want to test the evidence against the claim that the mean for ____________ in the population of ________ (μ) is equal to ___ (μ_0). The null and alternative hypotheses are:”</td></tr>
<tr><td colspan="2">Two Samples: “We want to test the evidence against the claim that the mean for ____________ in the population of ________ (μ_1) is equal to the mean for ____________ in the population of ________ (μ_2). The null and alternative hypotheses are:”</td></tr>
<tr><td rowspan="2">B. State null hypothesis.</td><td colspan="2">One Sample H₀: $\mu = \mu_0$</td></tr>
<tr><td colspan="2">Two Samples H₀: $\mu_1 = \mu_2$</td></tr>
<tr><td rowspan="2">C. State Alternative Hypothesis. (Determine by the number of samples, and between two-sided or one-sided.)</td><td>One Sample, One-sided
H$_a$: $\mu < \mu_0$ OR
H$_a$: $\mu > \mu_0$</td><td>One sample, Two-sided
H$_a$: $\mu \neq \mu_0$</td></tr>
<tr><td>Two Sample, One-sided
H$_a$: $\mu_1 < \mu_2$ OR
H$_a$: $\mu_1 > \mu_2$</td><td>Two Sample, Two-sided
H$_a$: $\mu_1 \neq \mu_2$</td></tr>
<tr><td>STEP II: Check Conditions</td><td colspan="2"></td></tr>
<tr><td rowspan="2">A. State the appropriate significance test procedure based on number of samples and statistic type.</td><td colspan="2">Number of Samples: Choose between one sample, and two samples. For matched pairs, use one sample procedure μ_{DIFF}.</td></tr>
<tr><td colspan="2">Statistic Type: Is the population’s standard deviation known? If yes, use z-statistic. If not, use t-statistic.</td></tr>
<tr><td rowspan="2">B. Verify the conditions required to use the chosen procedure.</td><td colspan="2">z-statistic Conditions:
• SRS: Discuss sampling design from problem statement. If not definitive, consider “OK to proceed, but SRS uncertainty may limit out ability to generalize interpretations to the population of ___________.”
• Normality: Distribution for $\bar{x}$ or $\bar{x}_1 - \bar{x}_2$ is either drawn from a normal population (exact), or has large sample size (approximate via Central Limit Theorem).
• Independence of Selections: Note “Random samples with replacement”. OR “Random sample without replacement but population size is at least ten times sample size.”
• Independence of Two Samples: “Two samples are independent (by assumption) or (stated in problem).”</td></tr>
<tr><td colspan="2">t-statistic Conditions:
• SRS: (Same as z-statistic above)
• t-distribution of $\bar{x}$ or $\bar{x}_1 - \bar{x}_2$ appropriate: For $n < 15$, population near normal, no outliers; for $15 \leq n < 40$, population can have moderate skewness, but no outliers; and for $n \geq 40$, population can be extremely skewed, but still note influence of outliers (1.5 X IRQ). Replace n with $n_1 + n_2$ for two sample tests.
• Independence: (Same as z-statistic above)</td></tr>
<tr><td>C. Set Level of Significance (α)</td><td colspan="2">Determine critical value(s) for selected α
Note $\frac{\alpha}{2}$ determines critical values for two-sided tests.</td></tr>
</table>

STEP III: Perform Procedure	
A. Calculate the test statistic.	Apply formulas.
B. Find the P-value for the test statistic.	For z-statistic, use standard normal table. Confirm with TI .
	For t-statistic, use t-distribution table with appropriate degrees of freedom (df). Confirm with TI calculator.
	One sample: Use $n-1$ for degrees of freedom. Two samples, consider: (1) Most conservative approach is to use smaller of n_1-1 or n_2-1 (2) Slightly conservative approach is to use df formula (text book page 659) and round down to next whole number. (3) Most precise approach is to use TI calculator which can calculate probabilities for fractional df.
C. Draw Distribution To Illustrate	Include notation and labeling of z- or t-distribution, label with center, and points that are +/- one standard deviation, label critical values, and identify test statistic with p-value area shaded and noted.
STEP IV: Interpretation	
A. Determine if P-value is less than the significance level (α)	If it is, "reject H_o and accept H_a" If it is not, "fail to reject H_o"
B. Interpret your results in the context of the problem.	Reject Scenario: "We reject the null hypothesis at the ____% significance level (α). The P-value of ___ falls (well below) (just below) the significance level, thus there is (strong) (marginally strong) evidence that the alternative hypothesis is true, ____. "
	One Sample Fail to Reject Scenario: "We fail to reject the null hypothesis at the ___% significance level (α). The P-value of ___ shows that an observed sample mean as extreme as ___ ($\bar{x}$) would be expected to occur ____% of the time, and thus mere chance could explain the deviation of the sample mean and the reported population mean. We cannot say that the mean for _____________ in the population of _____________ is (not equal to)(greater than)(less than) the reported mean of ____ (μ_0)."
	Two Samples Fail to Reject Scenario: "We fail to reject the null hypothesis at the ___% significance level (α). The P-value of ___ shows that an observed difference in the sample means as extreme as ____ ($\bar{x}_1-\bar{x}_2$) would be expected to occur ____% of the time. Thus mere chance could explain the difference of the sample means even if no actual difference existed in the two population means ($\mu_1=\mu_2$). We cannot say that the mean for _____________ in the population of _____________ (μ_1) is (not equal to)(greater than)(less than) the mean for _____________ in the population of ______________ (μ_2)."
C. Report decision when question asks for one. Report Type I error, Type II error, and power when requested.	_______________ (will likely) (should) (may consider) ______________________________. Also, report any limiting conditions that may impact appropriateness of procedure.

AP Statistics/Mr. Nelson/Periods 5 & 6

TESTS OF SIGNIFICANCE: Proportions

<table>
<tr><td>STEP I: Identify Procedure</td><td colspan="2"></td></tr>
<tr><td rowspan="2">A. Identify the population of interest and the parameter you want to draw conclusions about.</td><td colspan="2">One Sample:
“We want to test the evidence against the claim that the proportion of __________________ in the population of ______________ (ρ) is equal to ___% (ρ_0).   The null and alternative hypotheses are:”</td></tr>
<tr><td colspan="2">Two Sample:
“We want to test the evidence against the claim that the proportion of ______________ in the population of ________________ (ρ_1) is equal to the proportion of __________ in the population of ____________ (ρ_2). “</td></tr>
<tr><td rowspan="2">B. State null hypothesis.</td><td colspan="2">One Sample   Ho : $\rho = \rho_0$</td></tr>
<tr><td colspan="2">Two Samples   Ho : $\rho_1 = \rho_2$</td></tr>
<tr><td rowspan="2">C. State Alternative Hypothesis. Determine by number of samples, and between two-sided or one sided.</td><td>One Sample, One-sided
Ha: $\rho < \rho_0$ OR
Ha: $\rho > \rho_0$</td><td>One sample, Two-sided
Ha: $\rho \neq \rho_0$</td></tr>
<tr><td>Two Sample, One-sided
Ha: $\rho_1 < \rho_2$ OR
Ha: $\rho_1 > \rho_2$</td><td>Two Sample, Two-sided
Ha: $\rho_1 \neq \rho_2$</td></tr>
<tr><td>STEP II: Check Conditions</td><td colspan="2"></td></tr>
<tr><td rowspan="2">A. State the appropriate significance test procedure based on number of samples.</td><td colspan="2">Number of Samples: Choose between one sample, or two samples.</td></tr>
<tr><td colspan="2">Statistic Type: Always use z-statistic.</td></tr>
<tr><td rowspan="2">B. Verify the conditions required to use the chosen procedure.</td><td colspan="2">One Sample Conditions:
SRS: Discuss sampling design from problem statement. If not definitive, consider “OK to proceed, but SRS uncertainty may limit out ability to generalize interpretations to the population of ______________.”
Normality: Distribution for $\hat{\rho}$ is approximately normal if $n\rho_0 \geq 10$ and $n(1-\rho_0) \geq 10$.
Independence of Selections: Note “Random samples with replacement”. OR “Random sample without replacement but population size is at least ten times sample size.”</td></tr>
<tr><td colspan="2">Two Sample Conditions:
SRS: (Same as one sample)
Normality: Distribution of $\hat{\rho}_1 - \hat{\rho}_2$ is approximately normal if $n\tilde{\rho} \geq 10$ and $n(1-\tilde{\rho}) \geq 10$ where $\tilde{\rho}$ is the pooled proportion for both samples [total number of successes divided by total of sample sizes ($n_1 + n_2$)].
Independence of Selections: Note “Random samples with replacement”. OR “Random sample without replacement but population size is at least ten times sample size.”
Independence of Two Samples: “Two samples are independent (by assumption) or (stated in problem).”</td></tr>
<tr><td>C. Set Level of Significance (α)</td><td colspan="2">Determine critical value(s) for selected α</td></tr>
</table>

STEP III: Perform Procedure		
A. Calculate the test statistic.	Apply formulas. One Sample: Use ρ_0 to calculate standard deviation (denominator) and $\hat{\rho} - \rho_0$ (numerator).	 Two Sample Pooled: Use pooled $\tilde{\rho}$ to calculate standard deviation (denominator) and use $\hat{\rho}_1 - \hat{\rho}_2$ (numerator).
B. Find the P-value for the test statistic.	Always use Z-statistic, standard normal table. Confirm with TI calculator.	
C. Draw Distribution To Illustrate	Include notation and labeling of z-distribution, label with center, and points that are +/- one standard deviation, label critical values, and identify test statistic with p-value area shaded and noted.	
STEP IV: Interpretation		
A. Determine if P-value is less than the significance level (α)	If it is, reject H_o and accept H_a If it is not, fail to reject H_o	
B. Interpret your results in the context of the problem.	Reject Scenario: "We reject the null hypothesis at the ____% significance level (α). The P-value of ___ falls (well below) (just below) the significance level, thus there is (strong) (marginally strong) evidence that the alternative hypothesis is true, ____."	
	One Sample Fail to Reject Scenario: "We fail to reject the null hypothesis at the ___% significance level (α). The P-value of ___ shows that an observed sample proportion as extreme as ___ % would be expected to occur ____% of the time. Thus, mere chance could explain the difference between the sample proportion of ____% ($\hat{\rho}$), and the reported population proportion of ___%(ρ). We cannot determine that the proportion of __________ that __________ is (not equal to)(greater than)(less than) ___% (ρ_0)."	
	Two Samples Fail to Reject Scenario: "We fail to reject the null hypothesis at the ___% significance level (α). The P-value of ____ shows that an observed difference between the two sample proportions as extreme as ___ % ($\hat{\rho}_1 - \hat{\rho}_2$) would be expected to occur ____% of the time even if no actual difference existed in the two population proportions ($\rho_1 = \rho_2$). Thus mere chance could explain the difference between the sample proportions. We cannot determine if the proportion of __________that __________ ($\hat{\rho}_1$) is (not equal to)(greater than)(less than) the proportion of __________ that _________ ($\hat{\rho}_2$).	
C. Report decision when question asks for one. Report Type I error, Type II error, and power when requested.	_______________ (will likely) (should) (may consider) ______________________________. Also, report any limiting conditions that may impact appropriateness of procedure.	

AP Statistics/Mr. Nelson/Periods 5 & 6

CONFIDENCE INTERVALS: Means

STEP I: Identify Procedure	
A. Identify the population of interest and the parameter you want to draw conclusions about.	One Sample: "We want to estimate the mean for ____________ in the population of ____________ (μ).
	Two Samples: "We want to estimate the difference between the mean for _________ in the population of ____________ (μ_1) less the mean for __________ in the population of ____________ (μ_2). "
STEP II: Check Conditions	
A. State the appropriate confidence interval procedure based on the number of samples and statistic type.	Number of Samples: Choose between one sample, and two samples. For matched pairs, use one sample procedure μ_{DIFF}.
	Statistic Type: Is the population's standard deviation known? If yes, use z-statistic. If not, use t-statistic.
B. Verify the conditions required to use the chosen procedure.	z-statistic Conditions: • SRS: Discuss sampling design from problem statement. If not definitive, consider "OK to proceed, but SRS uncertainty may limit out ability to generalize interpretations to the population of ______________." • Normality: Distribution for $\bar{x}$ or $\bar{x}_1 - \bar{x}_2$ is either drawn from a normal population (exact) or has large sample size (approximate via Central Limit Theorem) • Independence of Selections: Note "Random samples with replacement". OR "Random sample without replacement but population size is at least ten times sample size." • Independence of Two Samples: "Two samples are independent (by assumption) or (stated in problem)."
	t-statistic Conditions: • SRS: (Same as z-statistic above) • t-distribution for $\bar{x}$ or $\bar{x}_1 - \bar{x}_2$ appropriate: For $n < 15$, population near normal, no outliers; for $15 \le n < 40$, population can have moderate skewness, but no outliers; and for $n \ge 40$, population can be extremely skewed, but still note influence of outliers (1.5 X IRQ). Replace n with $n_1 + n_2$ for two sample tests. • Independence of Selections: Note "Random samples with replacement". OR "Random sample without replacement but population size is at least ten times sample size." • Independence of Two Samples: "Two samples are independent (by assumption) or (stated in problem)."
C. Set Confidence Level	Determine $1-\alpha$ (90%, 95%, 99% are most typical). Note $\frac{\alpha}{2}$ determines critical values for confidence intervals.

STEP III: Perform Procedure		
A. Calculate Estimate of proportion (one sample) or difference of two proportions (two samples)	One Sample: Use $\bar{x}$ to estimate μ.	Two Samples: Use $\bar{x}_1 - \bar{x}_2$ to estimate $\mu_1 - \mu_2$
B. Add/subtract the Margin of Error (ME)	One Sample: Find ME by multiplying z-score or t-score for $\frac{\alpha}{2}$ by the standard deviation for the $\bar{x}$ normal distribution ($\frac{\sigma}{\sqrt{n}}$) or the standard error for the $\bar{x}$ t-distribution ($\frac{s}{\sqrt{n}}$). Confirm confidence interval with TI calculator.	
	Two Samples: Find ME by multiplying z-score or t-score for $\frac{\alpha}{2}$ by the standard deviation for the $\bar{x}$ normal distribution ($\frac{\sigma}{\sqrt{n}}$) or the standard error for the $\bar{x}$ t-distribution ($\frac{s}{\sqrt{n}}$). Confirm confidence interval with TI calculator.	
	For t-statistic, use t-distribution table with appropriate degrees of freedom (df).	
	One sample, use $n-1$ for degrees of freedom.	Two samples, consider: (1) Most conservative approach is to use smaller of $n_1 - 1$ or $n_2 - 1$ (2) Slightly conservative approach is to use df formula (text book page 659) and round down to next whole number. (3) Most precise approach is to use TI calculator which can calculate probabilities for fractional df.
STEP IV: Interpretation		
A. Report interval with associated confidence level ($1-\alpha$)	One Sample: "We are ___% confident that the mean for ______ in the population of _________ (μ) falls between ___ and ___."	
	Two Samples: "We are ___% confident that the difference between the mean for ________ in the population of _________ (μ_1) and the mean for _________ in the population of _________ (μ_2) falls between ___ and ___."	
B. Report decision when question asks for one.	_________________ (will likely) (should) (may consider) ___________________________________. Also, report any limiting conditions that may impact appropriateness of procedure.	

CONFIDENCE INTERVALS: Proportions

STEP I: Identify Procedure	
A. Identify the population of interest and the parameter you want to draw conclusions about.	One Sample: "We want to estimate the proportion of ________________ in the population of ______________. "
	Two Samples: "We want to estimate the difference between the proportion of _________ in the population of ____________ less the proportion of __________ in the population of ___________. "
STEP II: Check Conditions	
A. State the appropriate confidence interval procedure.	Number of Samples: Choose between one sample, two samples (difference in proportions), or matched pairs.
B. Verify the conditions required to use the chosen procedure.	One Sample Conditions: • SRS: Discuss sampling design from problem statement. If not definitive, consider "OK to proceed, but SRS uncertainty may limit out ability to generalize interpretations to the population of ____________." • Normality: Distribution for $\hat{\rho}$ is approximately normal if $n\hat{\rho} \geq 10$, and $n(1-\hat{\rho}) \geq 10$. When this condition fails, consider PLUS FOUR CI. • Independence of Selections: Note "Random samples with replacement". OR "Random sample without replacement but population size is at least ten times sample size."
	Two Sample Conditions: • SRS: (Same as one sample above) • Normality: Distribution for $\hat{\rho}_1 - \hat{\rho}_2$ is approximately normal if $n\hat{\rho}_1 \geq 5$, $n\hat{\rho}_2 \geq 5$, $n(1-\hat{\rho}_1) \geq 5$ and $n(1-\hat{\rho}_2) \geq 5$. When this condition fails, consider PLUS FOUR CI. • Independence of Selections: Note "Random samples with replacement". OR "Random sample without replacement but population size is at least ten times sample size." • Independence of Two Samples: "Two samples are independent (by assumption) or (stated in problem)."
	PLUS FOUR Confidence Interval: • SRS: (Same as one sample above). • Normal distribution for $\hat{\rho}$ can be approximated with this procedure if confidence level is at least 90% and $n \geq 10$. • Independence of Selections: Note "Random samples with replacement". OR "Random sample without replacement but population size is at least ten times sample size." • Independence of Two Samples: "Two samples are independent (by assumption) or (stated in problem)."
C. Set Confidence Levels	Determine $1-\alpha$ (90%, 95%, 99% are most typical). Note $\frac{\alpha}{2}$ determines critical values for confidence interval.

<table>
<tr><td>STEP III: Perform Procedure</td><td colspan="2"></td></tr>
<tr><td>A. Calculate Estimate of proportion (one sample) or difference of two proportions (two samples)</td><td>One Sample:
Use $\hat{\rho}$ to estimate ρ.</td><td>Two Samples:
Use $\hat{\rho}_1 - \hat{\rho}_2$ to estimate $\rho_1 - \rho_2$</td></tr>
<tr><td rowspan="2">B. Add/subtract the Margin of Error (ME)</td><td colspan="2">One Sample: Find ME by multiplying z-score for $\frac{\alpha}{2}$ by the standard error calculated using $\hat{\rho}$ (see page 689 of text book). Confirm confidence interval with TI calculator.</td></tr>
<tr><td colspan="2">Two Sample: Find ME by multiplying z-score for $\frac{\alpha}{2}$ by the standard error calculated using $\hat{\rho}_1$ and $\hat{\rho}_2$ (see page 704 of text book). Confirm confidence interval with TI calculator.</td></tr>
<tr><td>STEP IV: Interpretation</td><td colspan="2"></td></tr>
<tr><td rowspan="2">A. Report interval with associated confidence level ($1-\alpha$)</td><td colspan="2">One Sample: "We are ___% confident that the proportion of __________that ___________ (ρ) falls between ____% and ____%."</td></tr>
<tr><td colspan="2">Two Samples: "We are ___% confident that the difference in the proportion of __________that ___________ (ρ_1) and the proportion of ___________ that __________ (ρ_2) falls between ______ and _____ percentage points."</td></tr>
<tr><td>B. Report decision/further interpretation when question asks for one.</td><td colspan="2">__________________ (will likely) (should) (may consider) _____________________________________. Also, report any limiting conditions that may impact appropriateness of procedure.</td></tr>
</table>

AP Statistics/Mr. Nelson/Periods 5 & 6

CHI SQUARE TESTS

STEP I: Identify Procedure	
A. Identify the population of interest and the parameter you want to draw conclusions about.	Goodness of Fit Test: ""We want to test the evidence against the claim that the distribution of proportions for ________________ are ___% (ρ_1), ___% (ρ_2), and ___% (ρ_3) for each of the respective subcategories, ____________, ______________, and ___________. The null and alternative hypotheses are:"
	Test of Independence/Association "We want to test the evidence against the claim that ________________ and _______________ are independent in the population of ____________ . The null and alternative hypotheses are:
	Test for Homogeneity of Proportions: "We want to test the evidence against the claim that the proportions of ___________ in the population of _____________ is the same for all subcategories of _______________. The null and alternative hypotheses are:
B. State null hypothesis.	Goodness of Fit Test: H_0: $\rho_1 = a$, $\rho_2 = b$, $\rho_3 = c$ . . . a,b,c are all between 0 and 1, and a+b+c = 1
	Test of Independence/Association: H_0: ____________ and _______________ in the population of __________ are independent.
	Test for Homogeneity of Proportions: H_0: All proportions of _________ for each of the subcategories is equal.
C. State Alternative Hypothesis. Determine by number of samples, and between two-sided or one-sided.	H_a: At least one of these proportions is not equal to the proportion reported in the null hypothesis.
	H_a: ____________ and _____________ in the population of ______________ are not independent.
	H_a: At least one of the subcategories has a proportion that is not equal to the other proportions.
STEP II: Check Conditions	
A. State the appropriate test details.	Identify test type, number of subcategories for each variable (matrix size of table).
B. Verify the conditions required to use the chosen procedure.	For GOF and Independence: (1) Simple Random Sample (SRS): Discuss sampling design. (2) Expected Counts: All expected counts are one or greater, and no more than 20% are less than five. "No expected counts were less than one, and only ___ of ____ expected counts were under five."
	For Homogeneity: (1) SRS and (2) Expected Counts as noted above. (3) Independence: Samples are independent of each other, and all outcomes of each sample are independent (probably will need to use 10X rule).
C. Set Level of Significance (α)	Determine critical value(s) for selected α
D. Determine Degrees of Freedom	(Number of rows – 1) X (Number of columns – 1)

STEP III: Perform Procedure	
A. Calculate the test statistic.	Apply formula.
B. Find the P-value for the test statistic.	Hand calculate Chi Square-statistic. Using TI calculator, confirm statistic and find P-value.
C. Graph P-value	Draw graph with appropriate degrees of freedom, shade area to right of Chi Square statistic.
STEP IV: Interpretation	
A. Determine if P-value is less than level of significance (Chi square statistic is greater than the chi square value for the selected level of significance (α))	If it is, reject H_o and accept H_a If it is not, fail to reject H_o
B. Interpret your results in the context of the problem.	All Three Tests - Reject Scenario: "We reject the null hypothesis at the ____% significance level (α). The P-value of ____ falls (well below) (just below) the level of significance, thus there is (strong) (marginally strong) evidence that the alternative hypothesis is true, ________________________ ."
	All Tests – Fail to Reject Scenario – Start With: "We fail to reject the null hypothesis at the ____% significance level (α). The P-value of ____ shows that a set of observed counts as or more different from the expected counts would be expected to occur ____% of the time. Thus, mere chance could explain the degree of difference between the observed and expected counts.
	Add for Goodness of Fit Test Fail to Reject Scenario: "We cannot determine that the set of proportions reported in the null hypothesis are not equal to the actual proportions present in the population of ____________________. "
	Add for Test of Independence Fail to Reject Scenario: "We cannot determine that _______________ and ________________ in the population of ____________________ are not independent. "
	Add for Test of Homogeneity Fail to Reject Scenario: "We cannot determine that the proportion of _______________ in the population of _________________ is not the same for all subcategories of _____________________.
C. Follow-up Analysis When H_0 is Rejected.	_______________________contribute(s) the largest components of the Chi Square statistic. This subcategory suggests the proportion of _________ in the subcategory of ____________ is not equal to the proportions for the other subcategories.
D. Report decision when question asks for one. Report Type I error, Type II error, and power when requested.	__________________ (will likely) (should) (may consider) __________________________________. Also, report any limiting conditions that may impact appropriateness of procedure.

AP Statistics/Mr. Nelson/Periods 5 & 6

TEST OF SIGNIFICANCE: Slope of Least Squares Regression Line (LSRL)

STEP I: Identify Procedure		
A. Identify the population of interest and the parameter you want to draw conclusions about.	For two-way test, "We want to test the evidence against the claim that there is no true linear relationship between ____________ (explanatory variable) and ____________ (response variable) in the population of __________. The null and alternative hypotheses are:"	
	For one-way test, "We want to test the evidence against the claim that there is no true linear relationship (with a positive slope)(with a negative slope) between ____________ (explanatory variable) and ____________ (response variable) in the population of __________. The null and alternative hypotheses are:"	
B. State null hypothesis.	$H_0 : \beta = 0$	
C. State Alternative Hypothesis. (Determine by the number of samples, and between two-sided or one-sided.)	One-sided : $H_a : \beta < 0$ or $H_a : \beta > 0$	Two-sided: $H_a : \beta \neq 0$
STEP II: Check Conditions		
A. State the appropriate significance test.	Identify test type, explanatory variable, response variable, and t-statistic with ___ ($n-2$) degrees of freedom.	
B. Verify the conditions required to use the chosen procedure.	(1) Simple Random Sample (SRS): Discuss sampling design. (2) Linear relation is apparent in a scatterplot, a residual plot, OR normal probability plot. Show scatterplot. Add "The scatterplot above shows a (strong)(moderate) linear relationship. " Show Residual Plot. Add "The residual plot below shows no pattern." Show Probability Plot. Add "The probability plot below shows the distribution of the residuals is approximately normal." Conclude with, "This observation is sufficient for us to proceed with the test."	
C. Set Confidence Levels (α)	Determine critical value(s) for selected α	

STEP III: Perform Procedure		
A. Calculate the test statistic.	$t = \frac{b}{SE_b}$	$SE_b = \sqrt{\frac{\sum (y-\hat{y})^2}{(n-2)\sum (x-\bar{x})^2}}$
B. Find the P-value for the test statistic.	For t-statistic, use t-distribution table with appropriate degrees of freedom (df). Confirm with TI calculator.	
STEP IV: Interpretation		
A. Determine if P-value is less than significance level (α)	If it is, "reject H_o and accept H_a" If it is not, "fail to reject H_o"	
B. Interpret your results in the context of the problem.	Reject Scenario: "We reject the null hypothesis at the ____% significance level (α). The P-value of ___ falls (well below) (just below) the significance level, thus there is (strong) (marginally strong) evidence that the alternative hypothesis is true, ____. " (Remember that a linear relationship may be indicated, but it does not provide evidence regarding the strength.)	
	Fail to Reject Scenario: "We fail to reject the null hypothesis at the ___% significance level (α). The P-value of ___ shows that an observed LSRL slope ___ (b) as far or further from zero would be expected to occur ____% of the time. Mere chance could explain the observed slope even if no true linear relationship existed in the population ($\beta = 0$).	
C. Report decision when question asks for one. Report Type I error, Type II error, and power when requested.	_______________ (will likely) (should) (may consider) ______________________________. Also, report any limiting conditions that may impact appropriateness of procedure.	
D. Interpret Slope	"Based on the LSRL (give actual equation with variable in text), a __________ (one unit) increase in the ________________ (explanatory variable) is associated with an (increase OR decrease) of ___________ (# units indicated by slope) in the predicted ___________________ (response variable)."	
E. Interpret Coefficient of Determination	"Based on the LSRL (give actual equation with variable in text), ____% of the total sample variation is explained by the LSRL with ______________ as response variable and __________________ as explanatory variable. "	

AP Statistics/Mr. Nelson/Periods 5 & 6

CONFIDENCE INTERVAL: Slope of Least Squares Regression Line (LSRL)

STEP I: Identify Procedure	
A. Identify the population of interest and the parameter you want to draw conclusions about.	"We want to estimate the slope of the least squares regression line (LSRL) for ____________________ (explanatory variable) and _____________________ (response variable) in the population of ______________ .
STEP II: Check Conditions	
A. State the appropriate confidence interval procedure.	Identify explanatory variable, response variable, and t-statistic with ___ ($n-2$) degrees of freedom.
B. Verify the conditions required to use the chosen procedure.	(1) Simple Random Sample (SRS): Discuss sampling design. (2) Linear relation is apparent in a scatterplot, a residual plot, OR normal probability plot. Show scatterplot. Add "The scatterplot above shows a (strong)(moderate) linear relationship. " Show Residual Plot. Add "The residual plot below shows no pattern." Show Probability Plot. Add "The probability plot below shows the distribution of the residuals in approximately normal ." Conclude with, "This observation is sufficient for us to proceed with the test."
C. Set Confidence Levels (α)	Determine $1-\alpha$ (90%, 95%, 99% are most typical). Note $\frac{\alpha}{2}$ determines critical values for two-sided test of significance.

STEP III: Perform Procedure		
A. Calculate Estimate of Slope	Use b (slope of LSRL from sample) to estimate the true slope from the population (β)	
B. Add/subtract the Margin of Error (ME)	$\pm t \bullet SE_b$ t=t-score for $\frac{\alpha}{2}$	$SE_b = \sqrt{\frac{\sum (y-\hat{y})^2}{(n-2)\sum (x-\bar{x})^2}}$
STEP IV: Interpretation		
A. Report interval with associated confidence level ($1-\alpha$)	"We are ___% confident that the predicted _________________ (response variable) (increases)(decreases) by ___ to ___ for each one _______ (unit of measure) increase in ______________________ (explanatory variable)."	
B. Report decision/further interpretation when question asks for one.	_________________ (will likely) (should) (may consider) ________________________________. Also, report any limiting conditions that may impact appropriateness of procedure.	
C. Interpret Slope	"Based on the LSRL (give actual equation with variable in text), a ___________ (one unit) increase in the _________________ (explanatory variable) is associated with an (increase OR decrease) of ____________ (# units indicated by slope) in the predicted ______________________ (response variable)."	
D. Interpret Coefficient of Determination	"Based on the LSRL (give actual equation with variable in text), ____% of the total sample variation is explained by the LSRL with _______________ as response variable and _____________________ as explanatory variable. "	