

Stats Medic AP Stats Exam Review – Videos and Practice Problems

Unit 1: One Variable Data

1.1 Types of Displays	Unit 1 Stats Medic Practice Multiple Choice (10)
1.2 Describing a Distribution	Unit 1 Stats Medic Practice Free Response
	Unit 1 AP Free Response (2015 #1)

Unit 2: Two Variable Data

2.1 Describing a Relationship	Unit 2 Stats Medic Practice Multiple Choice (10)
2.2 Predictions and Residuals	Unit 2 Stats Medic Practice Free Response
	Unit 2 AP Free Response (2017 #1)

Unit 3: Sampling and Experiments

3.1 Sampling Methods and Issues	Unit 3 Stats Medic Practice Multiple Choice (10)
3.2 Experimental Design	Unit 3 Stats Medic Practice Free Response
	Unit 3 AP Free Response (2016 #3)

Unit 4: Probability

4.1 General Probability	Unit 4 Stats Medic Practice Multiple Choice (20)
4.2 Binomial Distributions	Unit 4 Stats Medic Practice Free Response
4.3 Transforming and Combining Random Variables	Unit 4 AP Free Response (2017 #3)
4.4 Normal Distribution Calculations	
4.5 Geometric Distributions	

Unit 5: Sampling Distributions

5.1 Introduction to Sampling Distributions	Unit 5 Stats Medic Practice Multiple Choice (10)
5.2 Sampling Distributions for One Population	Unit 5 Stats Medic Practice Free Response
5.3 Sampling Distributions for Two Populations	Unit 5 AP Free Response (2010 #2)

Unit 6: Confidence Intervals

6.1 One Sample Confidence Intervals	Unit 6 Stats Medic Practice Multiple Choice (20)
6.2 Two Sample Confidence Intervals	Unit 6 Stats Medic Practice Free Response
	Unit 6 AP Free Response (2017 #2)

Unit 7: Significance Tests

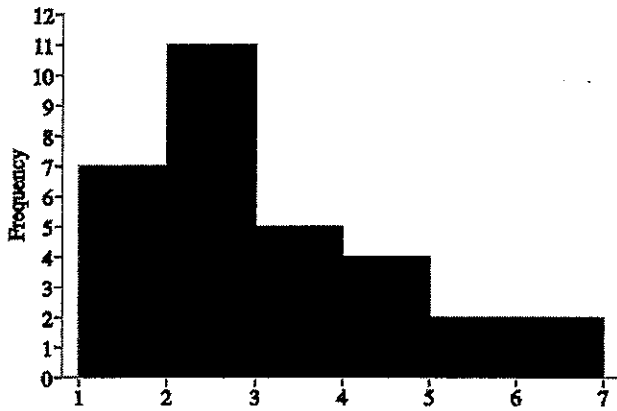
7.1 One Sample Significance Tests	Unit 7 Stats Medic Practice Multiple Choice (20)
7.2 Two Sample Significance Tests	Unit 7 Stats Medic Practice Free Response
7.3 Difference of Means OR Mean of Differences?	Unit 7 AP Free Response (2015 #4)
7.4 Chi-square Tests	Unit 7 AP Free Response (2017 #5)
7.5 Inference for Linear Regression	
7.6 Type 1 and Type 2 Errors + Power	

Getting Ready for the AP Exam!

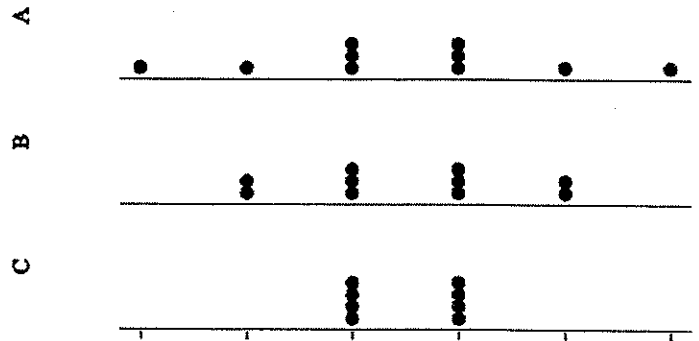
Name That Significance Test	Stats Medic Full Length Practice Exam
Using Your Calculator on the AP Stats Exam	Multiple Choice (40)
Know Your AP Stats Formula Sheet	Free Response (6)
How to CRUSH the AP Stats Free Response	
How to Survive the Investigative Task	
Top 10 AP Stats Exam Tips	

Video 1.1 Types of Displays

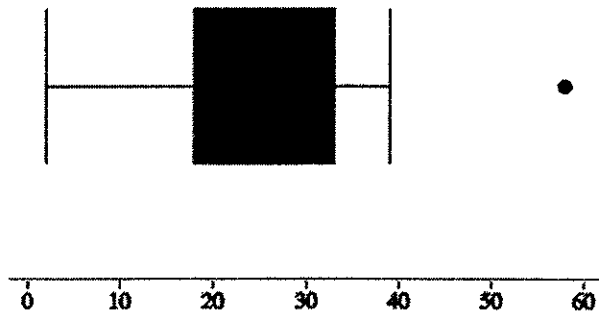
Histogram: Find the median.



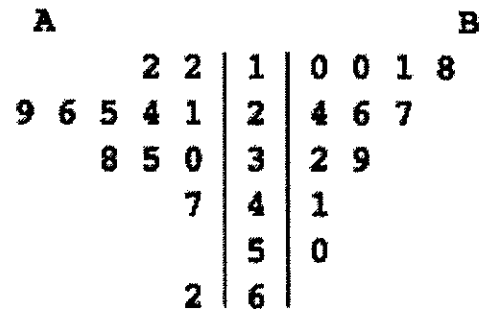
Dotplot: Which distribution has the smallest standard deviation?



Boxplot: Give 5-number summary and IQR



Stemplot: Compare shapes



AP Exam Tips:

Video 1.2 Describing a Distribution

SOCS + context

Shape

Center

Spread

Outliers

Example: # hours of sleep

3 5 6 6 7 7 7 7 8 8

Describe the distribution.

AP Exam Tips:

Video 2.1 Describing a Relationship

DUFS + context

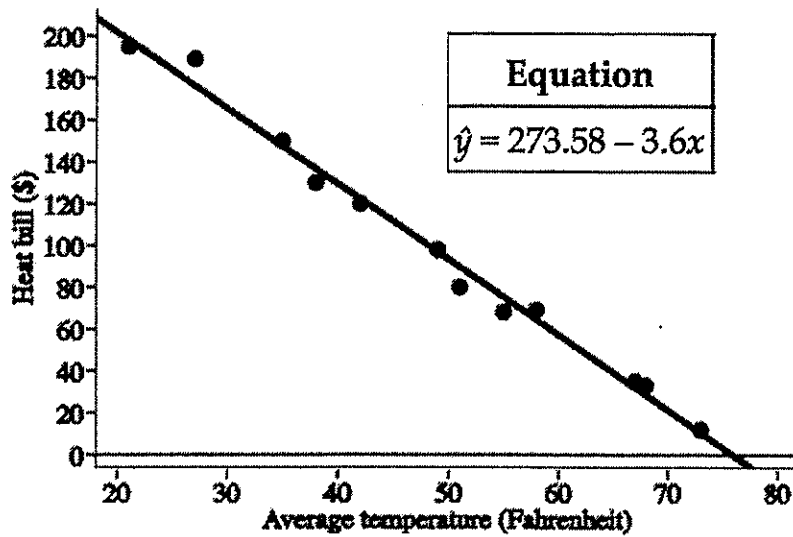
Direction

Unusual Features

Form

Strength

Example: Heat bills



Describe the distribution

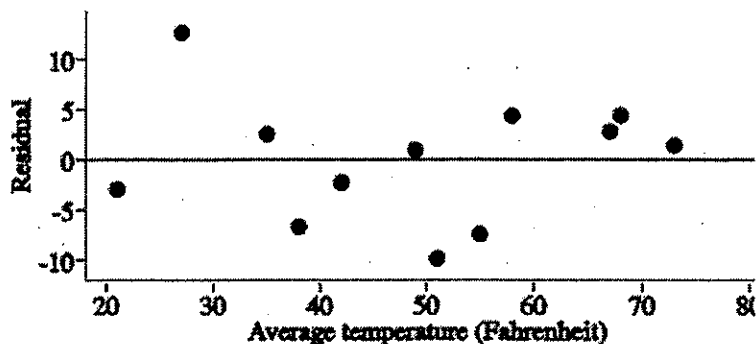
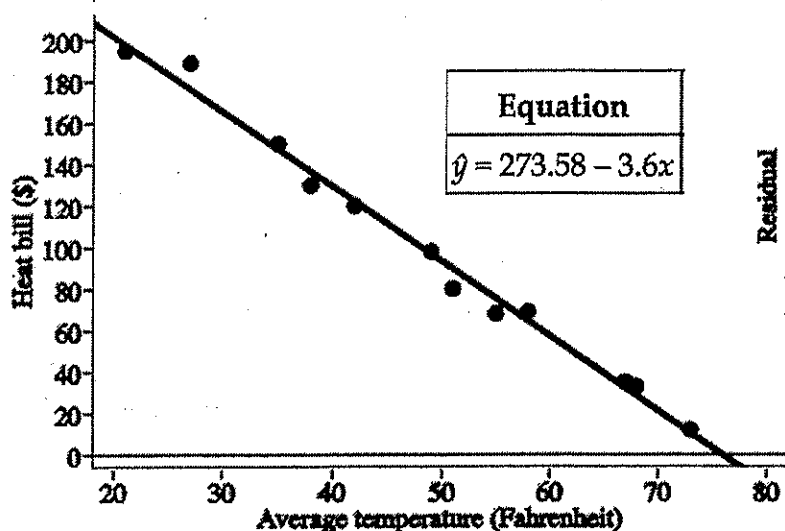
Interpret slope

Interpret $r^2 = 0.989$

AP Exam Tips:

Video 2.2 Predictions and Residuals

Example: Heat bills



Find the predicted bill for a month with an average temperature of 42° F.

The actual bill for a month with average temperature of 42° F was \$120. Calculate and interpret the residual.

Is a linear model appropriate for the data set?

What if the data appears nonlinear? Use a nonlinear model to calculate a predicted bill for a month with an average temperature of 42° F.

$$\log(\text{heat bill}) = 4.52 - 1.57 \log(\text{average temp})$$

AP Exam Tips:

Video 3.1 Sampling Methods and Issues

Sampling Methods:

Picture:

Convenience Sample

Voluntary Response Sample

Simple Random Sample

How to do an SRS

Sampling Issues:

Undercoverage

Nonresponse

Response Bias

Stratified vs. Cluster

Picture:

Stratified

Cluster

AP Exam Tips:

Video 3.2 Experimental Design

Average AP Exam Scores:

Stats Medic 4.3

Review book 3.8

Picture:

Confounding variable

Draw outline of the experiment:

What is the difference between an experiment and an observational study?

What is the advantage of an experiment over and observational study?

Block design

AP Exam Tips:

Video 4.1 General Probability

"OR"

Define mutually exclusive

No:

Yes:

"AND"

Define independent

No:

Yes

Example: Stella's Lounge only sells burgers and sandwiches. Each comes with chips or, for \$1 more, it can be served with fries. The probability that a randomly selected customer orders a burger is 60%. If they order a burger, 70% of the time they will get fries. If the customer orders a sandwich, they get fries 45% of the time. What is the probability that a randomly selected customer orders:

- (a) A sandwich and fries
- (b) Fries
- (c) A sandwich, given they order fries

AP Exam Tips:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Video 4.2 Binomial Distributions

A certain NBA basketball player is an 85% free throw shooter, meaning he has an 85% probability of making any given free throw. In one month he will shoot 100 free throws. Assume each shot is independent of the others.

Let X = the number of free throws he makes out of 100 attempts.

(a) Describe the distribution of X .

(b) What is the probability that the basketball player makes exactly 80 free throws out of 100?

(c) Find the probability that the player makes at least 80 free throws out of 100.

AP Exam Tips:

Video 4.3 Transforming and Combining Random Variables

Transforming Random Variables

Number hours of sleep: 3 5 6 6 7 7 7 7 8 8

X → number of hours of sleep $\mu_x =$ $\sigma_x =$ $\sigma_x^2 =$

Y → number of minutes of sleep $\mu_y =$ $\sigma_y =$ $\sigma_y^2 =$

Z → number of minutes of sleep $\mu_z =$ $\sigma_z =$ $\sigma_z^2 =$
 (with 20 minute nap)

RULES: Mean SD Variance

Multiply/divide by A

Add/subtract B

Combining Random Variables

X → Number of hours of sleep for 1st hour. $\mu_x = 6.4$ $\sigma_x = 1.51$

Y → Number of hours of sleep for 2nd hour. $\mu_y = 6.2$ $\sigma_y = 1.98$

S = X + Y D = X - Y

$\mu_s =$ $\mu_D =$

$\sigma_s =$ $\sigma_D =$

$\sigma_s^2 =$ $\sigma_D^2 =$

AP Exam Tips:

Video 4.4 Normal Distribution Calculations

Example: The number of daily views at StatsMedic.com follows an approximately normal distribution with a mean of 15,000 and a standard deviation of 4,000.

(a) Find the probability that a randomly selected day has more than 20,000 views.

(b) How many views would be in the bottom 5% of all days.

AP Exam Tips:

Video 4.5 Geometric Distributions

Example: In 2016, the Bottle Flip Challenge (flipping a water bottle into the air and landing it right side up) took the internet by storm. Michael is really good at the bottle flipping. On any given bottle flip, he has a 35% probability of landing the bottle right side up. Assume that each bottle flip is independent.

Let X = the number of flips it takes until Michael lands a bottle flip.

Conditions:

B:

I:

F:

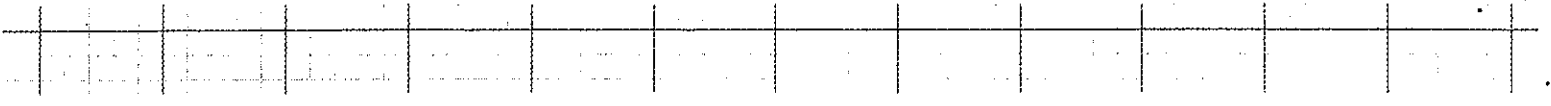
S:

(a) Describe the distribution of X .

(b) Find the probability that it takes Michael 4 flips until he lands the bottle right side up.

(c) Find the probability that Michael lands the bottle right side up within the first 4 flips.

AP Exam Tips:



Video 5.1 Introduction to Sampling Distributions

Picture

A statistic estimates a parameter

Example: Find the average word length for Beyonce's Crazy in Love

What makes a good statistic?

AP Exam Tips:

Video 5.2 Sampling Distributions for One Population

	Sample proportion	Sample mean
Parameter		
Statistic		
Shape		
Center		
Variability		
z-score formula		

Example 1: At a large local high school, 52% of the previous year's graduating class enrolled in a four-year university the following fall. The school counselors contact an SRS of 50 of the previous year's graduates. Find the probability that the SRS contains at least 23 students who are enrolled in a four-year university.

Picture:

Show work:

Example 2: The ACT scores a recent school year were approximately Normally distributed with a mean of 21 and a standard deviation of 5.4. If a random sample of 5 test scores is chosen, what is the probability that the sample mean is 25 or greater?

Picture:

Show work:

AP Exam Tips:

Video 5.3 Sampling Distributions for Two Populations

Example 1: Two veteran sales people at a local company keep track of the proportion of sales they make out of the number of sales meetings they have. Person A made sales at 42% of their meetings. Person B made sales at 30% of their meetings. Their manager independently selects a random sample of 50 meetings for person A and 60 meetings for person B. Describe the sampling distribution of $\hat{p}_1 - \hat{p}_2$.

Example 2: The weights of cupcakes at a local bakery have a mean of 115 grams and a standard deviation of 8 grams. The weights of donuts at the same bakery have a mean of 28 grams and a standard deviation of 12 grams. Two independent random samples of size 40 are chosen from the cupcakes and donuts. Describe the sampling distribution of $\bar{x}_1 - \bar{x}_2$.

	Two proportions	Two means
Parameter		
Statistic		
Shape		
Center		
Variability		

AP Exam Tips:

Video 6.1 One Sample Confidence Intervals

Example 1: At a local restaurant, a small order of French fries should weigh 6 oz. The restaurant owner is concerned that her employees are filling orders of French fries improperly. She would like to estimate the true mean weight of a small order of French fries, so she randomly selects 12 orders throughout the week and weighs them. The weights are given in the table (in ounces):

6.45	6.31	5.99	6.04	5.84	7.02
6.9	6.29	6.08	5.95	6.88	6.65

Construct and interpret a 95% confidence interval to estimate the true mean weight of a small order of French fries at this restaurant.

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Example 2: The city council is considering changing an old law that prohibits people from mowing their lawns after 9 pm. In order to determine if the people of the city would support this change, they randomly surveyed 50 people in the city. They find that 23 of the 50 people surveyed would support changing the law.

Construct and interpret a 90% confidence interval for the true proportion of people in the city who would support changing the law.

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Video 6.2 Two Sample Confidence Intervals

Example 1: A pharmaceutical company is testing a new medication for cholesterol. 100 volunteers with high cholesterol are randomly assigned to either take the new medication or the current medication the company sells. After 6 months of use, their cholesterol level will be tested to see if there is a difference in the proportion of people with reduced cholesterol. Thirty-nine of the 50 subjects taking the new medication had a reduction in cholesterol. Thirty-four of the 50 subjects taking the current medication had a reduction in cholesterol.

- (a) Construct and interpret a 95% confidence interval for the true difference in proportions of people like those in the study who would have reduced cholesterol after 6 months on their respective medication.

STATE:	DO:
PLAN:	CONCLUDE:

- (b) Does the company have convincing evidence that there is a difference in the proportion of people with reduced cholesterol?

Example 2: There is a rivalry between the AP calculus students and the AP statistics students at a large high school. They often argue about which group has the higher average SAT score. To settle the matter, they take random samples of 10 students from each course. The sample mean from the AP calculus group has a mean of 1320 with a standard deviation of 56, while the AP statistics group has a mean of 1352 with a standard deviation of 108. Both population distributions of scores can be assumed to be approximately Normal.

Construct and interpret a 99% confidence interval for the true difference in mean SAT scores between the AP calc students and the AP stats students.

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Video 7.1 One Sample Significance Tests

Example 1: Chicago style popcorn is a type of popcorn made by mixing together cheddar and caramel popcorn. True Chicago style popcorn is composed of at least 40% caramel popcorn. A new popcorn shop advertises that they will be selling Chicago style popcorn. To test this claim, a popcorn lover takes a random sample of 500 kernels of the popcorn and finds that 183 kernels are caramel. Do the data provide convincing evidence that the shop is not selling true Chicago style popcorn?

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Example 2: Last year, an AP stats class spent an average of 25 minutes a night on their homework. Their teacher randomly sampled 30 of her students this year to see if this average had gone up. The sample had a mean of 32 minutes spent on homework each night and a standard deviation of 11 minutes. Do the data provide convincing evidence that AP stats students spend more time on homework per night this year than last year?

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Video 7.2 Two Sample Significance Tests

Example 1: Two rival universities are both claiming that their graduates are more likely to gain employment within 3 months of graduation than those who graduate from the other school. A random sample of 500 recent graduates from College A revealed that 450 had employment within 3 months. A separate random sample of 400 recent graduates from College B showed that 342 had jobs. Do the data provide convincing evidence that there is a difference in the proportion of graduates who had employment within 3 months from College A and College B.

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Example 2: Last year, East Kentwood High School had 650 students take a geometry final exam. The school gave two forms of the exam, which were randomly assigned to the students. Half of the students took form A and the rest took form B. After the exam, some students claimed that form B was more difficult than form A. To test this claim, the principal took random samples of 30 exam scores from each form and recorded the score. The results are shown:

Form A	$n = 30$	$\bar{x} = 73.4$	$s_x = 12.9$
Form B	$n = 30$	$\bar{x} = 68.6$	$s_x = 15.4$

Do the data provide convincing evidence that the mean score on form A was higher than the mean score on form B using $\alpha = 0.01$?

STATE:	DO:
PLAN:	CONCLUDE:

AP Exam Tips:

Video 7.3 Difference of Means OR Mean of Differences?

Example: Two versions of the final exam.

Version A	90	82	76	88	99
Version B	83	77	79	80	81
Differences	7	5	-3	8	18

Scenario 1: Difference of Means

$$\bar{x}_A = 87 \quad s_A = 8.66$$

$$\bar{x}_B = 80 \quad s_B = 2.24 \quad \bar{x}_A - \bar{x}_B = 7$$

Scenario 2: Mean of Differences

$$\bar{x}_{diff} = 7 \quad s_{diff} = 7.52$$

AP Exam Tips:

Video 7.4 Chi-Square Tests

	GOODNESS OF FIT TEST	TEST OF HOMOGENEITY	TEST OF INDEPENDENCE
AP Exam Question			
Hypotheses			
Expected			
Degrees of freedom			
Chi-square formula			
P-value			

What is the same?

Draw flowchart here:

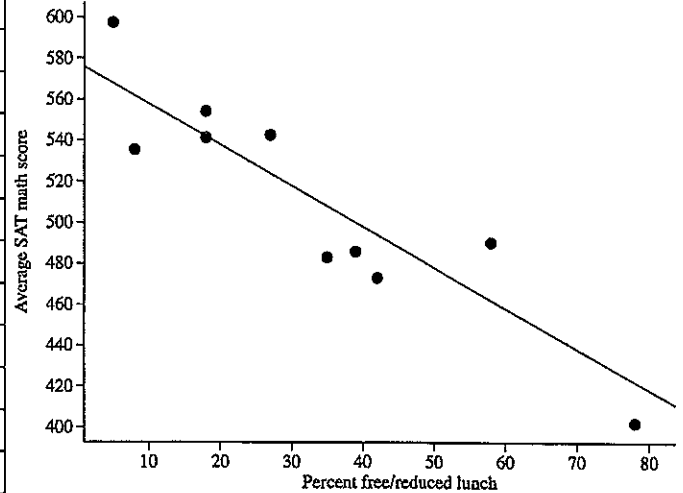
What is different?

AP Exam Tips:

Video 7.5 Inference for Linear Regression

Example: A random sample of 11 high schools was selected from Michigan. The percent of students who are free/reduced lunch and the mean SAT Math score of each high school in the sample were recorded. Here are the data:

	Percent free/reduced	Mean SAT Math
East Kentwood High School	58	490.4
Rockford High School	8	535.5
Caledonia High School	18	541.3
Cedar Springs High School	39	485.9
Muskegon High School	85	427.3
Comstock Park High School	42	473.2
Sparta High School	35	483.1
Lowell High School	27	542.7
Spring Lake High School	18	554.1
Ottawa Hills High	78	402.3
Northville High School	5	597.6



Regression Analysis: Mean SAT Math score (dollars) versus Percent free/reduced lunch				
Predictor	Coef	SE Coef	T	P
Constant	577.9	12.5	46.16	0.000
Percent free/reduced lunch	-1.993	0.276	-7.22	0.000
S = 23.3168		R-Sq = 85.29%		R-Sq(adj) = 83.66%

Line of best fit:

Linear regression t-interval for slope

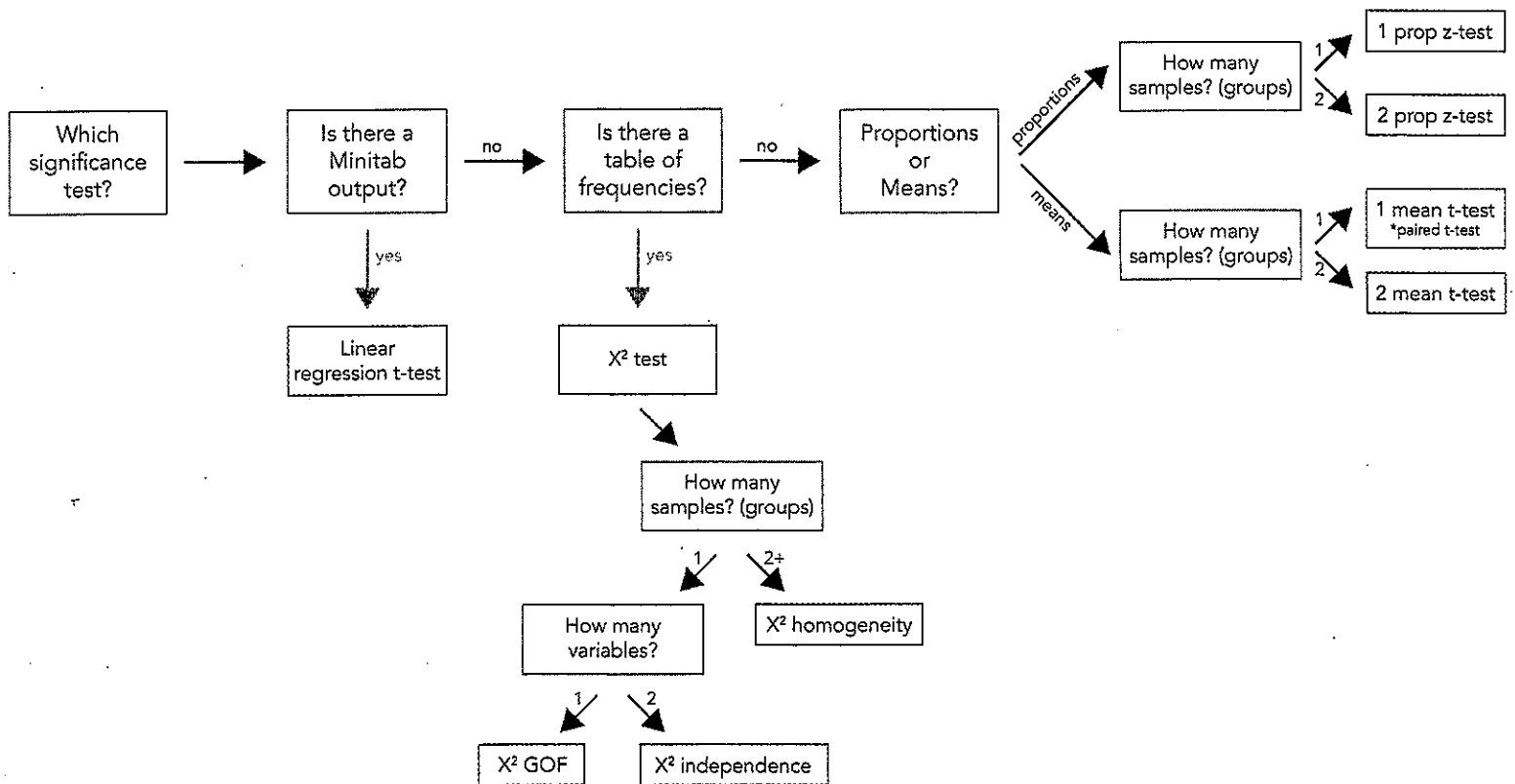
Linear regression t-test for slope

AP Exam Tips:

Name That Significance Test

How do I know which question is asking to do a significance test?

- (1)
- (2)
- (3)



Using Your Calculator on the AP Stats Exam

One Variable Data

Function	When to use it	Input Command
1-Var Stats (STAT, CALC)	To find mean, standard deviation, and 5 number summary for a set of data.	Enter data in L_1 and frequency in L_2 if needed 1-Var Stats L_1 or 1-Var Stats L_1, L_2

Two Variable Data

Function	When to use it	Input Command
LinReg ($a + bx$) (STAT, CALC)	To find the equation for a line of regression. Also gives correlation (r).	Enter explanatory variable in L_1 Enter response variable in L_2 LinReg ($a + bx$) L_1, L_2
2-Var Stats (STAT, CALC)	Same information as 1-Var Stats but for two sets of data.	Enter data in L_1 and L_2 2-Var Stats L_1, L_2

pdf and cdf

Function	When to use it	Input Command
binompdf (2 nd , VARS, DISTR)	To find the probability of getting <u>exactly</u> X successes.	binompdf(n, p, X) n : number of trials p : probability of success X : number of successes
binomcdf (2 nd , VARS, DISTR)	To find the probability of getting <u>at most</u> X successes.	binomcdf(n, p, X) n : number of trials p : probability of success X : number of successes
normalcdf (2 nd , VARS, DISTR)	To find area in an interval for a normal distribution.	normalcdf(lower, upper, mean, SD)
tcdf (2 nd , VARS, DISTR)	To find area in an interval for a t distribution.	tcdf(lower, upper, df)
χ^2 cdf (2 nd , VARS, DISTR)	To find area in an interval for a χ^2 distribution.	χ^2cdf(lower, upper, df)

Confidence Intervals

Function	When to use it	Input Command
1-PropZInt (STAT, TESTS, A:)	To calculate a confidence interval to estimate a <u>proportion</u> .	1-PropZInt x: number of successes n: sample size C-Level: confidence level (decimal)
TInterval (STAT, TESTS, 8:)	To calculate a confidence interval to estimate a <u>mean</u> .	TInterval Inpt: Stats \bar{x} : sample mean S_x : sample standard deviation n: sample size C-Level: confidence level (decimal)
2-PropZInt (STAT, TESTS, B:)	To calculate a confidence interval to estimate a <u>difference of proportions</u> .	2-PropZInt x1: number of successes in sample 1 n1: sample size in sample 1 x2: number of successes in sample 2 n2: sample size in sample 2 C-Level: confidence level (decimal)
2-SampTInt (STAT, TESTS, 0:)	To calculate a confidence interval to estimate a <u>difference of means</u> .	2-SampTInt Inpt: Stats \bar{x}_1 : sample mean of sample 1 S_{x1} : standard deviation of sample 1 n1: sample size of sample 1 \bar{x}_2 : sample mean of sample 2 S_{x2} : standard deviation of sample 2 n2: sample size of sample 2 C-Level: confidence level (decimal) Pooled: No
LinRegTInt (STAT, TESTS, G:) *only newer calculators have this command*	To calculate a confidence interval to estimate a <u>slope</u> .	LinRegTInt Enter explanatory variable in L_1 Enter response variable in L_2 Xlist: L_1 Ylist: L_2 Freq: 1 C-Level: confidence level (decimal)

Significance Tests

Function	When to use it	Input Command
1-PropZTest (STAT, TESTS, 5:)	To test a claim made about a <u>single proportion</u> .	1-PropZTest p_0 : null value x: number of successes n: sample size Prop: $\neq p_0 < p_0 > p_0$ (alternative)
T-Test (STAT, TESTS, 2:)	To test a claim made about a <u>single mean</u> (standard deviation of the population is unknown).	T-Test Inpt: Stats μ_0 : null value \bar{x} : sample mean S_x : sample standard deviation n: sample size μ : $\neq \mu_0 < \mu_0 > \mu_0$ (alternative)
2-PropZTest (STAT, TESTS, 6:)	To test a claim made about a <u>difference of proportions</u> .	2-PropZTest x1: number of successes sample 1 n1: sample size in sample 1 x2: number of successes sample 2 n2: sample size in sample 2 p1: $\neq p_2 < p_2 > p_2$ (alternative)
2-SampTTest (STAT, TESTS, 4:)	To test a claim made about a <u>difference of means</u> (standard deviation of the populations unknown).	2-SampTTest Inpt: Stats \bar{x}_1 : sample mean of sample 1 S_{x1} : standard deviation sample 1 n1: sample size of sample 1 \bar{x}_2 : sample mean of sample 2 S_{x2} : standard deviation sample 2 n2: sample size of sample 2 μ_1 : $\neq \mu_2 < \mu_2 > \mu_2$ (alternative) Pooled: No

Significance Tests - continued

Function	When to use it	Input Command
χ^2 -Test (STAT, TESTS, C:)	To test a claim made about the <u>distribution of a categorical variable</u> . <ul style="list-style-type: none"> • Chi square test of association • Chi square test of homogeneity 	χ^2 -Test Enter observed values in matrix A Observed: [A] Expected: [B] Expected values appear in matrix B
χ^2 GOF-Test (STAT, TESTS, D:) *only newer calculators have this command*	To test a claim made about the <u>distribution of a categorical variable</u> . <ul style="list-style-type: none"> • Chi square goodness-of-fit test 	χ^2 GOF-Test Enter observed values in L ₁ Enter expected values in L ₂ Observed: L ₁ Expected: L ₂ df: degrees of freedom
LinRegTTest (STAT, TESTS, E:)	To test a claim made about the <u>slope</u> of a population regression line.	LinRegTTest Enter explanatory variable in L ₁ Enter response variable in L ₂ Xlist: L ₁ Ylist: L ₂ Freq: 1 β : $\neq 0$ < 0 > 0 (alternative)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Know Your AP Stats Formula Sheet

Page 1

What categories of formulas appear on this page?

Important notes:

Page 2

What categories of formulas appear on this page?

Important notes:

How to CRUSH the AP Stats Free Response

Strategy #1: Know What to Expect

- 1-variable stats
- 2-variable stats
- Sampling methods or experimental design
- Probability
- Significance test
- Investigative Task

Strategy #2: Survive the Investigative Task

- 25% of free response grade
- New stuff!
- 4 to 5 parts
- Parts are scaffolded

Strategy #3: Have a Plan

- 90 minutes for 6 questions
- Take a practice test
- Two approaches:
 - 1 → 2 → 3 → 4 → 5 → 6
 - 1 → significance test → 6 → probability → others

Strategy #4: Get All Your Points!

- Don't leave any blank
- Make up an answer
- Always use context

How to Survive the Investigative Task

Know the Facts

-
-
-

Use These Strategies

-
-
-

2019 AP Statistics Exam FRQ #6

Write the highlighted text from each part.

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)

AP Exam Tips:

Top 10 AP Stats Exam Tips

- 1: Clearly communicate your understanding
- 2: Always include context in your answers
- 3: Be precise in your language and vocabulary
- 4: Use appropriate notation
- 5: Do not rely on your calculator
- 6: Manage your time
- 7: Do not leave anything blank
- 8: Know the formula sheet
- 9: Know your inference
- 10: Be confident!