

TOPIC: INFERENCES FOR SLOPE OF REGRESSION LINE

Hypothesis Test for Slope

◆ To run a hypothesis test for the slope of a regression line using a calculator, use the **F:LinRegTTest** function.

► If testing "no correlation", β ____ 0; "positive correlation", β ____ 0; "negative correlation", β ____ 0

EXAMPLE

An economics study looks at the relationship between advertising spending and product sales (in \$1,000s). The data is shown below. Test the claim that there is no linear relationship between ad spending and sales at $\alpha = 0.05$.

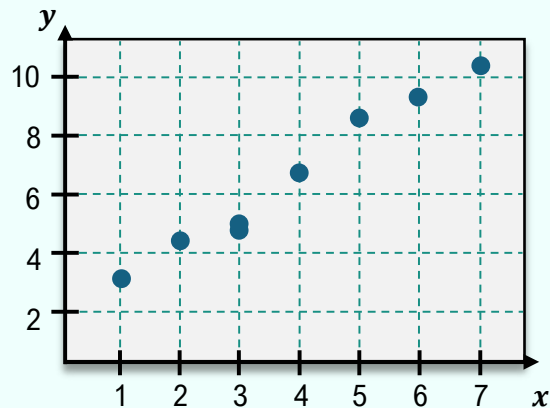
Ad Spending vs. Product Sales (in \$1,000s)								
Ad Spending	2	4	3	6	5	1	7	3
Product Sales	4.2	6.5	5.0	9.3	8.4	3.3	10.2	4.8

H_0 : _____

H_a : _____

P -value: _____

Because P -value [< | >] α ,
we [**REJECT** | **FAIL TO REJECT**] H_0 .
There is [**ENOUGH** | **NOT ENOUGH**]
evidence to suggest...



HOW TO: Hyp Test for Slope of LinReg

- 1) **STAT**, **1:Edit...**
Enter data in **L1** & **L2**
- 2) **STAT**, **>** **TESTS**
F:LinRegTTest
- 3) **Xlist:L1**
Ylist:L2
Freq:1
 β & p : $\neq 0$ < 0 > 0
Calculate

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PRACTICE

Using the sample data below, run a hypothesis test on β to see if there is evidence that there is a positive correlation between x and y with $\alpha = 0.01$.

Sample Data															
x	5	10	8	9	7	5	8	7	4	6	5	4	8	9	6
y	9	5	5	12	6	6	4	8	2	4	3	5	10	8	7



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- 1) **STAT**, **1:Edit...**
Enter data in L1 & L2
- 2) **STAT**, **>** **TESTS**
v **F:LinRegTTest**
- 3) **Xlist:L1**
Ylist:L2
Freq:1
 β & ρ : $\neq 0$ < 0 > 0
Calculate

EXAMPLE

A web designer is interested in whether the loading speed of a website (in seconds) is linearly correlated with the number of visits the website receives per minute, so they collect the data below.

Loading Speed vs Visits										
Speed	1.3	3.4	3.5	4.1	6.2	1.7	2.3	4.8	6.5	5.0
Visits	21	15	10	8	5	27	24	17	7	14

Perform a hypothesis test for β with a significance level of 0.1.

H_0 : _____ H_a : _____ P -value: _____

Because P -value [$<$ | $>$] α , we [**REJECT** | **FAIL TO REJECT**] H_0 . So there is [**ENOUGH** | **NOT ENOUGH**] evidence to suggest there is a _____ linear correlation between loading speed of and visits to a website.

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EXAMPLE

A shipping manager is interested whether increases in the shipping time for a package decreases the satisfaction of the customer, so they collect data on a sample of shipped packages to get the shipping time (in days) and customer satisfaction rating (out of 10) and get the data below:

Shipping Time vs Customer Satisfaction															
Sleep	6	10	8	11	4	13	5	7	9	10	6	2	8	9	6
RT	8	2	7	4	7	3	6	6	5	4	8	10	9	6	9

(A) Perform a hypothesis test for β with a significance level of 0.05.

H_0 : _____ H_a : _____ P -value: _____

Because P -value [< | >] α , we [**REJECT** | **FAIL TO REJECT**] H_0 . So there is [**ENOUGH** | **NOT ENOUGH**] evidence to suggest there is a _____ linear correlation between shipping time and customer satisfaction.

(B) If there is a negative correlation between shipping time and customer satisfaction, the manager will research more efficient shipping methods. Should they devote funds to research?



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- 1) **STAT**, **1:Edit...**
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- 2) **STAT**, **>** **TESTS**
F:LinRegTTest
- 3) **Xlist:L1**
Ylist:L2
Freq:1
 β & ρ : $\neq 0$ < 0 > 0
Calculate

EXAMPLE

A quality control expert is interested in seeing if servicing the machines in the plant more frequently will increase the productivity of each machine. They collect data on the number of times a machine is serviced per week and its daily productivity to get the data below:

Service Time vs Productivity										
Services	0	3	3	4	6	1	2	4	6	5
Productivity	20	33	25	20	24	21	27	34	30	32

(A) Find the regression line for the sample data.

(B) Perform a hypothesis test for β with a significance level of 0.05.

H_0 : _____ H_a : _____ P -value: _____

Because P -value [< | >] α , we [**REJECT** | **FAIL TO REJECT**] H_0 . So there is [**ENOUGH** | **NOT ENOUGH**] evidence to suggest there is a _____ linear correlation between number of services and productivity.

(C) The company wants to increase machine productivity. Do they have evidence that servicing their machines more often should help them achieve this goal?

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Confidence Interval for Slope

◆ To create a Confidence Int. for the slope of a regression line using a calculator, use the **G:LinRegTInt** function.

EXAMPLE

A school district is studying the relationship between hours teachers spend working on lesson plans and students' average test scores. The data is shown below. Construct a 95% confidence interval for the slope of the regression line. Does this suggest a linear relationship between hours & test scores?

Hours vs. Avg. Test Scores								
Hours	5	3	4	6	2	7	1	4
Test Scores	81	78	80	82	77	83	76	81

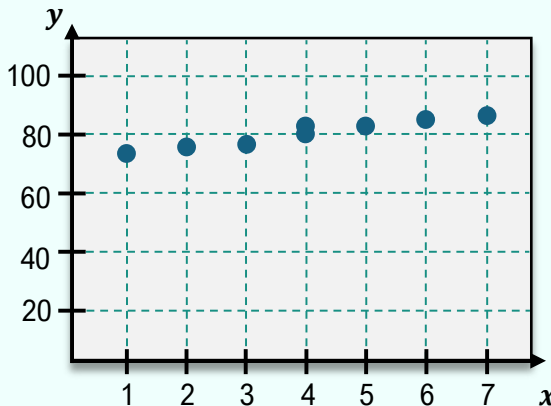
C-Level: _____

Confidence Interval: (_____ , _____)

We are ____% sure the slope of the reg. line is between ____ & ____.

This interval [**DOES | DOESN'T**] include 0.

There's [**ENOUGH | NOT ENOUGH**] evidence to suggest...



HOW TO: Cont. int. for Slope of LinReg

- 1) **STAT**, **1:Edit...**
Enter data in **L1** & **L2**
- 2) **STAT**, **>** **TESTS**
v **G:LinRegTInt**
- 3) **Xlist:L1**
Ylist:L2
Freq:1
C-Level:
Calculate

TOPIC: INFERENCES FOR SLOPE OF REGRESSION LINE

PRACTICE

Using the sample data below, create a confidence interval for β to see if there is evidence that there is a positive correlation between x and y with $\alpha = 0.01$.

Sample Data															
x	5	11	7	8	8	5	8	9	4	5	3	4	9	8	6
y	10	4	6	12	5	7	3	7	1	4	5	6	11	8	6



HOW TO: Cont. int. for Slope of LinReg

- 1) **STAT**, **1:Edit...**
Enter data in **L1** & **L2**
- 2) **STAT**, **>** **TESTS**
V **G:LinRegTInt**
- 3) **Xlist:L1**
Ylist:L2
Freq:1
C-Level:
Calculate

EXAMPLE

An advertising executive wonders if increasing the length of a television ad (in minutes) increases the sales (in thousands of USD) of a product. They collect the data below.

Ad Length vs Sales										
Length	35	43	21	28	34	41	38	35	29	31
Sales	2.1	6.3	1.9	2.6	3.1	6.2	5.5	4.8	3.7	4.1

- (A) Create a confidence interval for β with $\alpha = 0.1$.
- (B) If there is evidence that longer ads mean more sales, the ad exec will have his team produce longer ads. Should they create longer ads? Why or why not?

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EXAMPLE

An HR manager is interested in whether longer commute times decrease employee satisfaction, so they collect data on the commute time (in min) and employee satisfaction level (out of 10) of a random sample of employees.

Commute Time vs Employee Satisfaction												
Commute Time	15	24	32	46	16	21	33	17	53	27	34	44
ES Rating	8	7	6	4	9	7	5	8	3	7	6	5

- (A) Create a confidence interval for β with $\alpha = 0.1$.
- (B) Is there evidence that longer commute times lead to decreases in employee satisfaction, the company will enact a policy to allow employees to work remotely on Fridays. Will they be enacting the policy? How do you know?



HOW TO: Cont. int. for Slope of LinReg

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- 3) **Xlist:L1**
Ylist:L2
Freq:1
C-Level:
Calculate

EXAMPLE

A film critic is interested in whether the length of a movie (in hours) is associated with the score the film receives (out of 100), so they collect data on the movie length and score of a random sample of movies.

Movie Length vs Score										
Length	1.5	1.8	2.1	2.2	1.6	1.7	2.3	1.7	1.6	1.9
Score	87	65	74	90	88	76	63	86	69	72

- (A) Find the regression line for the sample data.
- (B) Create a confidence interval for β with $\alpha = 0.1$.
- (C) The film critic will do further research if there's evidence that movie length and score are linearly correlated. Should they do further research? Why or why not?