Statistics

Fall 2022

Lecture 14

Feb 19-8:47 AM

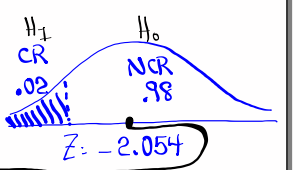
College claims that less than 45% of all students are in favor of face-to-face classes. → $p < .45$

In a sample of 625 students, 44% of them ($n = 625$, $\hat{p}$) were in favor of face-to-face classes.

use $\alpha = .02$ to test the claim. $x = n\hat{p} = 625(.44) = 275$

$H_0: p \geq .45$ CV Z LTT $\alpha = .02$

$H_1: p < .45$ claim, LTT



CTS $Z = -.503$
P-value $P = .308$
1-PropZTest
$P_0: .45$
$x = 275$
$n = 625$
Prop < P_0

$Z = \text{invNorm}(.02, 0, 1)$

CTS is in NCR ⇒ H_0 valid
P-value > α ⇒ H_1 invalid

Invalid claim ⇒ Reject the claim

Nov 29-6:50 PM

LA Times has reported that the mean age of all nurses in So. CAL. is 45 Yrs.

$H_0: \mu = 45$ claim

$H_1: \mu \neq 45$ TTT

In a Sample of 40 nurses, their mean age was 50 Yrs.

$n = 40$ $\bar{x} = 50$ $\sigma = 15$

It is also known that Standard deviation of ages of all nurses in So. CAL. is 15 Yrs.

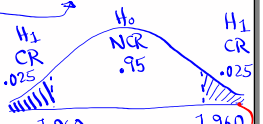
Determine the validity of LA times report.

NO α $\Rightarrow$ use .05

CV Z TTT $\alpha = .05$

Since σ Known

Z-Test



CTS $Z = 2.108$

P-value $P = .035$

$Z = \text{invNorm}(.975, 0, 1)$

$\mu_0 = 45$

$\sigma = 15$

$\bar{x} = 50$

$n = 40$

$\mu \neq \mu_0$

CTS is in CR $\Rightarrow$ H_0 invalid

P-value $\leq \alpha \Rightarrow$ H_1 valid

Invalid claim $\Rightarrow$ Reject the claim

If we change α to .01, .02, or .03 then

P-value $> \alpha \Rightarrow H_0$ valid $\Rightarrow$ Valid claim

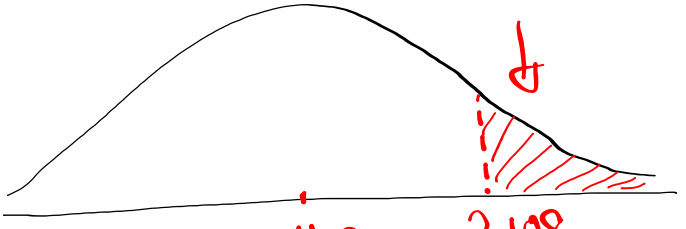
.035 FTR the claim

Nov 29-6:59 PM

Given CTS $Z = 2.108$, TTT

Find P-value.

P-value = Area * 2

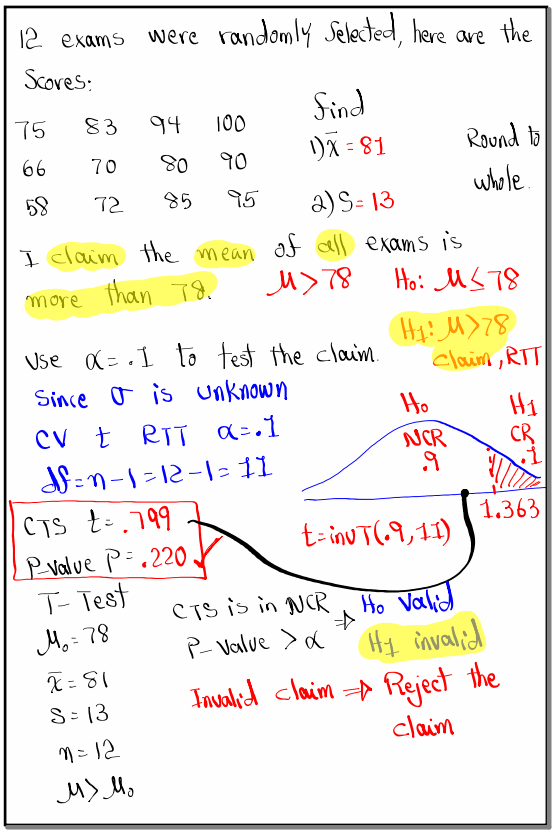


$\sigma = 1$

P-value = 2 * normalcdf(2.108, E99, 0, 1)

= .035

Nov 29-7:10 PM



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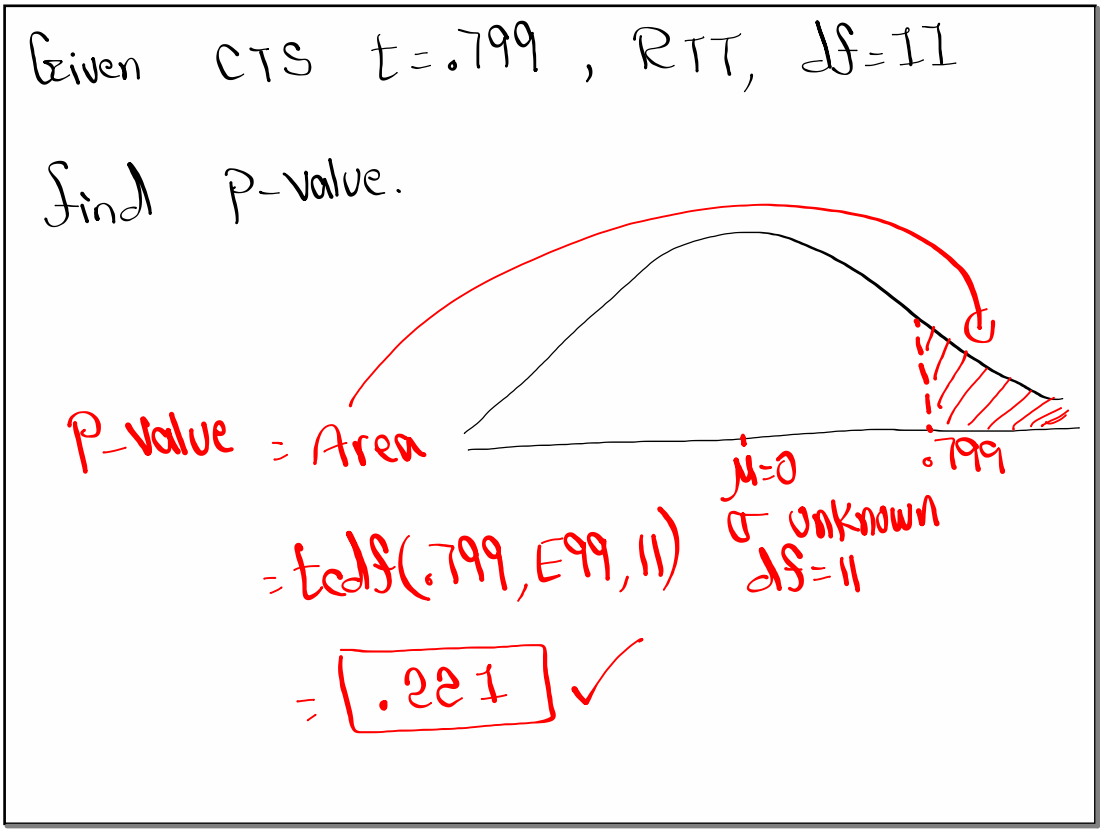


Nov 29-7:24 PM

Testing one population Standard deviation σ:

$H_0: \sigma = \sigma_0$ | $H_0: \sigma \leq \sigma_0$ | $H_0: \sigma \geq \sigma_0$

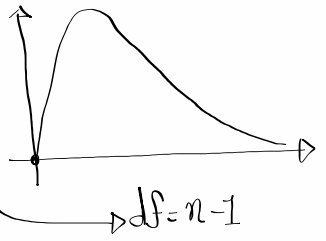
$H_1: \sigma \neq \sigma_0$ | $H_1: \sigma > \sigma_0$ | $H_1: \sigma < \sigma_0$

TTT | RTT | LTT

Always identify the claim & Type of testing

Use p-value Method only

CTS $\chi^2 = \dfrac{(n-1)\cdot s^2}{\sigma^2}$



use χ^2cdf(L, U, df) to find p-value.

df = n-1

Proceed with testing chart

Final Conclusion must be about the claim

Nov 29-7:27 PM

Given: $n = 10$, $s = 22$, $H_0: \sigma \leq 20$

claim is H_0, $\alpha = .04$

Test the claim.

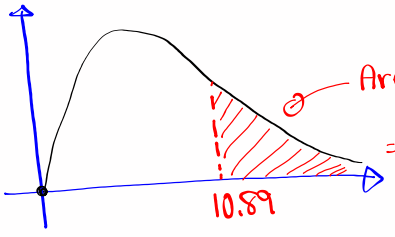
CTS $\chi^2 = \dfrac{(n-1)\cdot s^2}{\sigma^2}$

$H_0: \sigma \leq 20$ claim

$H_1: \sigma > 20$ RTT

$\chi^2 = \dfrac{(10-1)\cdot 22^2}{20^2}$

$= 10.89$



Area = P-value

$= \chi^2$cdf(10.89, E99, 9)

$= .283$

P-value $>$ α $\Rightarrow$ H_0 Valid → valid claim

.283 > .04

H_1 invalid

FTR the claim

Nov 29-7:32 PM

College claims that standard deviation of ages of all students is at least 10 Yrs.

$H_0: \sigma \geq 10$ claim

$H_1: \sigma < 10$ LTT

I randomly selected 20 students, and standard deviation of their ages was 8.5 Yrs

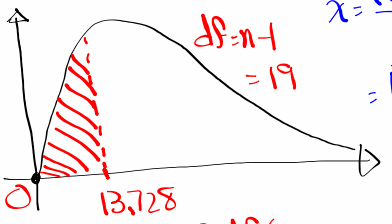
$n=20$ $S=8.5$

Test the claim.

No $\alpha \Rightarrow .05$

CTS $\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2} = \frac{(20-1)\cdot 8.5^2}{10^2}$

$= 13.728$



P-Value $= \chi^2 cdf(0, 13.728, 19) = .201$

P-Value $> \alpha$ $\Rightarrow$ H_0 Valid $\rightarrow$ Valid claim

.201 .05 H_1 invalid FTR the claim

Nov 29-7:38 PM

Dept. of health Services claims that standard deviation of Salaries of all nurses is $400. Per month.

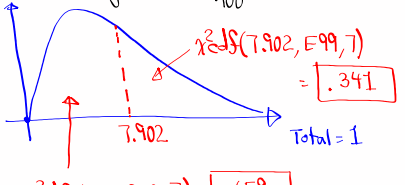
$H_0: \sigma = 400$ claim

$H_1: \sigma \neq 400$ TTT

I took a Sample of 8 nurses Stand. dev. of their Salaries was $425 per month.

Use $\alpha = .01$ to test the claim. $n=8$ $S=425$

CTS $\chi^2 = \frac{(n-1)\cdot S^2}{\sigma^2} = \frac{(8-1)\cdot 425^2}{400^2} = 7.902$



$\chi^2 cdf(0, 7.902, 7) = .659$

P-Value = 2 * Smaller area

$= 2(.341) = .682$

P-Value $> \alpha$ H_0 Valid $\rightarrow$ Valid claim

.682 .01 H_1 invalid FTR the claim

Sec 26 & 27

Nov 29-7:46 PM

SG 31

Comparing Two Population Standard Deviations:

σ_1 & σ_2

Sample 1	Sample 2
$n_1=$	$n_2=$
$s_1=$	s_2

$s_1 > s_2$

$Ndf = n_1 - 1$

$Ddf = n_2 - 1$

$H_0: \sigma_1 = \sigma_2$
$H_1: \sigma_1 \neq \sigma_2$
TTT

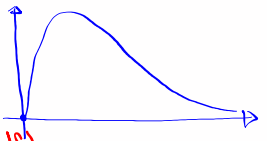
$H_0: \sigma_1 \leq \sigma_2$
$H_1: \sigma_1 > \sigma_2$
RTT

$H_0: \sigma_1 \geq \sigma_2$
$H_1: \sigma_1 < \sigma_2$
LTT

CTS $F = \frac{s_1^2}{s_2^2}$

Use Fcdf to find P-value

Fcdf(L, U, Ndf, Ddf)



F-Dist.

We can also use 2-SampFTest for CTS & P-value

Proceed with testing chart (P-value method)

Final conclusion about the claim

Reject the claim OR FTR the claim

Nov 29-8:12 PM

Use the chart below

Sample 1	Sample 2
$n_1 = 8$	$n_2 = 10$
$s_1 = 12$	$s_2 = 10$

1) Verify that $s_1 > s_2$. ✓

2) $Ndf = n_1 - 1 = 7$
$Ddf = n_2 - 1 = 9$

3) Use $\alpha = .1$ to test the claim that $\sigma_1 = \sigma_2$.

$H_0: \sigma_1 = \sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

STAT TESTS D

CTS $F = \frac{s_1^2}{s_2^2} = \frac{12^2}{10^2}$

CTS F = 1.44
P-Value P = .597

2-SampFTest
Stats
Inpt:
$s_1 = 12$
$n_1 = 8$
$s_2 = 10$
$n_2 = 10$
$\sigma_1 \neq \sigma_2$

P-Value > α
.597 .1

H_0 valid → Valid claim

H_1 invalid

FTR the claim

Nov 29-8:20 PM

10 Female students had stand. dev. of 8 for their ages. $n=10$, $S=8$

12 Male students " " " = 5 for their ages. $n=12$, $S=5$

Females	Males
$n_1=10$, $Ndf=9$, $S_1=8$	$n_2=12$, $Ddf=11$, $S=5$

$S_1 > S_2$

Test the claim that there is a difference between two Pop. standard deviations.

No α → use .05

$H_0: \sigma_1 = \sigma_2$

$H_1: \sigma_1 \neq \sigma_2$ claim, TTT

CTS $F = 2.56$

P-value $P = .144$

CTS $F = \frac{S_1^2}{S_2^2} = \frac{8^2}{5^2} = 2.56$

P-value $>$ α

.144 > .05

2-SampFTest

Stat TESTS

H_0 valid, H_1 invalid

Invalid claim

Reject the claim

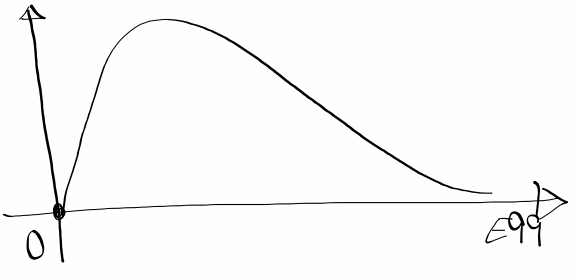
Nov 29-8:27 PM

F-dist

1) Graph is Similar to χ^2-dist
   Starts at 0, Skewed to the right,
   Not Symmetric, Total Area = 1

2) Numerator df → Ndf
   Denominator df → Ddf

3) Use Fcdf(L, U, Ndf, Ddf)



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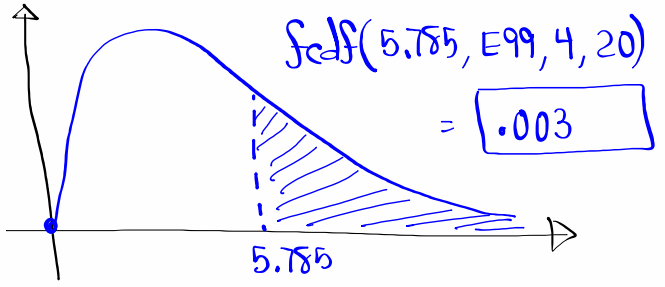
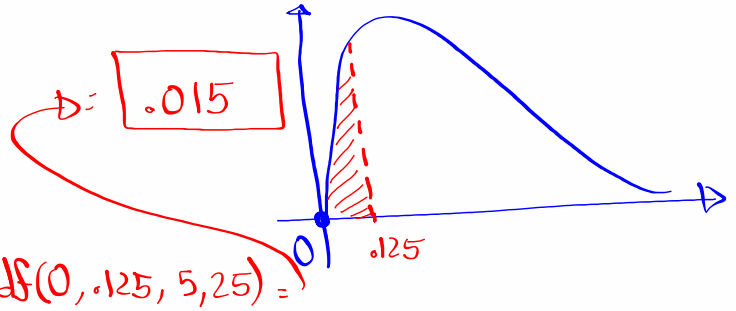
Find $P(F > 5.785)$ with Ndf=4, Ddf=20.



Find $P(F < .125)$ with Ndf=5, Ddf=25



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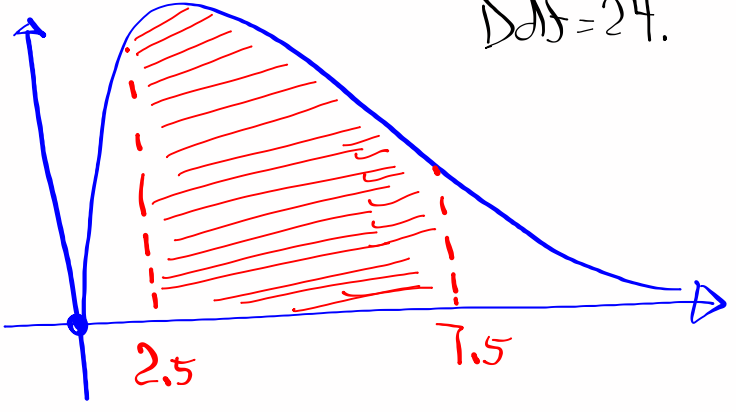
Find $P(2.5 < F < 7.5)$ with Ndf=3, Ddf=24.



fcdf (2.5, 7.5, 3, 24) = .083

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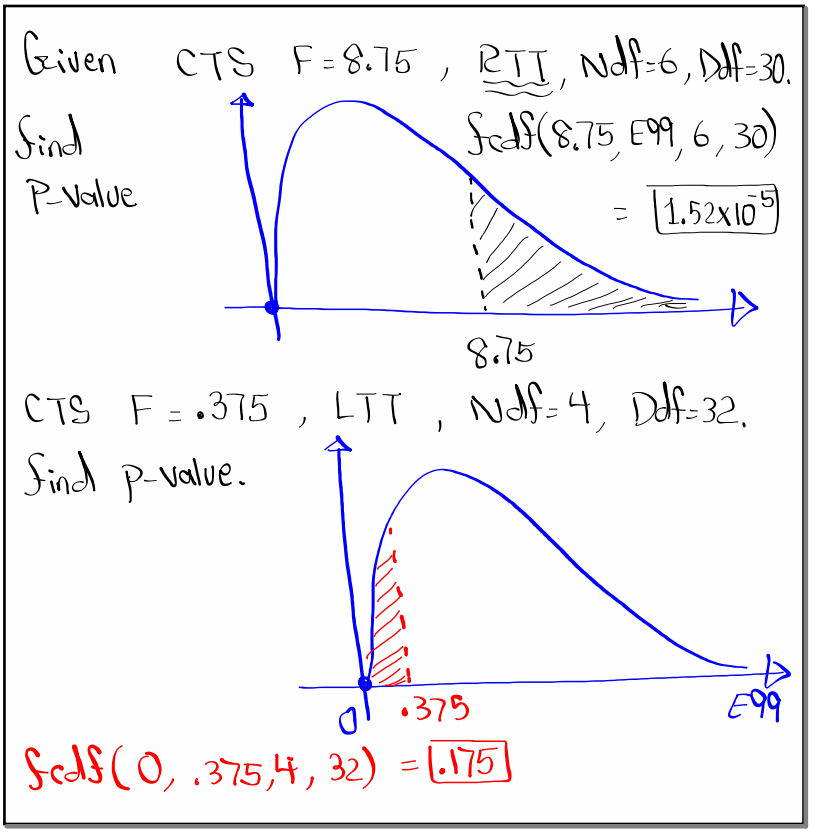

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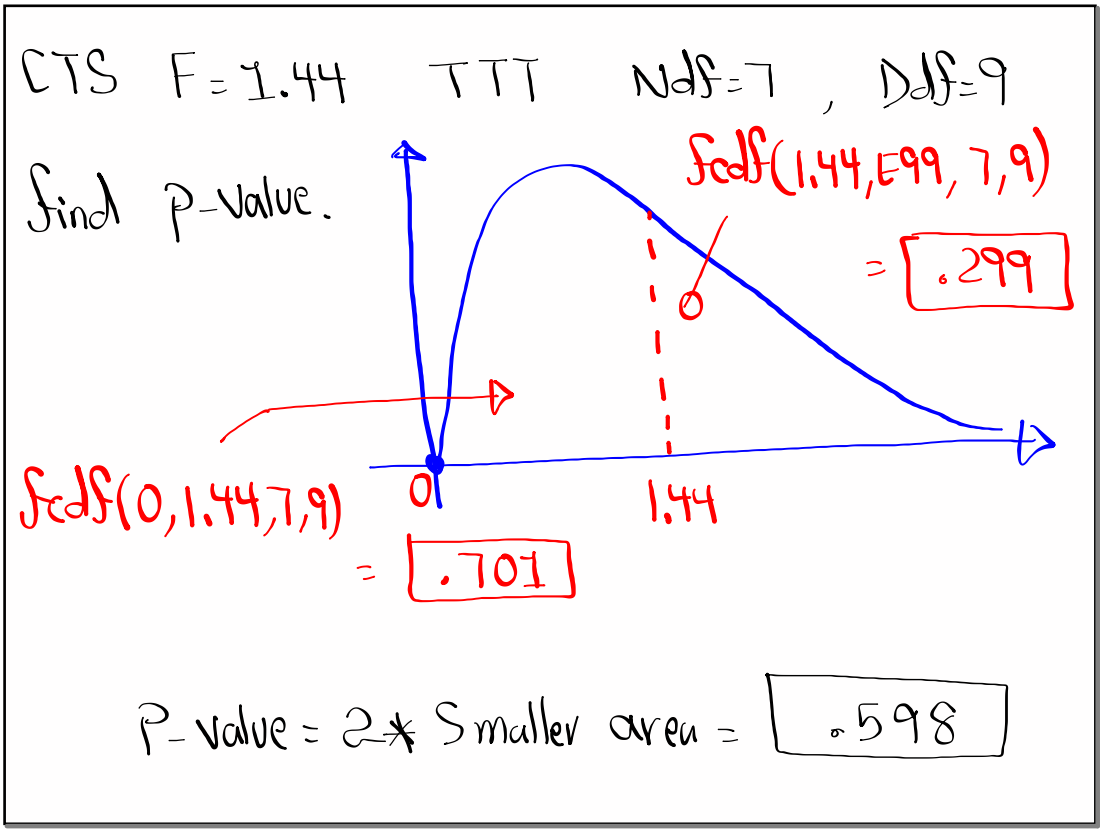


Nov 29-8:50 PM

Morning class	Evening class
72 85 90	70 86 94
65 100 80	69 100
$\bar{x}=82$	$\bar{x}=84$
$s=13$	$s=14$
$n=6$	$n=5$

Round to whole #

Test the claim that $\sigma_1=\sigma_2$. No α use .05

Sample 1	Sample 2
$n_1=5$	$n_2=6$
$s_1=14$	$s_1=13$

$H_0: \sigma_1=\sigma_2$ claim

$H_1: \sigma_1 \neq \sigma_2$ TTT

$Ndf=n_1-1=4$

$Ddf=n_2-1=5$

CTS $F=1.160$

P-value $P=.854$ ✓

2-SampF Test

P-value > α

.854 .05

H_0 is valid

H_1 is invalid

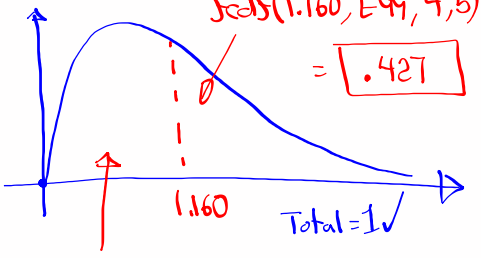
Valid claim

FTR the claim

Nov 29-8:54 PM

Given CTS $F=1.160$, $Ndf=4$, $Ddf=5$

TTT Find P-value.



$Fcdf(1.160, E99, 4, 5) = .427$

$Fcdf(0, 1.160, 4, 5) = .573$

P-value = 2 * Smaller area

$= 2(.427) = .854$

Final Exam in 2 weeks.
Start Your Preparation.

SG 31 ✓

Nov 29-9:01 PM