Calculus

Date:

Items Needed: .Book,.

Objective: The students will be able to work with the natural log function, e, and find the derivative of the Natural Log Function.

Lesson:

- Remember with the general power rule we could use it for everything except for the function 1/x.
- In this section we will use the Second Fundamental Theorem of Calculus to define such a function. This function is considered to be a logarithmic function.
- The natural logarithmic function is defined by $\ln x = \int_1^x \frac{1}{t} dt$, x>0.
- $\frac{d}{dx} \ln x = \frac{d}{dx} \int_1^x \frac{1}{t} dt = \frac{1}{x}$. Derivative of the *ln x* is 1/x.
- Take the integral of $\int_1^x \frac{1}{t} dt$ and you get $\frac{-1}{x} + 1$ and put the values in and refer to figure 5.1 p. 324.
- Take a look at the slope field that is generated by all the equations of slope 1/x. The graph of the lnx is the equation that goes through point (1,0).
- Look at all of the properties of the Natural Logarithmic Function. p. 325

- Remember the logarithmic properties.
  1. ln(1)=0
  2. ln(ab)=ln a + ln b
  3. ln a^n=n ln a
  4. ln(a/b)=ln a – ln b

- Do example 1 b, c, d
- Point out that to rewrite a function using logs you must make sure that the domain stays the same. Have the students graph $f(x) = \ln x^2$ and then graph $f(x) = 2 \ln x$. Are the domains the same?

- Talk about how e was discovered using the reference to the book on p. 327. There has to be some value that lnx=1. Look at figure 5.6 and the definition of e.
- Therefore if $x=e^n$ then ln x = n.

- Define the derivative of the natural log.

1. $\frac{d}{dx}\left[\ln x\right] = \frac{1}{x}$
2. $\frac{d}{dx}\left[\ln u\right] = \frac{u'}{u}$

- Do example 3
- Do number 54, p. 332, refer to manual.
- Rewriting functions using logs are helpful. Look at example 4 & 5.
- Do number 65, p. 332.

- As long as u doesn't equal 0 you can find the derivative of an absolute value logarithmic function.
- $\frac{d}{dx}\left[\ln|u|\right] = \frac{u'}{u}$
- Look at example 7.

- Remember how you find relative extrema? Do you remember what relative extrema are?
- Look at how you find the information and refer back to it.
- Do example 8.

Assignment: . Have students do 20, 21, 24, 27, 30, 33, 35, p. 331.
Have students do 43, 50, 55, 58, 61, 63, 69, 72, 76 p. 332
Have students do 87, 88, 91, 93, 115, 118, 120 (Capstone), p. 332

Evaluation: (Could be from any one/several of the following)
Responses from classroom questions
Results of classroom sample problems
Homework responses
Check answer with Calculator
End of the section exam

Enrichment: