7-6 Natural Logs

The function $y = e^x$ has an inverse, the **natural logarithmic function**, $y = \log_e x$, or $y = \ln x$.

Same conversion rule:

Don't overcomplicate this!!!

$e^b = a$ <----------> $\ln a = b$

think of it as base e!

Same properties:

Product: ln a + ln b = ln ab

Quotient: ln a - ln b = ln a/b

Power: p ln a = ln a^p

Feb 29-7:57 AM

1. What is each expression written as a single natural logarithm?

a. $\ln 7 - 2\ln 5$

$\ln 7 - \ln 25$

$\ln \frac{7}{25}$

b. $3\ln x + 2\ln y + \ln 5$

$\ln x^3 + \ln y^2 + \ln 5$

$\ln 5x^3y^2$

Feb 29-8:05 AM

2. What are the solutions of each equation?

a. $\ln_e x = 2$

$e^2 = x$

calc.

$7.3891 = x$

b. $\ln 2x + \ln 3 = 2$

$\ln 2x \cdot 3 = 2$

$\ln_e 6x = 2$

$e^2 = 6x$

$x \approx 1.2315$

Feb 29-8:07 AM

3. What is the solution of $e^{x-2} = 12$?

Key Fact!!!

$\ln e = 1$

$\ln e^{x-2} = \ln 12$

$(x-2) \cdot \ln e = \ln 12$

$x - 2 = \ln(12)$

$+2 \quad +2$

$x \approx 4.4849$

Feb 29-8:12 AM

4. What is the solution of $4e^{2x} + 2 = 16$?

$-2 \quad -2$

$\frac{4 \cdot e^{2x}}{4} = \frac{14}{4}$

$e^{2x} = 3.5$

$\ln e^{2x} = \ln(3.5)$

$2x = \ln(3.5)$

$x = \frac{\ln(3.5)}{2}$

$x \approx 0.6264$

Feb 29-8:14 AM

Word Problem:

An initial investment of $350 is worth $420 after six years of continuos compounding. Find the annual interest rate.

Use: $y = Pe^{rt}$

What do we know?

$P = 350$

$y = 420$

$t = 6$

$\frac{420}{350} = \frac{350 \cdot e^{6r}}{350}$

$1.2 = e^{6r}$

$\ln(1.2) = \ln e^{6r}$

$\frac{\ln(1.2)}{6} = r$

$r \approx 0.030386\ldots$

$\times 100$

$r = 3.04\%$

Feb 29-8:14 AM

Homework:

P. 481:

#'s: 11-37 odds, 53, 60, 61, 66

Feb 29-8:18 AM

11. ln 125 **13.** ln 4 **53.** ≈301 days

15. $\ln \frac{\sqrt[3]{xy}}{z^4}$ **60.** 27,347.9

61. 78.342

66. 5.78

17. ln 40,960

19. ln 1

21. 0.135

23. ±11.588

25. ±2.241

27. 1488.979

29. ≈2.890

31. ≈1.242

33. ≈2.401

35. 0

37. ≈2.2

7-6

ANS to HW:

p. 481

#'s

11-37 odds,

53, 60, 61, 66

Mar 1-11:31 AM