Use Functions Involving e

important like 0, 1, π, i

e is a mathematical constant $e \approx 2.71828\ldots$

Irrational, like π. Named for Euler. 1707-1783 Swiss

AKA "Napier's constant" – X Files episode "Paperclip" code to access mining facility where all our DNA is kept

Ex 1: Simplify expressions with e.

A. $e^{-2} \cdot e^{11}$ e^9

B. $(2e^{-3})^{-4}$ $2^{-4}e^{12} = \frac{e^{12}}{16}$

C. $\sqrt{9e^4} \cdot 2e^{-3}$ $3e^2 \cdot 2e^{-3} = 6e^{-1} = \frac{6}{e}$

D. $\frac{e^3}{e^{x+3}}$ $= e^{3-(x+3)} = e^{-x} = \frac{1}{e^x}$ or $\left(\frac{1}{e}\right)^x$

Ex 2: Use a calculator to evaluate each expression. Round to the nearest thousandth.

A. $e^{-\frac{3}{4}}$ $\approx .472$

B. $5e^{7.2}$ .001 ≈ 6697.154

Ex 3: Scientists used traps to study the Formosan subterranean termite population in New Orleans. The mean number y of termites collected annually can be modeled by the equation $y = 738e^{0.345t}$, where t is the number of years since 1989. What was the mean number of termites collected in 1999?

$t = 10$

$y = 738e^{.345(10)}$ 2.3247 $\approx$ ~~31381~~ termites were collected in 1999.

Ex 4: $$$MONEY$$$

Formulas:

$A = P\left(1 + \frac{r}{n}\right)^{nt}$

$A = Pe^{rt}$ → continuously compounded interest

A. You deposit $500 in an account earning 1.25% annual interest. Find the amount in the bank after 20 years if the money is compounded: $r = .0125$

- yearly

$500\left(1 + \frac{.0125}{1}\right)^{20} \approx \$641.02$

- monthly

$500\left(1 + \frac{.0125}{12}\right)^{12 \cdot 20} \approx \$641.93$

- daily

$500\left(1 + \frac{.0125}{365}\right)^{365 \cdot 20} \approx \$642.01$

- continuously

$500e^{.0125(20)} \approx \$642.01$ same, but slightly higher

B. Which is better? You deposit $100000 in an account:

- 2.5% interest compounded semiannually for 100 years

$100{,}000\left(1 + \frac{.025}{2}\right)^{2 \cdot 100} \approx \$1{,}199{,}516.92$

- 2.5% interest compounded continuously for 99 years

$100{,}000e^{.025(99)} \approx \$1{,}188{,}170.71$ 100yrs continuous $\approx \$1{,}218{,}249.40$

C. You have just inherited $24735.23 from a long lost relative. If the money was deposited in an account earning 1.75% annual interest, compounded continuously, and was in the account for 39 years, how much money was originally deposited?

$24{,}735.23 = Pe^{.0175(39)}$

P ≈ $12,5000 so maybe $12,500.00?