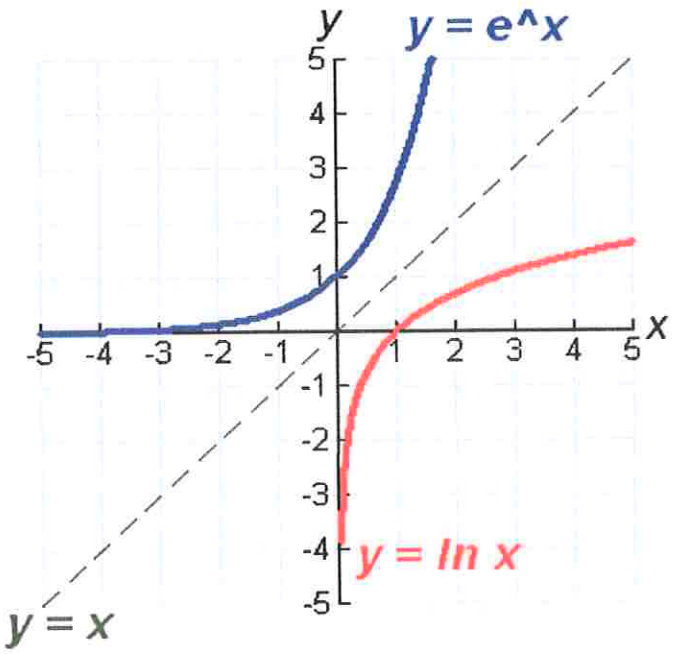
CALCULUS 12

DERIVATIVES OF EXPONENTIAL AND LOGARITHMIC FUNCTIONS



$$\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^{x} = e$$

e = 2.71828

$$\lim_{h\to 0}\frac{e^{h}-1}{h} = 1$$

$$\frac{d}{dx}(e^{x}) = e^{x}$$

$$\frac{d}{dx}(a^{u}) = a^{u}\cdot \ln a\cdot\frac{du}{dx} \qquad \text{For } a > 0 \text{ and } a \neq 1$$

Example 1: Find $\frac{dy}{dx}$ of $y = e^{(x^3-5x)}$

Example 2: Find $\frac{dy}{dx}$ of $y = 4^{(x^3-5x)}$

$$\frac{dy}{dx}\ln u = \frac{1}{u}\cdot\frac{du}{dx}$$

Example 3: Find $\frac{dy}{dx}$ of $y = \ln(x + 8x^3)$

$$\frac{dy}{dx}\log_a u = \frac{1}{u\ln a}\cdot\frac{du}{dx} \qquad \text{For a} > 0 \text{ and a} \neq 1$$

Example 4: Find $\frac{dy}{dx}$ of $y = \log_4(x^2 + \sqrt{x})$

POWER RULE FOR ARBITRARY REAL POWERS

If u is a differentiable function of x and n is any real number, then u^n is a differentiable function of x, and

$$\frac{d}{dx}(u^n) = n \cdot u^{n-1} \cdot \frac{du}{dx}$$

Example 5: Find $\frac{dy}{dx}$ of $y = x^{\sqrt{3}}$

Example 6: Find $\frac{dy}{dx}$ of $y = (2x - x^3)^e$

LOGARITHMIC DIFFERENTIATION

Example 7: Find dy/dx for $y = x^x$ for x > 0.

Example 8: Find dy/dx for $y = x^{2x+1}$ for x > 0.

HW: textbook p 178-179 Do at least the first 30 questions and the Standardized Test Questions