

October 5, 2026

National Do Something Nice Day

Today in History:

First James Bond Movie (Dr. No) opens (1962)

Steve Jobs dies (2011)

Number of the Day: 793

$787 = 13 \times 61$

793 is one less than twice its reversal: $793 = 2(397) - 1$.

Fun Fact:

In Tennessee, it is illegal to shoot any game other than whales from a moving automobile.

Quote of the Day:

"One of the great things about books is sometimes there are some fantastic pictures."

- George W. Bush

Today's Weather:

Abundant sunshine. High 61°

Math 121

Quiz #21

Find $f'(x)$ for

$$f(x) = [\arcsin(e^x)]^3$$

$$f'(x) = 3 (\arcsin(e^x))^2 \frac{1}{\sqrt{1-(e^x)^2}} e^x$$

$$y = e^x$$

$$\frac{dy}{dx} = e^x$$

$$e^y = \ln x$$

$$\frac{d}{dx} [e^y = x]$$

$$e^y \frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = \frac{1}{e^y} = \frac{1}{x}$$

$$y = \ln x$$

$$\frac{dy}{dx} = \frac{1}{x}$$

$$y = \ln(\text{optimus})$$

$$\frac{dy}{dx} = \frac{\text{optimus prime}}{\text{optimus}}$$

$$y = \ln(3x^4 + 2x + 3)$$

$$\frac{dy}{dx} = \frac{12x^3 + 2}{3x^4 + 2x + 3}$$

$$y = x^2 \ln x$$

$$\frac{dy}{dx} = x^2 \left(\frac{1}{x}\right) + 2x \ln x$$

$$y = \ln(x^2) = 2 \ln x$$

$$\frac{dy}{dx} = \frac{\cancel{2x}}{x^{\cancel{2}}} = \frac{2}{x}$$

$$\frac{dy}{dx} = 2 \left(\frac{1}{x}\right) = \frac{2}{x}$$

$$\underline{\underline{y = b^x}}$$

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{b^{x+h} - b^x}{h}$$

$$= \lim_{h \rightarrow 0} \frac{b^x (b^h - 1)}{h} = \underline{b^x} \lim_{h \rightarrow 0} \frac{b^h - 1}{h}$$


$$\ln(y = \underline{\underline{b^x}})$$

$$\frac{d}{dx} (\ln y = \ln b^x = \underline{x \ln b})$$

$$\frac{1}{y} \frac{dy}{dx} = \ln b$$

$$\frac{dy}{dx} = y \ln b$$

$$\frac{dy}{dx} = b^x \ln b$$

$$y = b^{\text{JUNK}}$$

$$\frac{dy}{dx} = b^{\text{JUNK}} \ln b \cdot \text{JUNK}'$$

EXAMPLE

$$y = 3^x$$

$$\frac{dy}{dx} = 3^x \ln 3$$

$$y = 4^{5x}$$

$$\frac{dy}{dx} = 4^{5x} \ln 4 (5)$$

$$y = 5^{\sin x}$$

$$\frac{dy}{dx} = 5^{\sin x} \ln 5 (\cos x)$$

$$\underline{y = \text{LOG}_b x} \iff \frac{d}{dx} (\underline{b^y = x})$$

$$b^y \ln b \frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = \frac{1}{b^y \ln b} = \frac{1}{x \ln b}$$

LOG RHYTHMIC DIFF.

EXAMPLE

$$f(x) = \ln \left[\frac{(3x^4 + 5x + 6)^3 (2x + 1)^6}{\sqrt{5x + \cos x}} \right]$$

$$f(x) = 3 \ln(3x^4 + 5x + 6) + 6 \ln(2x + 1) - \frac{1}{2} \ln(5x + \cos x)$$

$$f'(x) = 3 \frac{12x^3 + 5}{3x^4 + 5x + 6} + 6 \frac{2}{2x + 1} - \frac{1}{2} \frac{5 - \sin x}{5x + \cos x}$$

$$\ln f(x) = \ln \frac{(3x^3 + 2x)^4 (5x + 7)^3}{(e^x + \sin x)^5}$$

$$\ln f(x) = 4 \ln(3x^3 + 2x) + 3 \ln(5x + 7) - 5 \ln(e^x + \sin x)$$

$$\frac{1}{f(x)} \cdot \underline{f'(x)} = 4 \frac{9x^2 + 2}{3x^3 + 2x} + 3 \frac{5}{5x + 7} - 5 \frac{e^x + \cos x}{e^x + \sin x}$$

$$f'(x) = f(x) \left[4 \frac{9x^2 + 2}{3x^3 + 2x} + 3 \frac{5}{5x + 7} - 5 \frac{e^x + \cos x}{e^x + \sin x} \right]$$

$$f'(x) = \frac{(3x^3 + 2x)^4 (5x + 7)^3}{(e^x + \sin x)^5} \left(4 \frac{9x^2 + 2}{3x^3 + 2x} + 3 \frac{5}{5x + 7} - 5 \frac{e^x + \cos x}{e^x + \sin x} \right)$$

$$f(x) = x^x$$

$$\frac{d}{dx} (\ln f(x) = \ln(x^x) = \underline{x \ln x})$$

$$\frac{1}{f(x)} \cdot f'(x) = x \left(\frac{1}{x}\right) + \ln x$$

$$f'(x) = f(x) [1 + \ln x]$$

$$f'(x) = x^x [1 + \ln x]$$

$$f(x) = (\sin x)^x$$

$$\frac{d}{dx} (\ln f(x) = \ln(\sin x)^x = \underline{x \ln \sin x})$$

$$\frac{1}{f(x)} \cdot f'(x) = x \frac{\cos x}{\sin x} + \ln \sin x$$

$$f'(x) = (\sin x)^x \left(x \frac{\cos x}{\sin x} + \ln \sin x \right)$$

RECAP

$$\frac{f(x)}{e^x}$$

$$e^x$$

$$\ln x$$

$$b^x$$

$$\log_b x$$

$$\frac{f'(x)}{e^x}$$

$$e^x$$

$$\frac{1}{x}$$

$$b^x \ln b$$

$$\frac{1}{x \ln b}$$

$$\boxed{f(x)^{g(x)}}$$

FUNCTION FUNCTION

you must use LOG. DIFF.

$$e^{\text{JUNK}}$$

$$e^{\text{JUNK}} \cdot \text{JUNK}'$$

$$\ln(\text{JUNK})$$

$$\frac{1}{\text{JUNK}} \cdot \text{JUNK}'$$

$$b^{\text{JUNK}}$$

$$b^{\text{JUNK}} \ln b \cdot \text{JUNK}'$$

$$\log_b(\text{JUNK})$$

$$\frac{1}{\text{JUNK} \ln b} \cdot \text{JUNK}'$$