

Math 026L.01 Spring 2000
Differentiation Gateway Solutions

1. $\frac{d}{dx} (x^\pi - \pi^x + e^x - e^\pi) = \pi x^{\pi-1} - (\ln \pi)\pi^x + e^x$

2. $\frac{d}{dx} \left(\frac{x + \sqrt{x}}{e^x - x} \right) = \frac{(e^x - x) \left(1 + \frac{1}{2\sqrt{x}} \right) - (x + \sqrt{x})(e^x - 1)}{(e^x - x)^2}$

3. $\frac{d}{dx} \ln \left(\frac{x^2 e^x}{e^x - 1} \right) = \left(\frac{e^x - 1}{x^2 e^x} \right) \left(\frac{(e^x - 1)(x^2 e^x + 2x e^x) - (x^2 e^x)(e^x)}{(e^x - 1)^2} \right)$

4. $\frac{d}{dx} \left(\sqrt[3]{x} + \frac{3}{\sqrt[3]{x}} \right) = \frac{1}{3} x^{-\frac{2}{3}} - x^{-\frac{4}{3}}$

5. $\frac{d}{dx} [e^{x^2} \ln(x^2 + 1) (3^x - 4)]$
 $= e^{x^2} \ln(x^2 + 1) [\ln 3 (3^x)] + e^{x^2} (3^x - 4) \left[\frac{2x}{x^2 + 1} \right] + \ln(x^2 + 1) (3^x - 4) [2x e^{x^2}]$

6. Find $\frac{dy}{dx}$ if $x^3 + \frac{4}{3}y^3 - x^2y = 8$.

$$\frac{dy}{dx} = \frac{2xy - 3x^2}{4y^2 - x^2}$$

7. $\frac{d}{dx} (9x^2 + 16^x)^{\frac{1}{2}} = \frac{18x + \ln 16(16^x)}{2\sqrt{9x^2 + 16^x}}$

8. $\frac{d}{dx} e^x \ln x = \frac{e^x}{x} + e^x \ln x$