

Part 1: Derivatives of Exponential Functions**Example 1:** Find the derivative of each function.

a) $y = xe^x$

b) $y = e^{2x+1}$

c) $y = e^x - e^{-x}$

d) $y = 2e^x \cos x$

e) $y = x^2 10^x$

Chain Rule:

If $h(x) = f(g(x))$

$$h'(x) = f'[g(x)] \times g'(x)$$

Apply to exponential functions:

If $h(x) = b^{g(x)}$

$$h'(x) = b^{g(x)} \times \ln b \times g'(x)$$

Example 2: Identify the local extrema of the function $f(x) = x^2 e^x$.

Example 3: The effectiveness of studying for an exam depends on how many hours a student studies. Some experiments show that if the effectiveness, E , is put on a scale of 0 to 10, then $E(t) = 0.5 \left[10 + te^{-\frac{t}{20}} \right]$, where t is the number of hours spent studying for an examination. If a student has up to 30 hours for studying, how many hours are needed for maximum effectiveness.