3.4 Differentiation Rules for Exponential Functions Lesson

This document was composed and formatted by Annie Bernatchez.

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Part 1: Derivatives of Exponential Functions

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 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) $y = x^2 10^x$

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.

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