

Opener

7. $\frac{d}{dx} \cos^2(x^3) =$

(A) $6x^2 \sin(x^3) \cos(x^3)$

(B) $6x^2 \cos(x^3)$

(C) $\sin^2(x^3)$

(D) $-6x^2 \sin(x^3) \cos(x^3)$

(E) $-2 \sin(x^3) \cos(x^3)$

$$[\cos(x^3)]^2$$

$$2 [\cos(x^3)] \cdot (-\sin(x^3)) \cdot 3x^2$$

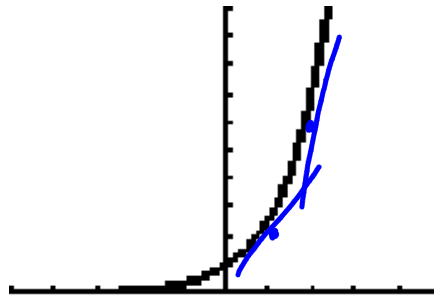
3-9 day 1 Derivatives of Exponential Functions

Learning Objectives:

I can calculate the derivatives of exponential functions.

Derivatives of Exponential Functions

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



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

Ex1. Differentiate *Product Rule*

1.) $y = x^2 e^x$ *f = x² f' = 2x* *g = e^x g' = e^x*
 $f'g + fg'$

$$y' = 2x e^x + x^2 e^x$$

2.) $y = \frac{\sin x}{e^x}$ *f = sin x f' = cos x* *g = e^x g' = e^x*
Quotient Rule
 $\frac{f'g - fg'}{g^2}$

$$y' = \frac{e^x \cos x - e^x \sin x}{e^{2x}}$$

3.) $y = \cos(e^x)$
Chain Rule
 $y' = -\sin(e^x) \cdot e^x$
 $y' = -e^x \sin(e^x)$

$$4.) g(x) = e^{2x+1}$$

$$g' = e^{2x+1} \cdot 2 = \boxed{2e^{2x+1}}$$

$$5.) g(x) = e^{x^2+2x+5}$$

$$e^{x^2+2x+5} (2x+2)$$

6.) $y = \sqrt{x^3 e^{x^2}}$

① $y = \sqrt{x^3 e^{x^2}} \quad y = (x^3 e^{x^2})^{\frac{1}{2}}$
 $f = x^3 \quad g = e^{x^2}$
 $f' = 3x^2 \quad g' = e^{x^2} \cdot 2x$
 $3x^2(e^{x^2}) + x^3(e^{x^2} \cdot 2x)$
 $y' = \left[\frac{1}{2} (x^3 e^{x^2})^{-\frac{1}{2}} \right] \cdot [3x^2(e^{x^2}) + x^3(e^{x^2} \cdot 2x)]$

7.) $y = \frac{e^{3x+5}}{\sqrt{2x-3}}$

⑦ $y = \frac{e^{3x+5}}{\sqrt{2x-3}}$
 $f = e^{3x+5}$
 $f' = e^{3x+5} \cdot 3$
 $g = \sqrt{2x-3}$
 $g' = \frac{1}{2}(2x-3)^{-1/2} \cdot 2$
 $y' = \frac{(3 e^{3x+5})(\sqrt{2x-3}) - (e^{3x+5})(\frac{1}{2}(2x-3)^{-1/2})}{(\sqrt{2x-3})^2}$
 $y' = \frac{(3 e^{3x+5})(\sqrt{2x-3}) - \frac{1}{2}(e^{3x+5})(2x-3)^{-1/2}}{2x-3}$

8.) $h(x) = 2^{4x^2} \cos(x^2 + x)$

⑧ $h(x) = 2^{4x^2} \cdot \cos(x^2 + x)$
 $f = 2^{4x^2} \quad g = \cos(x^2 + x)$
 $f' = 2^{4x^2} \ln(2) \cdot 8x \quad g' = -\sin(x^2 + x) \cdot (2x + 1)$
 $f'g + fg' \rightarrow \left[(2^{4x^2} \ln(2) \cdot 8x)(\cos(x^2 + x)) \right]$
 $+ \left[(2^{4x^2})(-\sin(x^2 + x))(2x + 1) \right]$

Homework

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50, 52, 53