10/3

Derivative of e^x and e^{kx}, k constant

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

$$\frac{d}{dx}(e^{kx}) = \underline{e^{kx}} \cdot k = ke^{kx}$$

Ex: $F = Pe^{rt}$

$$\frac{dF}{dt} = ? = P \cdot re^{rt} = (rP)e^{rt}$$

$$= r(Pe^{rt})$$

$$\frac{dF}{dt} = rF$$

$$a^x = [\underbrace{e^{(\ln a)}}_{a}]^x = e^{x \ln a}$$

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

$$\frac{d}{dx}\left(e^{g(x)}\right) = \underline{e^{g(x)}} \cdot g'(x)$$

Ex: $\frac{d}{dx}\left(e^{x^3+2x^2-5x}\right) = \left(e^{x^3+2x^2-5x}\right)\left(3x^2+4x-5\right)$

Ex: $f(x) = x^5 \cdot e^{2x} = x^5\left(e^{2x}\right)' + \left(x^5\right)' \cdot e^{2x}$

Product Rule

$= x^5 \cdot 2e^{2x} + 5x^4 \cdot e^{2x}$

$= x^4 e^{2x}\left[2x+5\right]$

Ex: $f(x) = \frac{e^{5x}}{3x-1}$ Want $f'(x) = ?$

$$f'(x) = \frac{(3x-1)(5e^{5x}) - (3)e^{5x}}{(3x-1)^2}$$

For U^{239}

Start w/ 100g.

$$A(t) = 100e^{\underbrace{-0.362}_{k}t}$$

(i) Find $A'(t)$

(ii) Find $A'(3)$

(i) $A'(t) = (100)(-0.362)e^{-0.362t}$

$= -36.2e^{-0.362t}$ (g/yr)

(ii) $A'(3) = -12.2\ g/yr$

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p.258

#7 $f(t) = 100^t$ $f'(t) = \ln(100) \cdot 100^t$

#12 $y = 1.2e^{5x}$ $y'(x) = (1.2)(5e^{5x})$

$= 6e^{5x}$

#31 $f(z) = \left(2z + e^{-z^2}\right)^2$

$f'(z) = 2\left(2z + e^{-z^2}\right) \cdot \left(2z + e^{-z^2}\right)'$

harder

$= 2\left(2z + e^{-z^2}\right) \cdot \left[2 + e^{-z^2} \cdot (-2z)\right]$

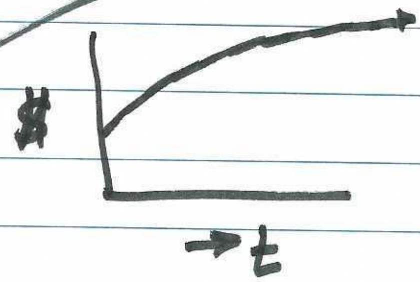
#42 $f(x) = e^{\left(\frac{x^2}{x^3+2}\right)}$

$f'(x) = e^{\left(\frac{x^2}{x^3+2}\right)} \cdot \left[\frac{x^2}{x^3+2}\right]'$

$= e^{\left(\frac{x^2}{x^3+2}\right)} \cdot \left[\frac{(x^3+2)(2x) - (x^2)(3x^2)}{(x^3+2)^2}\right]$

#52 $S(t) = 100 - 90e^{-0.3t}$ $27e^{-.9}$

(a) $S'(t) : 27e^{-0.3t}$



(b) $S'(5)$ $27e^{-1.5}$

(c) Rate of sales increase declines

#56 $A(t) = 10t^2 2^{-t}$ # people aware of product after t months

%

(a) after 2 month:

$A'(2) : A'(t) = 10\left[t^2(\ln 2 \cdot 2^{-t}) + (2t \cdot 2^{-t})\right]$

$= 10 \cdot 2^{-t}(t^2 \ln 2 + 2t)$

$= 10 \cdot \frac{1}{4}(4 \cdot 0.693 + 4)$

$= \frac{5}{2}(6.28) \sim > 0$

$A'(A) < 0$

1) $\frac{d}{dx}(\ln x) = \frac{1}{x}$

2) $\frac{d}{dx}(\log_a x) = \frac{1}{\ln a \cdot x}$

3) $\frac{d}{dx}(\ln g(x)) = \frac{g'(x)}{g(x)}$ < "relative change"

4) $\frac{d}{dx}(\log_a g(x)) = \frac{g'(x)}{g(x)} \cdot \frac{1}{\ln a}$

Ex: $f(x) = 3x(\ln x^2) = (3x)(2\ln x) = \underline{6x\ln x}$

$f'(x) = 6\left[x \cdot \frac{1}{x} + (1)(\ln x)\right]$

$= 6\left[1 + \ln x\right]$

$f(t) = 30,781 - 24,277 \log(0.46t+1)$

Find $f(8)$; $f'(8)$

$f(8) = 30,781 - 24,277 \log(8 \cdot 0.46 + 1)$

$= 14,509$

$$f'(t) = \frac{(-24,277) \cdot (0.46)}{(0.46t+1)(\ln 10)} = ?$$

$f'(8) = -1036$

$f(0) - f(8)$ is 8 yr depreciation

$f'(8)$ is annual rate of loss @ $t=8$