Calc AB

Lesson 26

8/27/15

Agenda: 8/27/15

HW leader:

Period 3: Hayden N.

Period 4: Manasa S.

Lesson 26

Derivatives of

e^x, $\sin(x)$, $\cos(x)$, $\ln(x)$

Exp growth / decay

★ Test 1 Tomorrow

- Lessons 1-24
- 7 problems & parts
- 100 points

★ Handout Derivative WS #2

- $\frac{d}{dx}(e^x) = \lim_{h\to 0} \frac{e^{x+h} - e^x}{h}$

$= e^x \left[\lim_{h\to 0} \frac{e^h - 1}{h}\right] = 1$

Since $e = \lim_{h\to 0} (h+1)^{1/h}$

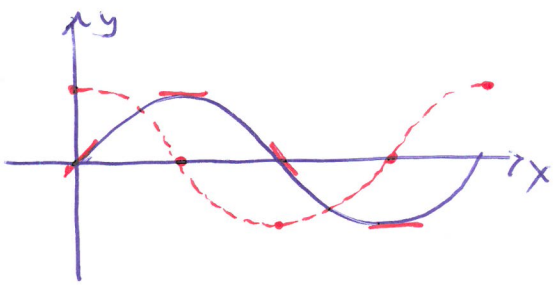
$= e^x$

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

- $\boxed{\frac{d}{dx}(\ln(x)) = \frac{1}{x}}$ ← We will prove this later!

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

- Find $\frac{d}{dx}(\sin(x))$ and $\frac{d}{dx}(\cos(x))$



$$\boxed{\frac{d}{dx}(\sin(x)) = \cos(x)}$$

Since $\cos(x) = \sin\left(x + \frac{\pi}{2}\right)$

$$\boxed{\frac{d}{dx}(\cos(x)) = \cos\left(x + \frac{\pi}{2}\right) = -\sin(x)}$$

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Ex. Find the derivative of $y = \ln(4x) - 6e^x - 3\cos(x)$

$y = \ln(4) + \ln(x) - 6e^x - 3\cos(x)$

$$y' = \frac{1}{x} - 6e^x + 3\sin(x)$$

Exp. Growth and Decay

Form: $A(t) = A_0 e^{kt}$

- $A(t)$: Present Amount at time t
- A_0: initial Amount
- k: constant related to growth rate
- t: time

Ex. Radium 226, decays exponential, with a half life of 1612 years. How long will it take for a 10 gram sample to decay to 6 grams?

(1) First find k

$$\frac{1}{2}A_0 = A_0 e^{k \cdot 1612}$$

$$\frac{\ln(\frac{1}{2})}{1612} = k \approx -0.0043$$

(2) Use $A(t) = A_0 e^{kt}$ and solve for t

$$6 = 10e^{-0.0043t}$$

$$\frac{\ln(\frac{6}{10})}{-0.0043} = t \quad \text{so} \quad t \approx 1188 \text{ years}$$