Good morning Happy Tuesday!
Agenda:
-Warm Up

-Prove ax, Sinx and Cosx

-Derivatives of other Transcendental functions

$= a^x \cdot \ln(a)$

$= \boxed{\ln(a) \cdot a^x}$

$y = 5^x \Rightarrow y' = \ln(5) \cdot 5^x$

$y = 3^{2x} =$

$\boxed{f'(u) \cdot \underline{u'} = \ln(3) 3^u \cdot 2}$

$\boxed{u = 2x}$ $f(u) = 3^u$

$\ln(3)(3^{2x}) \cdot 2$

$2 \cdot \ln(3) \cdot 3^{2x}$

$\ln(9) \cdot 3^{2x}$

$y = 4^{\sin(x)}$

$u = \sin x$

$f(u) = 4^u$

$f'(u) \cdot u'$

$\ln(4) \cdot 4^u \cdot \cos(x)$

$\ln(4) \cdot 4^{\sin x} \cdot \cos(x)$

$\boxed{\ln(4) \cdot \cos(x) \cdot 4^{\sin x}}$

$4 \cos(x) \cdot 4^{\sin x}$

$f \qquad g$

$$y = 2^{x^2} \cdot 3^x$$

$g'(x) = \ln(3) \cdot 3^x$

$u = x^2 \qquad u' = 2x$

$f(u) = 2^u$

$\ln(2)\, 2^u$

$\boxed{\ln(2)\, 2^{x^2} \cdot 2x}$ f'

$gf' + g'f$

$f'g + g'f$

$\left[2x \cdot 2^{x^2} \ln(2) \cdot 3^x\right] + \ln(3) \cdot 3^x \cdot 2^{x^2}$

$(\ln(2)\, 2x \cdot 2^{x^2} \cdot 3^x) + (\ln(3)\, 2^{x^2}\, 3^x)$

$$2^{x^2} \cdot 3^x \left(\ln(2) \cdot 2x + \ln(3)\right)$$

1

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

$$\frac{d}{dx}\left(\ln(1500x)\right)$$

$$\frac{d}{dx}\ln(3x)$$

$u = 3x \rightarrow u' = 3$

$f(u) = \ln(u) \rightarrow f'(u) = \frac{1}{u}$

$f'(x) = \frac{1}{3x}\cdot 3 = \frac{1}{x}$

$*\ \frac{d}{dx}\ln(\cos x)$

$f(\ ) = \ln(\ ) = \frac{1}{\cos x} = f'$

$g(x) = \cos(x)) \quad g' = -\sin x$

$$\frac{-\sin x}{\cos x} = \boxed{-\tan x}$$

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

$= \frac{1}{\ln(a)}\cdot\frac{1}{x}$

Ex) $\frac{d}{dx}\log(x) = \boxed{\frac{1}{\ln(10}\cdot\frac{1}{x}}$

$\frac{d}{dx}\log_5(2x) =$

$u = 2x \Rightarrow u' = 2$

$f(u) = \log_5(u)$

$f'(u) = \frac{1}{\ln(5)u}$

$\frac{1}{\cancel{2}x\ln(5)}\cdot\cancel{2}$

$\frac{1}{x\ln(5)}$

$$\frac{d}{dx}\sin x = \cos x$$

$$\lim_{h \to 0} \frac{\sin(x+h) - \sin(x)}{h}$$

$$\lim_{h \to 0} \frac{\sin x \cos h + \cos x \sin h - \sin x}{h}$$

$$\lim_{h \to 0} \frac{\cos x \sin h \left(-\sin x + \sin x \cos h\right)}{h}$$

$$\lim_{h \to 0} \frac{\cos x \sin h}{h} + \lim_{h \to 0} \frac{-\sin x(1 - \cos h)}{h}$$

$$\cos x \lim_{h \to 0} \underbrace{\frac{\sin h}{h}}_{1} + -\sin x \lim_{h \to 0} \underbrace{\frac{1 - \cos h}{h}}_{0}$$

$$\boxed{\cos x}$$

In words explain

1)

a) What a derivative is/represents...

at

~~slope of~~ a point in a function

instantenous rate.

b) What the power rule is...

way to derive a power function

Find derivitives using polynomials

c) What a tangent line represents

Slope at point

- Line intersecting at one point, instant rate

2)Answer a,b, and c from part 1 but in 8 words or less.

e^x

$a^x \to \boxed{\frac{d}{dx} a^x = \ln(a) \cdot a^x}$

$\frac{d}{dx}\left(e^{\ln(a^x)}\right) = \frac{d}{dx} e^{(x\ln(a))}$ $3x$

$u = x \ln(a)$

$f(u) = e^u \to$ $f'(u) \cdot u'$ $f'(u) = e^u$ $u' = \ln(a)$

$e^u \cdot \ln(a)$

$e^{x\ln(a)} \cdot \ln(a)$

$e^{\ln(a)^x} \cdot \ln(a)$

$a^x \cdot \ln(a) = \boxed{\ln(a) \cdot a^x}$

Ex) $3^x \Rightarrow \frac{d}{dx} 3^x$

$\boxed{\ln(3) \cdot 3^x}$

Ex2) $5^{x^2} \to \frac{d}{dx} 5^{x^2}$

$u = x^2$ $f'(u) \cdot u' \to 2x$

$f(u) = 5^u$

$f'(u) = \ln(5) 5^u$

$\ln(5) 5^u \cdot 2x$

$\ln(5) \cdot 2x \cdot 5^{x^2}$

$(2\ln(5)x)5^{x^2}$ $x\ln(25)5^{x^2}$

EX3) $4^{\sin(x)} \to \frac{d}{dx} 4^{\sin x}$

$u = \sin(x)$ $u' = \cos x$

$f(u) = 4^u$ $f'(u) = \ln(4) \cdot 4^u$

$\ln(4) \cdot 4^{\sin x} \cdot \cos x = \boxed{\ln(4) \cos x \, 4^{\sin x}}$

Ex 5

$$y = 2^{4x} \cdot 3^{2x}$$

f g

$f'g + g'f$

$f' = \ln(2) \cdot 2^{4x} \cdot 4$

$g' = \ln(3)\, 3^{2x} \cdot 2$

$\ln(2) \cdot 4 \cdot 2^{4x} \cdot 3^{2x} + \ln(3) \cdot 2 \cdot 3^{2x} \cdot 2^{4x}$

$\boxed{2^{4x} \cdot 3^{2x} \cdot 2}(2\ln(2) + \ln(3))$

$4\ln(2) + 2\ln(3)$

$\ln(16) + \ln(9)$

$\ln(144)$

$2^{4x} \cdot 3^{2x}$

$2^{4x} \cdot 3^{2x} \ln(144)$

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

$$\frac{d}{dx}\ln(5x)$$

$u' = 5$

$u = 5x$

$f(u) = \ln(u)$ $\quad f'(u) = \frac{1}{u}$

$\frac{1}{5x} \cdot 5 = \frac{5}{5x} = \frac{1}{x}$

$\ln(100x)$

$u = 100x$

$f(u) = \ln(u)$ $\quad f' = \frac{1}{u} \cdot u' = \frac{1}{100x} \cdot 100$

$= \frac{1}{x}$

<u>Ex)</u> $\ln(\cos(x))$

$u = \cos x)$ $\quad u' = -\sin x$

$f(u) = \ln(u)$ $\quad f'(u) = \frac{1}{u}$

$f'(x) = \frac{1}{\cos x} \cdot -\sin x$

$\frac{-\sin x}{\cos x} = -\tan x$

Ex 11

$$\frac{d}{dx}\log_7(x^2)$$

$u' = 2x$

$u = x^2$

$f(u) = \log_7(u)$ $\quad f'(u) = \frac{1}{\ln(7) \cdot u}$

$\boxed{f'(x) = \frac{2x}{\ln(7) \cdot x^2} = \frac{2}{\ln(7)x}}$

$$\frac{d}{dx}\sin x = \cos x$$

$$\lim_{h\to 0} \frac{\sin(x+h) - \sin x}{h}$$

$$\lim_{h\to 0} \frac{\sin x \cos h + \cos x \sin h - \sin x}{h}$$

$$\lim_{h\to 0} \frac{\cos x \sin h - \sin x + \sin x \cos h}{h}$$

$$\lim_{h\to 0} \frac{\cos x \sin h}{h} + \lim_{h\to 0} \frac{-\sin x + \sin x \cos h}{h}$$

$$\lim_{h\to 0} \frac{\cancel{\cos x}\sin h}{h} + \lim_{h\to 0} \frac{-\sin x(1-\cos h)}{h}$$

$$\cos x\left(\quad 1 \quad \right) + -\sin x\left(\, 0 \, \right)$$

$$\cos x \qquad 0$$

Title: Oct 29-2:12 PM (9 of 11)

41. $f(t) = t^2 \sin t$

42. $f(\theta) = (\theta + 1)\cos \theta$

43. $f(t) = \dfrac{\cos t}{t}$

44. $f(x) = \dfrac{\sin x}{x^3}$

45. $f(x) = -e^x + \tan x$

46. $y = e^x - \cot x$

47. $g(t) = \sqrt[4]{t} + 6 \csc t$

48. $h(x) = \dfrac{1}{x} - 12 \sec x$

49. $y = \dfrac{3(1 - \sin x)}{2 \cos x}$

50. $y = \dfrac{\sec x}{x}$

51. $y = -\csc x - \sin x$

52. $y = x \sin x + \cos x$

53. $f(x) = x^2 \tan x$

54. $f(x) = \sin x \cos x$

55. $y = 2x \sin x + x^2 e^x$

56. $h(x) = 2e^x \cos x$

57. $y = \dfrac{e^x}{4\sqrt{x}}$

58. $y = \dfrac{2e^x}{x^2 + 1}$