Week 14 Wednesday

December 5, 2018 11:28 AM

④ $$y = \frac{8x^2+3}{5x+1}$$

$$y' = \frac{vu' - uv'}{v^2}$$

$$= \frac{(5x+1)(16x) - 5(8x^2+3)\cancel{(5)}}{(5x+1)^2}$$ expand

$$= \frac{80x^2 + 16x - 40x^2 - 15}{(5x+1)^2}$$

$$= \frac{40x^2 + 16x - 15}{(5x+1)^2}$$ ✓

⑤ $$\boxed{\begin{array}{l}\text{Recap Implicit Differentiation} \\ \frac{d}{dx}[x^4] = 4x^3 \\ \frac{d}{dx}[y^4] = 4y^3 \frac{dy}{dx}\end{array}}$$

$$\cos(xy) - \sin(3y) = 1 + x^3$$

Take $\frac{d}{dx}$: $$-\sin(xy)\underbrace{\left[x\frac{dy}{dx} + y(1)\right]}_{\text{Product Rule}} - \cos(3y)\left[3\frac{dy}{dx}\right] = 3x^2$$

Expand: $$-x\sin(xy)\frac{dy}{dx} - y\sin(xy) - 3\cos(3y)\frac{dy}{dx} = 3x^2$$

Expand: $-x\sin(xy)\frac{dy}{dx} - y\sin(xy) - 3\cos(3y)\frac{dy}{dx} \;\ldots$

$$-x\sin(xy)\frac{dy}{dx} - 3\cos(3y)\frac{dy}{dx} = y\sin(xy) + 3x^2$$

Factor: $$\left[-x\sin(xy) - 3\cos(3y)\right]\frac{dy}{dx} = y\sin(xy) + 3x^2$$

$$\frac{dy}{dx} = \frac{y\sin(xy) + 3x^2}{-x\sin(xy) - 3\cos(3y)}$$

6. $\boxed{\text{Recall} \quad \frac{d}{dx}\left[\log_b x\right] = \frac{1}{\ln b}\cdot\frac{1}{x} \qquad \frac{d}{dx}\left[\ln x\right] = \frac{1}{x}}$

$$y = \ln\left[x^3(x^2+4)\right]$$ (Could use log rules)

$$y' = \frac{1}{x^3(x^2+4)}\left[x^3(2x) + (x^2+4)(3x^2)\right]$$

$$y'\Big|_{x=1} = \frac{1}{5}\left[2 + 15\right]$$

$$\boxed{m = \frac{17}{5}} \qquad \boxed{(x_1, y_1) = (1, \ln 5)}$$

y

$$y - y_1 = m(x - x_1)$$

$$y - \ln 5 = \frac{17}{5}(x-1)$$

$$y = \frac{17}{5}x - \frac{17}{5} + \ln 5$$

⑦ Newton's Method: $f(x) = 0$

$$e^x = \cos x + 1$$

$$\underbrace{e^x - \cos x - 1}_{f(x)} = 0$$

$$f'(x) = e^x + \sin x$$

x_n	$f(x_n)$	$f'(x_n)$	$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$
-3	0.0398	-0.0913	-2.56

RADIANS

⑧
$$\boxed{\text{Recap} \quad \frac{d}{dx}[e^x] = e^x \qquad \frac{d}{dx}[b^x] = \ln b \cdot b^x}$$

$$x = e^{-t^2+8t}$$

$$v_x = e^{-t^2+8t} \cdot (-2t+8)$$

@ $t = 0.2$:

$$y = te^{7t}$$

$$v_y = t\left[e^{7t} \cdot 7\right] + e^{7t}(1)$$
$$= (7t+1)e^{7t}$$

@ $t = 0.2$:

$v_x = 7.6\,e^{1.56}$

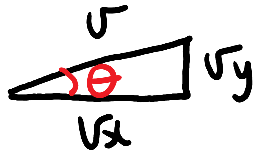
≈ 36.167

$v_y = 2.4\,e^{1.4}$

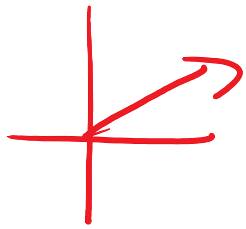
≈ 9.732

Speed $v = \sqrt{v_x^2 + v_y^2}$

≈ 37.5 m/s



direction $\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right)$ $(+180°)$



$\theta = \tan^{-1}\left(\frac{9.732}{36.167}\right)$

$= 15.1°$