Exam 2 FRQ Musts

- Make sure to write $\underline{\frac{dy}{dx}}$ (or $\underline{y'}$ or $f'(x)$) when you differentiate

  ie $f(x) = x^3 - 3x + 2$
  $f'(x) = 3x^2 - 3$

- Write <u>tangent</u> lines as equations unless otherwise told to

  ie <u>horizontal</u> tangent line @ 5 $\boxed{y = 5}$

HW 12 #11

$$f(x) = \sqrt{x}\,\ln(x)$$

$$= (x)^{1/2}\ln(x)$$

$$x^{1/2} \cdot x^{-1} = x^{-1/2}$$

$$f'(x) = \frac{1}{2}x^{-1/2}\ln(x) + x^{1/2}\cdot\frac{1}{x}$$

$$\boxed{= \frac{1}{2}x^{-1/2}\ln(x) + x^{-1/2}}$$

$$f''(x) = \frac{-1}{4}x^{-3/2}\ln(x) + \frac{1}{2}x^{-1/2}\cdot\frac{1}{x} + \frac{-1}{2}x^{-3/2}$$

$$\boxed{= \frac{-1}{4}x^{-3/2}\ln(x) + \frac{1}{2}x^{-1/2}\cdot\frac{1}{x} - \frac{1}{2}x^{-3/2}}$$

HW 11 #9

$$9e^{x^3y^2} = y^2$$

$$9e^{x^3y^2}\underbrace{\frac{d}{dx}\left(x^3y^2\right)}_{3x^2y^2+x^3\cdot 2y\frac{dy}{dx}} = 2y\frac{dy}{dx}$$

$$9e^{x^3y^2}\left(3x^2y^2+2x^3y\frac{dy}{dx}\right) = 2y\frac{dy}{dx}$$

$$= \frac{\left(2y - 18x^3ye^{x^3y^2}\right)\frac{dy}{dx}}{2y-18x^3ye^{x^3y^2}}$$

$$\boxed{\frac{27x^2y^2e^{x^3y^2}}{2y-18x^3ye^{x^3y^2}} = \frac{dy}{dx}}$$

HW 11 #11

$$\frac{d}{dx}\left(-\arctan(x^2)\right) =$$

$$\frac{d}{dx}\arctan(\star) = \frac{-1}{1+(\star)^2} \cdot \frac{d}{dx}(\star)$$

$$\frac{-1}{1+(x^2)^2} \cdot 2x = \boxed{\frac{-2x}{1+x^4}}$$

HW 12 #4

$$\frac{d}{dx}\left(\frac{-2\cos(x)}{\ln(x)}\right) = \frac{-2(-\sin(x))\ln(x) - (-2\cos x)\frac{1}{x}}{(\ln(x))^2}$$

$$= \frac{2\sin(x)\ln(x) + \frac{2\cos(x)}{x}}{[\ln(x)]^2}$$

$$\boxed{y = x^{\ln(x)}}$$

$$\ln(y) = \ln\left(x^{\ln(x)}\right)$$

$$\ln(y) = \ln(x)\ln(x)$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{1}{x}\ln(x) + \ln(x)\frac{1}{x}$$

$$y \cdot \frac{1}{y} \cdot \frac{dy}{dx} = \frac{2}{x}\ln(x) \cdot y$$

$$\frac{dy}{dx} = \frac{2}{x}\ln(x)\, y$$

$$\boxed{\frac{dy}{dx} = \frac{2}{x}\ln(x)\, x^{\ln(x)}}$$

$$y = x^{\operatorname{arcsec}(x^3)}$$

$$\ln(y) = \ln\left(x^{\operatorname{arcsec}(x^3)}\right)$$

$$= \operatorname{arcsec}(x^3)\ln(x)$$

$$\left(\frac{1}{y}\frac{dy}{dx}\right)y = \left(\frac{1}{|x^3|\sqrt{(x^3)^2-1}}\cdot 3x^2\ln(x) + \operatorname{arcsec}(x^3)\cdot\frac{1}{x}\right)y$$

$$\boxed{\frac{dy}{dx} = \left[\frac{3x^2\ln(x)}{|x^3|\sqrt{x^6-1}} + \frac{\operatorname{arcsec}(x^3)}{x}\right]x^{\operatorname{arcsec}(x^3)}}$$