XRONOS HW8 #3:

$$\frac{d}{dx}\left[\frac{(x+3)(x+1)}{x^2-49}\right] = \frac{d}{dx}\left[\frac{x^2+4x+3}{x^2-49}\right]$$

$$= \frac{(x^2-49)\left[\frac{d}{dx}(x^2+4x+3)\right] - (x^2+4x+3)\left[\frac{d}{dx}[x^2-49]\right]}{\left[(x^2-49)^2\right]}$$

$$= \frac{(x^2-49)(2x+4) - (x^2+4x+3)(2x)}{(x^2-49)^2}$$

$$= \frac{(\cancel{2x^3} + 4x^2 - 98x - 196) - (\cancel{2x^3} + 8x^2 + 6x)}{(x^2-49)^2}$$

$$= \boxed{\frac{-4x^2 - 104x - 196}{(x^2-49)^2}}$$

NOTE:

$$\frac{d}{dx}(x^2+4x+3) = 2x^{2-1} + 4x^{1-1} + 0 \quad ; \quad \frac{d}{dx}[x^2-49] = 2x^{2-1} = 2x$$

$$= 2x + 4$$

XRONOS HW8 #4:

$$\frac{d}{dx}\left[\underbrace{\frac{x^{1/3} - 4}{x^{7/2}}}\right] = \frac{d}{dx}\left[\frac{x^{1/3}}{x^{7/2}} - 4x^{-7/2}\right]$$

$\frac{1}{3} = \frac{2}{6}$, $\frac{7}{2} = \frac{21}{6}$

$$= \frac{d}{dx}\left[\frac{x^{2/6}}{x^{21/6}}\right] - \frac{d}{dx}\left[4x^{-7/2}\right]$$

$$= \frac{d}{dx}\left[x^{-19/6}\right] - \frac{d}{dx}\left[4x^{-7/2}\right]$$

$$= \left(-\frac{19}{6}x^{-\frac{19}{6}-1}\right) - \left(\overset{2}{\cancel{4}}\left(-\frac{7}{\cancel{2}}\right)x^{-7/2-1}\right) = \boxed{-\frac{19}{6}x^{-25/6} + 14x^{-9/2}}$$

XRONOS HW8 #7:

$$\frac{d}{dx}\left[(3-5xe^x)(3x+2)\right] = \left[\frac{d}{dx}(3-5xe^x)\right](3x+2) + (3-5xe^x)\left[\frac{d}{dx}(3x+2)\right]$$

$$\frac{d}{dx}(3-5xe^x) = \frac{d}{dx}(3) - \frac{d}{dx}(5xe^x) = 0 - \left[\left(\frac{d}{dx}(5x)\right)(e^x) + (5x)\left(\frac{d}{dx}e^x\right)\right]$$

$$= -5e^x - 5xe^x$$

$$= (-5e^x - 5xe^x)(3x+2) + (3-5xe^x)(3)$$

$$= -15xe^x - 10e^x - 15x^2e^x - 10xe^x + 9 - 15xe^x$$

$$= \boxed{-40xe^x - 10e^x - 15x^2e^x + 9}$$

XRONOS HW8 #8:

$$\frac{d}{dx}\left[(x^3-2x+1)(3x^3+2x^2-5x)\right]$$

$$= \left[\frac{d}{dx}(x^3-2x+1)\right](3x^3+2x^2-5x) + (x^3-2x+1)\left[\frac{d}{dx}(3x^3+2x^2-5x)\right]$$

$$= (3x^2-2)(3x^3+2x^2-5x) + (x^3-2x+1)(9x^2+4x-5)$$

$$= 9x^5 + 6x^4 - 15x^3 - 6x^3 - 4x^2 + 10x + 9x^5 + 4x^4 - 5x^3 - 18x^3 - 8x^2 + 10x + 9x^2 + 4x - 5$$

$$= \boxed{18x^5 + 10x^4 - 44x^3 - 3x^2 + 24x - 5}$$

XRONOS HW 9 #1:

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

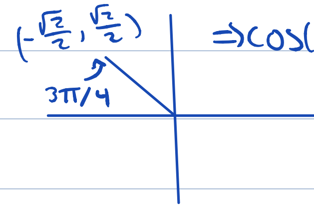
XRONOS HW 9 #2:

FIND THE EQUATION OF THE LINE TANGENT TO $f(x) = -2\sin(x)$ AT $x = \frac{3}{4}\pi$

STEP ONE: FIND $\frac{d}{dx}[f(x)]$

$$\frac{d}{dx}\left[-2\sin(x)\right] = -2\cos(x)$$

<u>STEP TWO:</u> THE SLOPE OF THE TANGENT LINE AT $X=3\pi/4$ IS THE VALUE OF $f'(x)$ AT $X=\frac{3\pi}{4}$:



$\Rightarrow \cos(3\pi/4) = -\frac{\sqrt{2}}{2}$

$$f'(3\pi/4) = -2\cos(3\pi/4)$$
$$= -\cancel{2}\left(-\frac{\sqrt{2}}{\cancel{2}}\right) = \sqrt{2}$$

SLOPE!

<u>STEP THREE:</u> PLUG IN $X=3\pi/4$ TO $f(x)=-2\sin(x)$ TO FIND ASSOCIATED Y-VALUE:

$$f(3\pi/4) = -2\sin(3\pi/4) = -\cancel{2}\left(\frac{\sqrt{2}}{\cancel{2}}\right) = -\sqrt{2}$$
$$\Rightarrow (3\pi/4, -\sqrt{2})$$

<u>STEP FOUR</u>: USE POINT-SLOPE FORM: $y-y_1=m(x-x_1)$: $y_1=-\sqrt{2}$, $x_1=3\pi/4$, $m=\sqrt{2}$

$$y-(-\sqrt{2}) = \sqrt{2}\left(x-\frac{3\pi}{4}\right) \Rightarrow y+\sqrt{2} = \sqrt{2}(x-3\pi/4)$$
$$\Rightarrow \boxed{y = \sqrt{2}(x-3\pi/4) - \sqrt{2}}$$

<u>**XRONOS HW 9 #3:**</u> COMPUTE THE FIRST AND SECOND DERIVATIVES FOR $f(x) = -3\cos(x) + 2\sin(x)$

$$\frac{d}{dx}\left[-3\cos(x)+2\sin(x)\right] = -(-3\sin(x)) + 2\cos(x)$$
$$\Rightarrow \boxed{f'(x) = 3\sin(x) + 2\cos(x)}$$

$$f''(x) = \frac{d}{dx}\left[3\sin(x)+2\cos(x)\right] = 3\cos(x) - 2\sin(x)$$
$$\Rightarrow \boxed{f''(x) = 3\cos(x) - 2\sin(x)}$$

XRONOS HW 9 #4:

$$\frac{d}{dx}\left[\frac{x-\cos(x)}{x^2+\cot(x)}\right]$$

$$=\frac{(x^2+\cot(x))\left[\frac{d}{dx}(x-\cos(x))\right]-(x-\cos(x))\left[\frac{d}{dx}(x^2+\cot(x))\right]}{[x^2+\cot(x)]^2}$$

$$=\frac{(x^2+\cot(x))(1+\sin(x))-(x-\cos(x))(2x-\csc^2(x))}{[x^2+\cot(x)]^2}$$

XRONOS HW 9 #7:

$$\frac{d}{dx}\left(8\csc(x)+2\right)=-8\cot(x)\csc(x)$$

XRONOS HW 7 #4:

FIND THE EQUATION OF THE LINE TANGENT TO $f(x)=-x^3+9x^2-6x+9$ AT THE POINT $(7,65)$

STEP ONE: FIND $\frac{d}{dx}[f(x)]$

$$\frac{d}{dx}[-x^3+9x^2-6x+9]=-3x^{3-1}+9(2)x^{2-1}-6x^{1-1}$$

$$=-3x^2+18x-6$$

$$\Rightarrow f'(x)=-3x^2+18x-6$$

STEP TWO: THE SLOPE OF THE TANGENT LINE AT $(7,65)$ IS THE VALUE OF $f'(x)$ AT $x=7$:

$$f'(7)=-3(7^2)+18(7)-6=-147+126-6=-27$$

SLOPE OF TANGENT LINE @ $x=7$

STEP THREE: POINT-SLOPE FORM: $y-y_1=m(x-x_1)$, $x_1=7$, $y_1=65$, $m=-27$

$$y-65=-27(x-7)$$

$$y-65=-27x+189$$

$$\boxed{y=-27x+254}$$