2a] $y = 3x^9 - 7x^6 - 3x + 1$

$y' = 27x^8 - 42x^5 - 3$

$\boxed{y'' = 27(8)x^7 - 42(5)x^4}$

2b] $y = \tan(3x)$

$y' = 3\sec^2(3x) = 3(\sec 3x)^2$

$\boxed{y'' = 6\sec(3x)(\sec 3x)(\tan 3x)\cdot 3 = 18\sec^2(3x)\tan(3x)}$

3a] $3x^2 - 5y^3 = x$

$6x - 15y^2\frac{dy}{dx} = 1$

$\boxed{\frac{dy}{dx} = \frac{1-6x}{-15y^2}}$

b) $5xy + \cos x = \sec y$

$5x\frac{dy}{dx} + y\cdot 5 - \sin x = \sec y\tan y\frac{dy}{dx}$

$5y - \sin x = (\sec y\tan y - 5x)\frac{dy}{dx}$

$\boxed{\frac{dy}{dx} = \frac{5y - \sin x}{\sec y\tan y - 5x}}$

4] $\sqrt{x+2} + \sqrt{y} = 3$

Goal: Tangent line @ (2, 1)

$\frac{1}{2}(x+2)^{-\frac{1}{2}} + \frac{1}{2}(y)^{-\frac{1}{2}}\frac{dy}{dx} = 0$

plug in $x=2, y=1$

$\frac{1}{2}\left(\frac{1}{2+2}\right)^{\frac{1}{2}} + \frac{1}{2}\left(\frac{1}{1}\right)^{\frac{1}{2}}\frac{dy}{dx} = 0$

$\frac{1}{2}\cdot\frac{1}{2} + \frac{1}{2}\frac{dy}{dx} = 0$

$\frac{1}{2}\frac{dy}{dx} = -\frac{1}{4}$

$\frac{dy}{dx} = -\frac{1}{2}$ @ (2, 1)

Ans $\boxed{y - 1 = -\frac{1}{2}(x-2)}$

5] $f(x) = \sin^2 x$

Goal: tangent line @ $x = \frac{\pi}{3}$

$f(\frac{\pi}{3}) = \left[\sin(\frac{\pi}{3})\right]^2 = \left(\frac{\sqrt{3}}{2}\right)^2 = \frac{3}{4}$

$f'(x) = 2\sin x\cos x$

$f'(\frac{\pi}{3}) = 2\sin\frac{\pi}{3}\cos\frac{\pi}{3} = 2\frac{\sqrt{3}}{2}\cdot\frac{1}{2} = \frac{\sqrt{3}}{2}$

$\boxed{y - \frac{3}{4} = \frac{\sqrt{3}}{2}(x - \frac{\pi}{3})}$

6] $g(x) = \cos\pi x + 3$

Goal: Tangent line @ $x = -2$

$g(-2) = \cos(-2\pi) + 3$

$= 1 + 3 = 4$

$g'(x) = -\pi\sin(\pi x)$

$g'(-2) = -\pi\sin(-2\pi) = 0$

$\boxed{y - 4 = 0(x+2) \Rightarrow y = 4}$

7] Where is tangent line to $f(x) = -x^2 - 6$ parallel to $y = 4x - 1$.

Where is $f'(x) = 4$?

$f'(x) = -2x$

Solve $-2x = 4 \Rightarrow \boxed{x = -2}$ pt $\boxed{(-2, -10)}$

8] Where is tangent line of $g(x) = x^3 - 3x$ perp. to $5y - 3x - 8 = 0$

$g'(x) = 3x^2 - 3$

Next, $5y - 3x - 8 = 0 \Rightarrow y = \frac{3}{5}x + \frac{8}{5}$

want perp. so need $g'(x) = -\frac{5}{3}$.

Solve $3x^2 - 3 = -\frac{5}{3}$

$3x^2 = 3 - \frac{5}{3} \Rightarrow x^2 = 1 - \frac{5}{9} = \frac{4}{9} \Rightarrow x = \pm\frac{2}{3}$

pts $\boxed{\left(\frac{2}{3}, \frac{-46}{27}\right), \left(\frac{-2}{3}, \frac{46}{27}\right)}$

$g(\frac{2}{3})$ $g(-\frac{2}{3})$