1.) Find the slope of the tangent line to $y = \tan(x)$ at $x = \frac{\pi}{4}$

$f(x) = \tan(\frac{\pi}{4})$, $\frac{d}{dx} f(x) = \sec^2(\frac{\pi}{4})$

$= \frac{1}{\cos(\frac{\pi}{4})^2}$ or $\frac{1}{\cos(45)^2} \Rightarrow \frac{1}{\left(\frac{\sqrt{2}}{2}\right)^2}$

$= \frac{1}{\frac{2}{4}} = \frac{4}{2} = \underline{\underline{2}}$

2.) Compute $\frac{d}{dx} f(x)$ when $f(x) = \ln(\tan x + \sec x)$

$\ln(\tan(x) + \sec(x)) = \ln\left(\frac{\sin(x)}{\cos(x)} + \frac{1}{\cos(x)}\right)$

* chain Rule + Quotient Rule

$\underbrace{\frac{d}{dx}\left[\ln\left(\frac{1+\sin(x)}{\cos(x)}\right)\right]} \cdot \frac{d}{dx}\left[\left(\frac{1+\sin(x)}{\cos(x)}\right)\right]$

$\frac{\left[\frac{d}{dx}(1+\sin(x)) \cdot \cos(x)\right] - \left[(1+\sin(x))\frac{d}{dx}(\cos x)\right]}{\cos(x)^2}$

$\left(\frac{1}{\frac{1+\sin(x)}{\cos(x)}} = \frac{\cos(x)}{1+\sin(x)}\right.$

$= \cos(x)^2 - (-\sin(x) - \sin(x)^2)$

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

$\underbrace{\cos(x)^2 + \sin(x)^2}$

$\longrightarrow \frac{\cancel{\cos(x)}}{\cancel{1+\sin(x)}} \cdot \frac{\cancel{1+\sin(x)}}{\cancel{\cos(x)^2}} = \frac{1}{\cos(x)}$

$= \underline{\underline{\sec(x)}}$

3.) Find the slope of tangent line to

$$y = \frac{x^2-5x+6}{x^2-1} \quad \text{at } x=2$$

$$\frac{\frac{d}{dx}(x^2-5x+6)\cdot(x^2-1) - (x^2-5x+6)\frac{d}{dx}(x^2-1)}{(x^2-1)^2}$$

$$= (2x-5)\cdot(x^2-1) - (x^2-5x+6)(2x)$$

$$(2x^3-2x-5x^2+5) - (2x^3-10x^2+8x)$$

$$\cancel{2x^3}\cancel{-2x}\cancel{-5x^2}\cancel{+5}\cancel{-2x^3}\cancel{+10x^2}\cancel{-8x}$$

$$= \frac{+5x^2-10x+5}{(x^2-1)^2} = \frac{5(2)^2-10(2)+5}{(3)^2} = \frac{5}{9}$$

$$= (3)^2 = 9$$

$$= \frac{5}{9}$$