First solving for (x_t, y_t)

$$\Rightarrow \frac{y_t - 1}{x_t} = \frac{2}{(1+x_t)^2} \Rightarrow y_t = \frac{2x_t}{(1+x_t)^2} + 1 \quad — (1)$$

$$y_t = \frac{2x_t}{1+x_t} \quad — (2) \text{ , so } (1) = (2)$$

$$\frac{2x_t}{(1+x_t)^2} + 1 = \frac{2x_t}{(1+x_t)}$$

$$\Rightarrow \frac{2x_t + (1+x_t)^2 - 2x_t(1+x_t)}{(1+x_t)^2} = 0$$

$$\Rightarrow 1 + x_t^2 + 2x_t + \cancel{2x_t} \cancel{- 2x_t} - 2x_t^2 = 0$$

$$\Rightarrow x_t^2 - 2x_t - 1 = 0$$

$$x_t = \frac{2 \pm \sqrt{8}}{2} \Rightarrow \boxed{x_t = 1 \pm \sqrt{2}} \Rightarrow \boxed{y_t = \pm\sqrt{2}}$$

So our pts of tangency are $(1+\sqrt{2}, \sqrt{2})$ and $(1-\sqrt{2}, -\sqrt{2})$

Slopes of tangent $\Rightarrow (0,1)\ (1+\sqrt{2}, \sqrt{2})$ and $(0,1)\ (1-\sqrt{2}, -\sqrt{2})$

$$\Rightarrow \boxed{\frac{\sqrt{2}-1}{\sqrt{2}+1} \text{ and } \frac{1+\sqrt{2}}{\sqrt{2}-1}}$$

So Eqns of tangent, $y - 1 = x\left(\frac{\sqrt{2}-1}{\sqrt{2}+1}\right)$ and $y - 1 = x\left(\frac{\sqrt{2}+1}{\sqrt{2}-1}\right)$