10. $\boxed{f(x) = 1 + \frac{x}{(1+x)^2}}$ $\boxed{f'(x) = \frac{1-x}{(1+x)^3}}$ $\boxed{f''(x) = \frac{2(x-2)}{(1+x)^4}}$

$$f'(x) = 0 + \frac{(1+x)^2\cdot 1 - x\cdot 2(1+x)\cdot 1}{(1+x)^4} = \frac{\cancel{(1+x)}\overbrace{[1+x-2x]}^{1-x}}{(1+x)^{\cancel{4}\,3}} = \frac{1-x}{(1+x)^3}$$

$$f''(x) = \frac{(1+x)^3\cdot(-1) - (1-x)\cdot 3(1+x)^2\cdot 1}{[(1+x)^3]^2} = \frac{\cancel{(1+x)^2}\overbrace{[-(1+x)-3(1-x)]}^{-1-x-3+3x}}{(1+x)^{\cancel{6}\,4}} = \frac{2x-4}{(1+x)^4}$$

10-1 $f(x)$ is a rational function (can put over common denom)

10-2 y-int $(\overset{x=0}{0}, \overset{y=?}{?})$ $y = f(0) = 1 + \frac{0}{(1+0)^2} = 1.$ $\Rightarrow$ $\boxed{\text{y-int}: (0,1)}$

10-3 x-ints $(\overset{x=?}{?}, \overset{y=0}{0})$ $0 = 1 + \frac{x}{(1+x)^2} = \frac{(1+x)^2+x}{(1+x)^2} = \frac{1+2x+x^2+x}{(1+x)^2} = \frac{x^2+3x+1}{(1+x)^2} \overset{=0}{=0}$

$\Rightarrow$ set numerator $= 0$ for x-int: solve $x^2+3x+1=0$ use quadratic formula

$$x = \frac{-3 \pm \sqrt{3^2-4(1)(1)}}{2(1)} = \frac{-3\pm\sqrt{9-4}}{2} = \frac{-3}{2} \pm \frac{\sqrt{5}}{2} \;\; \begin{cases} \frac{-3}{2}+\frac{\sqrt{5}}{2} \approx -0.4 \\ -\frac{3}{2}-\frac{\sqrt{5}}{2} \approx -2.6 \end{cases}$$

$\boxed{\text{x-ints}: \approx (-2.6, 0) \text{ and } (-0.4, 0)}$

10.4 CNs $f'(x) = 0 \Rightarrow 1-x=0 \rightarrow x_c = 1$

$f'(x)$ undefined $\Rightarrow (1+x)^3 = 0 \rightarrow x = -1$ ($f(x)$ and $f'(x)$ are undefined here)

$\Rightarrow$ Two critical numbers but there is a critical point only at $x=1$

10.5 CP $(x_c, f(x_c)) = (1, f(1)) = \boxed{(1, 1.25) = CP}$

$f(1) = 1 + \frac{1}{(1+1)^2} = 1 + \frac{1}{4} = \frac{5}{4} = 1.25$

10.6 2nd derivative test $f''(1) = \frac{2(1-2)}{(1+1)^4} = \frac{(+)(-)}{(+)} = \boxed{(1, 1.25) \; \frown \Rightarrow \text{Rel Max}}$

10.7 IPs $f''(x) = \frac{2(x-2)}{(1+x)^4} = 0 \rightarrow x = 2$ possible location of IP

$f''(1.9) = \frac{2(1.9-2)}{(1+1.9)^4} = \frac{(+)(-)}{+} = \frown$ ccdn

Test: $f''=0$ at 2; 1.9: $(-)$ $\frown$; 2.1: $(+)$ $\smile$

$f''(2.1) = \frac{2(2.1-2)}{(1+2.1)^4} = \frac{(+)(+)}{(+)} = (+)$ ccup

Concavity changes $\Rightarrow$ IP

$\boxed{\text{IP is } (2, f(2)) = (2, 11/9)}$ (6)

$f(2) = 1 + \frac{2}{(3)^2} = 1 + \frac{2}{9} = \frac{11}{9} \approx 1.2$