8.

a) $\Omega = \{ (x_0, f(x_0)), (x_1, f(x_1)), (x_3, f(x_3)) \}$

$P_2 = \sum_{i=0}^{2} L_i F(x_i) \qquad L_i = \prod_{j=0, i \neq j}^{2} \frac{x - x_j}{x_i - x_j}$

b) $\rightarrow P_2 = \left(\frac{x - x_1}{x_0 - x_1}\right)\left(\frac{x - x_2}{x_0 - x_2}\right) F(x_0) + \left(\frac{x - x_0}{x_1 - x_0}\right)\left(\frac{x - x_2}{x_1 - x_2}\right) f(x_1) + \left(\frac{x - x_0}{x_2 - x_0}\right)\left(\frac{x - x_1}{x_2 - x_1}\right) f(x_2)$

$P_2'(x) = \frac{F(x_0)}{(x_0 - x_1)(x_0 - x_2)}\left[(x - x_2) + (x - x_1)\right] + \frac{f(x_1)}{(x_1 - x_0)(x_1 - x_2)}\left[(x - x_2) + (x - x_0)\right]$

$+ \frac{f(x_2)}{(x_2 - x_0)(x_2 - x_1)}\left[(x - x_1) + (x - x_0)\right]$

$P_2'(x) = \frac{f(x_0)}{2h^2}\left[(x - x_2) + (x - x_1)\right] + \frac{f(x_1)}{-h^2}\left[(x - x_2) + (x - x_0)\right] + \frac{f(x_2)}{2h^2}\left[(x - x_1) + (x - x_0)\right]$

$P_2'(x_0) = \frac{f(x_0)}{2h^2}\left[x_0 - x_2 + x_0 - x_1\right] + \frac{f(x_1)}{-h^2}\left[x_0 - x_2\right] + \frac{f(x_2)}{2h^2}\left[x_0 - x_1\right]$

$P_2'(x_0) = \frac{-3h\, F(x_0)}{2h^2} + \frac{-2h\, f(x_1)}{-h^2} + \frac{-h\, f(x_2)}{2h^2} = \frac{-3 f(x_0)}{2h} + \frac{4 f(x_1)}{2h} - \frac{f(x_2)}{2h}$

$P_2'(x_0) = \frac{1}{2h}\left(-3 F(x_0) + 4 F(x_1) - f(x_2)\right) = \boxed{\frac{1}{2h}\left(-3 f(x_0) + 4 F(x_0 + h) - f(x_0 + 2h)\right)}$