10.1, #2. $P_n(x) = C_0 + C_1 x + C_2 x^2 + \cdots + C_n x^n$, where $C_j = f^{(j)}(0)/j!$. Now

$$\begin{aligned}
f^{(0)}(x) &= (1+x)^{1/2}, & f^{(0)}(0) &= 1,\\
f^{(1)}(x) &= (1/2)(1+x)^{-1/2}, & f^{(1)}(0) &= 1/2,\\
f^{(2)}(x) &= -(1/2)(1/2)(1+x)^{-3/2}, & f^{(2)}(0) &= -1/4,\\
f^{(3)}(x) &= (3/2)(1/2)(1/2)(1+x)^{-5/2}, & f^{(3)}(0) &= 3/8,\\
f^{(4)}(x) &= -(5/2)(3/2)(1/2)(1/2)(1+x)^{-7/2}, & f^{(4)}(0) &= -15/16.
\end{aligned}$$

Thus

$$\begin{aligned}
P_2(x) &= 1 + (1/2)x - (1/8)x^2,\\
P_3(x) &= 1 + (1/2)x - (1/8)x^2 + (1/16)x^3,\\
P_4(x) &= 1 + (1/2)x - (1/8)x^2 + (1/16)x^3 - (5/128)x^4.
\end{aligned}$$

10.1, #4.

$$\begin{aligned}
f^{(0)}(x) &= (1+x)^{-1}, & f^{(0)}(0) &= 1,\\
f^{(1)}(x) &= (-1)(1+x)^{-2}, & f^{(1)}(0) &= -1,\\
f^{(2)}(x) &= (-1)^2 2!(1+x)^{-3}, & f^{(2)}(0) &= 2!,\\
f^{(3)}(x) &= (-1)^3 3!(1+x)^{-4}, & f^{(3)}(0) &= -3!,\\
&\cdots & &\cdots\\
f^{(n)}(x) &= (-1)^n n!(1+x)^{-n-1}, & f^{(n)}(0) &= (-1)^n n!.
\end{aligned}$$

Thus

$$
\begin{aligned}
P_4(x) &= 1 - x + x^2 - x^3 + x^4, \\
P_6(x) &= 1 - x + x^2 - x^3 + x^4 - x^5 + x^6, \\
P_8(x) &= 1 - x + x^2 - x^3 + x^4 - x^5 + x^6 - x^7 + x^8.
\end{aligned}
$$

10.1, #5. $P_3(x) = P_4(x) = x + x^3/3$, for

$$
\begin{aligned}
f^{(0)}(x) &= \tan x, & f^{(0)}(0) &= 0, \\
f^{(1)}(x) &= \sec^2 x, & f^{(1)}(0) &= 1, \\
f^{(2)}(x) &= 2\sec^2 x \tan x & f^{(2)}(0) &= 0, \\
f^{(3)}(x) &= 4\sec^2 x \tan^2 x + 2\sec^4 x & f^{(3)}(0) &= 2, \\
f^{(4)}(x) &= 8\sec^2 x \tan^3 x + 16\sec^4 x \tan x & f^{(4)}(0) &= 0.
\end{aligned}
$$

10.1, #6. $P_3(x) = P_4(x) = x - x^3/3$, for

$$
\begin{aligned}
f^{(0)}(x) &= \quad \arctan x, & f^{(0)}(0) &= \quad 0, \\
f^{(1)}(x) &= \quad (1+x^2)^{-1}, & f^{(1)}(0) &= \quad 1, \\
f^{(2)}(x) &= -2x(1+x^2)^{-2} & f^{(2)}(0) &= \quad 0, \\
f^{(3)}(x) &= -2(1+x^2)^{-2} + 8x^2(1+x^2)^{-3} & f^{(3)}(0) &= -2, \\
f^{(4)}(x) &= \quad 24x(1+x^2)^{-3} - 48x^3(1+x^2)^{-4} & f^{(4)}(0) &= \quad 0.
\end{aligned}
$$

10.1, #7.

$$
\begin{aligned}
f^{(0)}(x) &= \ln(1+x), & f^{(0)}(0) &= 0,\\
f^{(1)}(x) &= (1+x)^{-1}, & f^{(1)}(0) &= 1,\\
f^{(2)}(x) &= (-1)(1+x)^{-2}, & f^{(2)}(0) &= -1,\\
f^{(3)}(x) &= (-1)^2 2!(1+x)^{-3}, & f^{(3)}(0) &= 2!,\\
&\cdots & &\cdots\\
f^{(n)}(x) &= (-1)^{n-1}(n-1)!(1+x)^{-n}, & f^{(n)}(0) &= (-1)^{n-1}(n-1)!.
\end{aligned}
$$

Thus

$$
\begin{aligned}
P_5(x) &= x - x^2/2 + x^3/3 - x^4/4 + x^5/5,\\
P_7(x) &= x - x^2/2 + x^3/3 - x^4/4 + x^5/5 - x^6/6 + x^7/7,\\
P_9(x) &= x - x^2/2 + x^3/3 - x^4/4 + x^5/5 - x^6/6 + x^7/7 - x^8/8 + x^9/9.
\end{aligned}
$$

10.1, #10.

$$
\begin{aligned}
f^{(0)}(x) &= (1+x)^p, & f^{(0)}(0) &= 1,\\
f^{(1)}(x) &= p(1+x)^{p-1}, & f^{(1)}(0) &= p,\\
f^{(2)}(x) &= p(p-1)(1+x)^{p-2}, & f^{(2)}(0) &= p(p-1),\\
f^{(3)}(x) &= p(p-1)(p-2)(1+x)^{p-3}, & f^{(3)}(0) &= p(p-1)(p-2),\\
f^{(4)}(x) &= p(p-1)(p-2)(p-3)(1+x)^{p-4}, & f^{(4)}(0) &= p(p-1)(p-2)(p-3).
\end{aligned}
$$

Thus

$$
\begin{aligned}
P_2(x) &= 1 + px - p(p-1)x^2/2!,\\
P_3(x) &= 1 + px - p(p-1)x^2/2! + p(p-1)(p-2)x^3/3!,\\
P_4(x) &= 1 + px - p(p-1)x^2/2! + p(p-1)(p-2)x^3/3! - p(p-1)(p-2)(p-3)x^4/4!.
\end{aligned}
$$