1. This problem involves the equation $7 + x = xy + y^2$.

(a) Use implicit differentiation to find y'.

$$\frac{d}{dx}\left[7+x\right] = \frac{d}{dx}\left[xy + y^2\right]$$

$$0 + 1 = 1\cdot y + xy' + 2yy'$$

$$1 - y = xy' + 2yy'$$

$$1 - y = y'(x + 2y)$$

$$\frac{1-y}{x+2y} = y'$$

$$\boxed{y' = \frac{1-y}{x+2y}}$$

(b) Use your answer from (a) to find the slope of the tangent to the equation's graph at $(3, 2)$.

$$y'\Big|_{(x,y)=(3,2)} = \frac{1-2}{3+2\cdot 2} = \boxed{\frac{-1}{7}}$$

2. Use logarithmic differentiation to find the derivative of $y = x^{x-1}$.

$$y = x^{x-1}$$

$$\ln|y| = \ln\left|x^{x-1}\right|$$

$$\ln|y| = (x-1)\ln|x|$$

$$\frac{d}{dx}\left[\ln|y|\right] = \frac{d}{dx}\left[(x-1)\ln|x|\right]$$

$$\frac{y'}{y} = 1\cdot \ln|x| + (x-1)\frac{1}{x}$$

$$y' = y\left(\ln|x| + \frac{x-1}{x}\right) = \boxed{x^{x-1}\left(\ln|x| + \frac{x-1}{x}\right)}$$