1. Use implicit differentiation to find $\frac{dy}{dx}$ for the equation below. Your answer can be left as a function of both $x$ and $y$.

$$y^3 + x^2y^2 = 2x^2 + 2y + 4$$

2. Find $\frac{dy}{dx}$ for the function below. Leave your answer **only** as a function of $x$. (Hint: Logarithmic differentiation)

$$y = x^{\sin x}$$
3. A 13 ft long ladder is leaned up against a wall as shown in the picture on the right. As the bottom of the ladder slides away from the wall, the top slides down the wall. Let $x$ represent the distance the base of the ladder is from the wall, and $y$, the height of the top of the ladder off the ground.

(a) What is an equation relating the distances $x$ and $y$ in the figure? (Hint: The ground, wall, and ladder make up a right triangle)

(b) How high is the top of the ladder off the ground when the base is 5 feet from the wall?

(c) Differentiate your equation in (a) to get a relation between the changes of $x$ and $y$ with respect to time $t$.

(d) If the base of the ladder is sliding away from the wall at a rate of $\frac{dx}{dt} = 2$ ft/s when the base is 5 feet from the wall, how fast is the top sliding down at this moment?