1. Use logarithmic differentiation to find $y'$. Do not simplify your answers. (2.5 pts)
$y = x^{\sqrt{x}}$.

   *Solution*: (This is Example 8 on page 219.)

$$\ln y = \ln \left( x^{\sqrt{x}} \right) = \sqrt{x} \ln x$$

   Differentiating both sides, we have

$$\frac{1}{y} y' = \frac{1}{2\sqrt{x}} \ln x + \sqrt{x} \left( \frac{1}{x} \right)$$
$$y' = y \left[ \frac{1}{2\sqrt{x}} \ln x + \sqrt{x} \left( \frac{1}{x} \right) \right]$$
$$y' = x^{\sqrt{x}} \left[ \frac{1}{2\sqrt{x}} \ln x + \sqrt{x} \left( \frac{1}{x} \right) \right].$$

   □

2. The length of the side of a cube is increasing at a rate of 0.1 m/min. Find the rate that the volume is changing when the side is 2 m. (2.5 pts)

   *Solution*: Let the length of the side of the cube be $x$, and the volume be $V$. Since

$$V = x^3$$

$$\frac{dV}{dt} = 3x^2 \frac{dx}{dt}.$$

   When $x = 2$ and $\frac{dx}{dt} = 0.1$, $\frac{dV}{dt} = 3\,(2)^2\,(0.1) = 1.2\,(m^3/\min)$.     □