1. Find the slope of the tangent line of the curve $\tan^{-1}(x^2y) = \frac{\pi}{2}(x + xy^2)$ at the point (1, 1) on the curve.

2. Find the slope of the tangent line of the curve $y = x \cos x$ at $x = \pi/3$.

3. Suppose the position of a particle moving along the real line is given by $s = t^4 - 4t^3 - 2t^2 + 12t$, $t \geq 0$. Find the interval of time $t$ when the particle is moving in the negative direction.

4. (1) Let $v$ and $s$ be the volume and the surface area of a ball. Express $v$ as a function of $s$. (Hint. If $r$ is the radius of the ball, then $v = \frac{4}{3}\pi r^3$ and $s = 4\pi r^2$. Express $r$ as a function of $s$ from the second equation and put it into the first one.)

(2) Suppose that a balloon is being deflated so that its volume is decreasing with the rate $1 \text{ cm}^3/\text{s}$. Then how fast is the surface area decreasing when the surface area is $400 \text{ cm}^2$?