Show work for all answers.

1. **(6 points)** Given that $xe^y = x - y$, find $\frac{dy}{dx}$ by implicit differentiation.

2. **(4 points)** Calculate $\frac{d}{dt}\frac{\arcsin t}{t^2-1}$

3. **(5 points)** If $f(x) = (\arctan x)\ln(7x^2 - 2)$, determine $f'(x)$.

4. **(5 points)** A cup of just-brewed coffee has temperature of 90°C and is sitting in a 20°C room. After 10 minutes its temperature has dropped to 75°C. Find a formula $f(t)$ for the temperature of the cup of coffee t minutes after brewing.

5. **(2 point bonus)** Given an invertable function $f(x)$ and its inverse $g(y)$, if $f(x_0) = y_0$, find and justify an expression for $g'(y_0)$ in terms of $f'(x_0)$.