1. (2 points) Given that \( w = \left( t^2 + 3 \right)^{\sin t} \), find a formula for \( \frac{dw}{dt} \). Your formula must be written in terms of \( t \).
2. (3 points) Given that $y = \tan^{-1}(xy)$, find a formula for $\frac{dy}{dx}$. Your formula may be written in terms of $x$, $y$, or both variables.
3. (2 points) A rock is thrown upward from the surface of the moon. Between the time that the rock is thrown and the time that the rock hits the ground, the rock’s height is given by the formula \( s(t) = 24t - 0.8t^2 \), where \( t \) is the number of seconds since the rock is first thrown and \( s(t) \) is measured in meters above the moon’s surface.

(a) Find a formula for the rock’s velocity at time \( t \).

(b) Find a formula for the rock’s acceleration at time \( t \).

(c) How fast was the rock moving, and in which direction, at the end of 25 seconds?

(d) What is the rock’s maximum height and at what time does it reach that height?
4. (3 points) The graph of a function $y = f(x)$ has the property that the slope of the tangent line at each point on this graph is equal to one half its $y$-coordinate. If the graph goes through the point $(6, e^5)$, then find a formula for $f(x)$. 
