Problem 1. Differentiate the given functions.

1. $y = \ln\left(\sqrt{x^3 + 1}\right)$.
2. $y = \ln(\csc x)$.
3. $y = \ln(\ln x)$.
4. $y = \ln\left(\dfrac{\tan x}{\sin x}\right)$.
5. $y = \dfrac{2x}{\ln x^2}$.

Problem 2. Use logarithmic differentiation to find derivatives of the following functions.

1. $y = (\sec x)^{\tan x}$.
2. $y = (\ln x)^x$.

Problem 3. Find antiderivatives of the following functions.

1. $f(x) = \dfrac{x}{\sqrt{x}} - \dfrac{3}{x^4} + \dfrac{1}{x\sqrt{x}}$.
2. $g(x) = \dfrac{1}{x^2} + x^3 - \dfrac{\sqrt{x}}{x}$.

Answers on next page

Answers to problem 1.

1. $\dfrac{dy}{dx} = \dfrac{3x^2}{2(x^3+1)}$.
2. $\dfrac{dy}{dx} = -\cot x$.
3. $\dfrac{dy}{dx} = \dfrac{1}{x \ln x}$.
4. $\dfrac{dy}{dx} = \dfrac{\sec^2 x}{\tan x} - \cot x$.
5. $\dfrac{dy}{dx} = \dfrac{\ln x - 1}{(\ln x)^2}$.

Answer to Problem 2.

1. $\dfrac{dy}{dx} = (\sec x)^{\tan x}\left((\sec^2 x).\ln(\sec x) + \tan^2 x\right)$.
2. $\dfrac{dy}{dx} = (\ln x)^x\left(\ln(\ln x) + \dfrac{1}{\ln x}\right)$.

Answers to Problem 3.

1. $F(x) = \dfrac{2}{3}x^{3/2} + \dfrac{1}{x^3} - \dfrac{2}{\sqrt{x}}$.
2. $G(x) = -\dfrac{1}{x} + \dfrac{x^4}{4} - 2\sqrt{x}$.