1. Differentiate the functions.

$$y = (1-x^2)\ln(1+x^2)$$

$$y = \tan\left[\ln(ax+b)\right]$$

$$g(t) = \frac{\ln t}{\arcsin(t^2)+1}$$

2. Newton's Law of Gravitation says that the magnitude F of the force exerted by a body of mass m on a body of mass M is

$$F = \frac{GmM}{r^2}$$

where G is the gravitational constant and r is the distance between the bodies.

(a) Find dF/dr and explain its meaning. What does the minus indicate?

(b) Assume we measure mass in kilograms, distance in meters, and force in Newtons. What are the units of dF/dr?

(c) Find dF/dm and explain its meaning and units.

3. A tank holds 5000 gallons of water which drains from the bottom of the tank in 40 minutes. The volume of water remaining in the tank after t minutes is

$$V = 5000\left(1 - \frac{1}{40}t\right)^2$$

for $0 \leq t \leq 40$. Find the rate at which water is draining from the tank after (a) 5 min, (b) 20 min, and (c) 40 min. Which is fastest/slowest?