Math 151
Quiz 3

Justify all answers with neat and organized work. Clearly indicate your answers. 20 points possible.

1. (5 pts.) Find dy/dx by implicit differentiation.

$$8 \sin x \cos y = 5$$

2. (5 pts.) The **normal line** to a curve C at a point P is, by definition, the line that passes through P and is perpendicular to the tangent line to C at P. Find an equation of the normal line to the parabola $y = 2 - 3x^2$ at the point $(3, -25)$. Sketch the parabola and its normal line.

Recall that two lines with slopes m_1 and m_2 are perpendicular if and only if $m_1 m_2 = -1$; that is, their slopes are negative reciprocals:

$$m_2 = -\frac{1}{m_1}$$

3. (5 pts.) A particle moves according to a law of motion

$$s = f(t) = t^3 - 18t^2 + 96t, \qquad (t \geq 0)$$

where t is measured in seconds and s in meters.

(a) Find the acceleration at time t, and after 3 seconds.

(b) Graph the position, velocity, and acceleration functions for $0 \leq t \leq 8$.

(c) When is the particle speeding up? When is it slowing down?

4. (5 pts.) A plane flying horizontally at an altitude of 2 miles and at a speed of 450 miles per hour passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it is 5 miles away from the station.