Math 140
Exam #2
Summer II '10

Name:

1. [20 pts.] Find the derivative of the function $g(x) = \sqrt{2-3x}$ using the limit definition of derivative. State the domain of the function and the domain of its derivative.

2. [10 pts. each] Differentiate using differentiation formulas.

   (a) $u = \sqrt[5]{t} + 4\sqrt{t^5}$

   (b) $y = \dfrac{t^2+2}{t^4+1}$

   (c) $f(x) = \dfrac{x}{2-\tan x}$

   (d) $g(x) = (4x - x^2)^{100}$

   (e) $y = \sin(x \cos x)$

   (f) $y = \sqrt{x + \sqrt{x}}$

3. [15 pts.] Find the first and second derivatives of the function $H(t) = \tan 3t$.

4. [15 pts.] Find equations of the tangent line and normal line to the curve $y = (1+2x)^2$ at the point $(1, 9)$.

5. [10 pts.] Find dy/dx by implicit differentiation: $x^2y^2 + x\sin y = 4$.

6. [10 pts.] Use implicit differentiation to find an equation of the tangent line to the curve $x^2 + 2xy - y^2 + x = 2$ at the point $(1, 2)$.

7. [15 pts.] The quantity of charge Q in coulombs (C) that has passed through a point in a wire up to time t (in seconds) is given by $Q(t) = t^3 - 2t^2 + 6t + 2$. Find the current when $t = 0.5$ s and $t = 1$ s. (The unit of current is an ampere, where 1 A = 1 C/s.) At what time is the current lowest?

8. [15 pts.] A plane flying horizontally at an altitude of 1 mile and a speed of 500 mi/h passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it is 2 miles away from the station.

9. [15 pts.] Gravel is being dumped from a conveyor belt at a rate of 40 ft^3/min, and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 12 ft high? (A cone with circular base of radius r and height h has volume $V = \frac{1}{3}\pi r^2 h$.)