Math 140
Exam #2 **Name:**
Summer '10

1. $\boxed{\text{15 pts.}}$ Find the derivative of the function $g(x) = \sqrt{1+2x}$ using the limit definition of derivative. State the domain of the function and the domain of its derivative.

2. $\boxed{\text{10 pts. each}}$ Differentiate using differentiation formulas.

   (a) $f(x) = \sqrt{x}(x^2 - 1)$

   (b) $g(x) = \dfrac{r^2}{1+\sqrt{r}}$

   (c) $h(\theta) = \theta \csc\theta - \cot\theta$

   (d) $y = \sqrt[4]{1 + 2x + x^3}$

   (e) $y = \sin(\tan 2x)$

3. $\boxed{\text{10 pts.}}$ Find an equation of the tangent line to the curve $y = x + \cos x$ at the point $(0, 1)$.

4. $\boxed{\text{10 pts.}}$ Find dy/dx by implicit differentiation: $y \cos x = 1 + \sin(xy)$.

5. $\boxed{\text{10 pts.}}$ Use implicit differentiation to find an equation of the tangent line to the curve $2(x^2 + y^2)^2 = 25(x^2 - y^2)$ at the point $(3, 1)$.

6. $\boxed{\text{10 pts. each}}$ If a ball is given a push so that it has an initial velocity of 5 m/s down a certain inclined plane, then the distance it has rolled after t seconds is $s = 5t + 3t^2$.

   (a) What is the velocity of the ball after 2 seconds?

   (b) How long does it take for the velocity to reach 35 m/s?

7. $\boxed{\text{15 pts.}}$ Two cars start moving from the same point. One travels south at 70 mi/h and the other travels west at 42 mi/h. At what rate is the distance between the cars increasing three hours later?

8. $\boxed{\text{15 pts.}}$ Gravel is being dumped from a conveyor belt at a rate of 30 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 $V = \frac{1}{3}\pi r^2 h$.)

9. $\boxed{\text{10 pts.}}$ Find the linearization $L(x)$ of the function $f(x) = 1/\sqrt{2+x}$ at 0.

10. $\boxed{\text{10 pts.}}$ Use an appropriate linearization to estimate the value of $\sin 1^\circ$.