

## Exam 2 -- MTH 229-07

October 29, 2004

*Show your work and/or reasoning on all problems unless otherwise instructed.  
All work must be on separate sheets of paper. Keep this question sheet.*

- (30) **1.** Find the derivative of each function. Treat any letters other than the independent variable as constants. Only obvious simplifications are required in (a)-(c), but complete simplification is required in (d).
- (a)  $f(x) = \sin^2(3x)$                       (b)  $h(x) = \sqrt{e^{mx} + e^{-nx}}$
- (c)  $s(t) = \frac{\tan^{-1}(t)}{1+t^2}$                       (d)  $a(t) = \ln(\sec(t) + \tan(t))$
- (25) **2.** A particle moves on a vertical line so that its coordinate at time  $t$  is given by  $y = te^{-2t}$ ,  $t \geq 0$ .
- (a) Find the velocity and acceleration functions.  
(b) When is the particle moving upward and when is it moving downward?  
(c) When is the particle speeding up and when is it slowing down?
- (20) **3.** A paper cup has the shape of a cone with height 10 cm and radius 3 cm at the top. If water is poured into the cup at a rate of  $2 \text{ cm}^3/\text{sec}$ , how fast is the water level rising when the water is 5 cm deep? (Hint: the volume of a cone is  $1/3$  the volume of a cylinder with the same dimensions.)
- (15) **4.** (a) Write the general formula for a linear approximation.  
(b) Find the linear approximation for  $f(x) = \tan(x)$  at  $x = \pi/4$ .
- (15) **5.** (a) Find a formula for  $y'$  if  $x^4 + 2x^2y^2 + \ln(y) = 3$ .  
(b) Find the slope of the graph of  $x^4 + 2x^2y^2 + \ln(y) = 3$  at the point (1,1).