

Name:

Math 1830- Midterm Exam #2 - October 20, 2006

1. (30 points) Find  $\frac{dy}{dx}$ .

a.  $y = \csc(x)$

b.  $y = \frac{x \sin(x)}{2x^2 - 3}$

c.  $y = \sqrt{\tan(x) + x^3}$

d.  $\sin(xy) = 2x^3 - y^2$

e.  $y = \sin(\sin(x^2))$

f.  $y = (x^2 + 2x + 3)^{10}(6x^3 - \frac{1}{x})^5$

2. (10 points) Find  $y''$  by *implicit differentiation*. Your final answer should be in terms of  $x$  and  $y$ .

$$xy + \frac{1}{y} = 1$$

3. (12 points) A table of values for  $f, g, f'$ , and  $g'$  is given:

$x$	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	3	2	4	6
2	1	8	5	7
3	7	2	7	9

a. If  $h(x) = f(g(x))$ , find  $h'(1)$ .

b. If  $r(x) = g(f(x))$ , find  $r'(1)$ .

c. If  $v(x) = f(x)g(x)$  find  $v'(2)$

d. If  $u(x) = \frac{f(x)}{g(x)}$  find  $u'(3)$ .

4. (8 points) State three ways a function  $y = f(x)$  can fail to be differentiable at  $x = a$ .

5. **(15 points)** An airplane flies at an altitude of 5 miles toward a point directly over an observer. The speed of the plane is 600 miles per hour. Find the rate at which the angle of elevation is changing when this angle is 30 degrees.

6. **(15 points)** Below is sketched the graph of a function  $y = f(x)$ . On the same axes sketch the graph of  $y = f'(x)$ .

7. **(10 points)** Find the equation of the tangent line to the graph of the equation below at the point  $(1, 2)$ :

$$(x^2 + y^2)^4 + 2x = xy + 625$$