MATH 150
Midterm 2, November 3, 2005

Last Name:	
First Name:	
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1. DO NOT LIFT UP THE COVER PAGE UNTIL INSTRUCTED.
2. Circle your instructor. If you don't, you lose a mark.
3. This test is comprised of 8 pages.
4. Once the test begins, please check that all pages are intact.
5. Do ALL questions.
6. Clearly explain your answer. No credit will be given for just writing down the answer.
7. If the answer space provided is not sufficient, write your answer on the back of the previous page. Clearly mark the question number.
8. Ordinary Scientific Calculators ONLY are allowed.
   NO GRAPHING CALCULATORS ALLOWED.

Question	Score	Max
1		7
2		4
3		9
4		6
5		4
Total		30

1) Find the indicated derivatives of the following functions. You do *not* need to simplify your answers.

(1a) (4 marks) y' *and* y'' where $y = e^{\sin(2x)}$

Answer

$y' =$

$y'' =$

(1b) (3 marks) $g'(t)$ where $g(t) = \left(\frac{1}{t+1}\right)^{t^2}, \quad t > 0$

Answer

2) A particle travels along a straight line. The distance s (in metres) the particle is from the origin 0 at time t (in seconds) is given by

$$s(t) \;=\; t^4 - 4t^3 + 2$$

(2a) (1 mark) Find the velocity and acceleration at time t.

Answer

(2b) (3 marks) When is the particle speeding up? When is the particle slowing down?

Answer

3) Consider the curve defined by $x^2 - y^2 = xy + 1$.

(3a) (1 mark) Show that $(1, -1)$ and $(-1, 1)$ lie on the curve.

Answer

(3b) (1 mark) Find another point on the curve *different from* the points in (3a).

Answer

(3c) (3 marks) Use implicit differentiation to find y' and y''. Express your answer in terms of x and y only. You do not need to simplify your answer.

Answer

(3d) (4 marks) Find all points on the curve whose tangent line has slope 1.

Answer

4) (6 marks) You are driving in a car at 60 km/hr towards the place where a rocket has recently been launched. You see the rocket directly in front of you at altitude θ (see diagram). It is travelling at 300 km/hr vertically. When you are 10 km from the launch pad the rocket is at height 30 km. At what rate do you see the altitude of the rocket changing at that time?

Answer

5) (4 marks) Use the linear approximation of $f(x)$ at $x = 3$ to estimate $f(3.05)$ where

$$f(x) \;=\; x\sqrt{8x+1}.$$

Answer