

NAME: \_\_\_\_\_

Panther ID: \_\_\_\_\_

**Exam 2 - MAC 2311**

Fall 2012

**General Directions:** *Read the problems carefully and provide answers exactly to what is requested. Use complete sentences and use notation correctly. Incomprehensible work is worthless. Full credit will be awarded only for work which is both correct and neatly presented. I am grading the work, not just the answer. Don't rush, don't try to do too many steps of a computation at once; work carefully. Good luck!*

1. (18 pts) Find the derivative of each of the following functions. Simplify your answer when possible (6 pts each):

(a)  $y = x^2e^{-3x}$

(b)  $y = \ln(\sec x)$

(c)  $g(x) = x^{\sin x}$

2. (10 pts) Using that  $(\tan x)' = \sec^2 x$ , find, with proof, the formula for

$$(\arctan x)'$$

3. (8 pts) Circle the correct answer:

(a) Suppose that  $f(x)$  is a differentiable function and that  $f'(1) = 3$ . Let  $h(x) = f(x^2)$ . Then  $h'(1) = \dots$

3             $2x$             5            6            0            1

(b) Which of the following is **not** an indeterminate form for a limit:

$1^\infty$              $0 \cdot \infty$              $\frac{0}{0}$              $\frac{\infty}{0}$              $\infty^0$

3. (20 pts) Compute each of the following limits:

(a)  $\lim_{x \rightarrow 0} \frac{\ln(1+x^2)}{1-\cos x}$

(b)  $\lim_{x \rightarrow +\infty} x^{(e^{-x})}$

5. (12 pts) An airplane flying horizontally at an altitude of 3 mi and at a speed of 480 mi/h passes directly above an observer on the ground. How fast is the distance from the observer to the airplane increasing 1 minute later? (*Hint:* Draw a picture.)

6. (12 pts) Verify that the hypothesis of the Mean-Value Theorem are satisfied for the function  $f(x) = \sqrt{9 - x}$  on the interval  $[0, 9]$ , and find the value(s) of  $c$  in the interval that satisfy the conclusion of the Theorem.

7. (14 pts) (a) (8 pts) Find the local linear approximation of the function  $f(x) = \tan x$  at  $x = \pi/4$ .

(b) (6 pts) Use the result of part (a) to estimate  $\tan 44^\circ$ . (Calculator estimates not allowed. Ok, for your answer to contain  $\pi$ .)

8. (16 pts) (a) (10 pts) Find the slope of the tangent line to the curve  $2x^3 + 3xy = y^3$  at the point  $(1, 2)$ .

(b) (6 pts) Find a point (if any) on the curve  $2x^3 + 3xy = y^3$  so that the tangent line to the curve at that point is horizontal.