

Name (Last, First) \_\_\_\_\_ ID # \_\_\_\_\_

Signature \_\_\_\_\_

Lecturer \_\_\_\_\_ Section # \_\_\_\_\_

UNIVERSITY OF MASSACHUSETTS AMHERST  
DEPARTMENT OF MATHEMATICS AND STATISTICS

Math 131

Exam 2

October 31, 2007  
7:00-8:30 p.m.

**Instructions**

- **Turn off all cell phones and watch alarms!** Put away iPods, etc.
- When calculating derivatives in #1–6, do *not* “simplify” your answers. But *do* use enough parentheses to show clearly how expressions are grouped together. For example, do *not* write  $x + 2 \cdot x - 1$  if you really mean  $(x + 2)(x - 1)$ .
- Do *not* use a calculator; do *not* use any “cheat sheet” or other paper.
- Organize your work in an unambiguous order. Show all necessary steps.
- Do all work in this exam booklet. You may continue work to backs of pages and the blank page at the end, but if you do so indicate where.
- Be ready to show your UMass ID card when you hand in your exam booklet.

QUESTION	PER CENT	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
TOTAL	100	

1. (10%) Calculate:

$$\frac{d}{dx} (3x^2 + 3^2) =$$

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2. (10%) Calculate:

$$\frac{d}{dx} \ln(\pi + x^5) =$$

3. (10%) Calculate:

$$\frac{d}{dx} (e^{-x} \cos^2 x) =$$

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4. (10%) Calculate:

$$\frac{d}{dx} \left( \frac{\sqrt[3]{x^2 + 1}}{4x + 5} \right) =$$

5. (10%) Calculate:

$$\frac{d}{dx} (\sqrt{1-x^2} \arcsin x) =$$

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6. (10%) Calculate:

$$\frac{d}{dx} e^{x \ln(\sin x)} =$$

7. (10%) An object is moving along the  $y$ -axis, starting at time  $t = 0$ . Its coordinate  $y(t)$ , in feet, at time  $t$ , in seconds, is

$$y(t) = 17 - 5t + 15t^3.$$

What is the object's *acceleration* when the object is (momentarily) at rest?

8. (10%) Find the **slope** of the the tangent line to the graph of

$$x^3 - x^2y + 3y^3 = 1$$

at the point  $(x, y) = (-1, 1)$ .

9. (a) (2%) Recalling that  $\arctan$  means  $\tan^{-1}$ , that is, “inverse of the tangent function,” simplify:

$$\tan(\arctan x) =$$

- (b) (8%) Starting with the identity you obtained in (a), derive the well-known formula for  $\frac{d}{dx}(\arctan x)$ .

10. (10%) The chemical Agent Q decays at a rate proportional to the mass present. A lab starts with 10 kg of Agent Q. After 5 days only 2 kg remains. How much will remain after a total of 7 days (including the original 5 days)?

(Identify the variables you use! Since you may not use a calculator, leave your answer as an exact quantity)



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