

MATH 2250

Midterm Exam II

November 7, 2013

NAME (please print legibly): _____

Your University ID Number: _____

Please complete all questions in the space provided. You may use the backs of the pages for extra space, or ask me for more paper if needed. This exam will be graded on:

- Correctness of computations.
- Clarity of explanation of procedure.
- Correctness of procedure.

A correct answer obtained using an incorrect or poorly explained procedure will not be graded for full credit. Please feel free to write as much as you like. Work carefully, and try to complete the problems you find easier before going back to the harder ones. Good luck!

Remember that you are strongly encouraged to have a non-graphing calculator to complete the exam. Remember also that smartphone (or computer, or other device) use is **prohibited** on this exam, regardless of what you use it for.

QUESTION	VALUE	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
TOTAL	90	

1. (10 points) Find the derivatives:

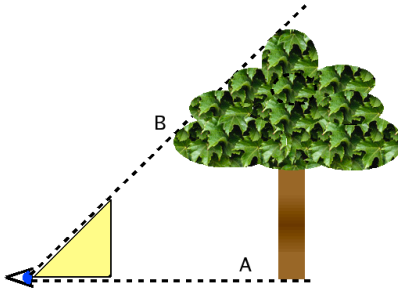
$$\frac{d}{dx} \arcsin(4x) =$$

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

2. (10 points) A NASCAR mechanic is reboring the 6 in deep cylinder of a racing engine using a milling machine which increases the diameter of the cylinder by 0.001 inches every 3 minutes. How fast is the total volume of the cylinder increasing when the radius of the cylinder is 3.5 inches?

ANSWER: _____

3. (10 points)



A surveyor estimates the height of a tall tree by measuring the distance from the base of the tree to her transit level with a tape (marked as distance “A” on the diagram), and measuring the angle θ required to point the level at the top of the tree (this angle shown as the yellow triangle).

Suppose that the distance A is (exactly) 40 feet and the transit measures an angle of 75 degrees ± 1 degree.

- Use trigonometry to compute the measured height of the tree if the angle is exactly 75 degrees.

ANSWER: _____

- Use *linear approximation* to estimate the error in the measurement of the height of the tree caused by the ± 1 degree accuracy of the transit.

ANSWER: _____

4. (10 points) Find the absolute maximum and minimum values of the function

$$f(x) = xe^{-x}, \quad \text{on the interval } [-2, 2].$$

ANSWER: _____

5. (10 points) A function $f(x)$ has

- $f'(x) > 0$ on $(1, 5]$
- $f'(x) = 0$ at $x = 1$
- $f'(x) < 0$ on $[0, 1)$

Is the critical point at $x = 1$ a local *max* for $f(x)$, a local *min* for $f(x)$ or *neither*? Why?

ANSWER: _____

6. (10 points) Your job is to manage the inventory of beige paint at the UGA physical plant warehouse. You know the following facts. The university uses 250 gallons of beige paint per week. The cost of each gallon is \$25. It costs the university \$2 to store a gallon of paint for one week. It costs the university \$50 to have an order of paint (of any size) shipped to the warehouse. When supplies of paint run low, you place an order for q gallons of paint.

It turns out that the average cost per week of buying, shipping, and holding paint is given in terms of the order size q by the equation:

$$A(q) = \underbrace{\$25 \times 250}_{\text{to buy paint}} + \underbrace{\$50 \times \frac{250}{q}}_{\text{to ship } 250/q \text{ orders of paint to UGA}} + \underbrace{\$2 \times \frac{q}{2}}_{\text{to hold an average of } q/2 \text{ gallons of paint until they are used}} .$$

What value for q minimizes the total (average) cost $A(q)$ of buying, shipping, and holding paint?

ANSWER: _____

7. (10 points) Use L'Hôspital's Rule to find the limit

$$\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3} =$$

ANSWER: _____

8. (10 points) Find the antiderivative

$$\int 3 \cos 5x \, dx =$$

ANSWER: _____

9. (10 points) The polynomial equation

$$x^3 + 3.1x^2 - 451.22x + 2663.64 = 0$$

has a small integer solution. Find it using Newton's method.

ANSWER: _____