

REMEMBER!

PLEASE start each problem at the TOP OF A NEW PAGE or the TOP OF NEW SIDE OF A PAGE!

ALSO, please *label* (or underline or box in) your answer. And **NO CALCULATORS!**

Thanks.

NOTE: THERE ARE 11 PROBLEMS AND TWO SIDES TO THIS FINAL EXAM SHEET! TURN THE SHEET OVER FOR THE OTHER PROBLEMS!!!!

1. (10) (*Taken from Midterm I*) Evaluate: $\lim_{x \rightarrow 0} \frac{x + x \cos x}{\sin x \cos x}$.
2. (10) (*Taken from Midterm II*) A baseball is thrown up into the air and the altitude is described by $s(t) = 64t - 16t^2$.
 - (a) How fast is the ball going at 3 seconds after it is thrown?
 - (b) How long does it take to reach half-way to its highest point?
3. (10) (*Taken from Midterm III*) Find $\frac{dy}{dx}$ if $y = (xy)^{1/3}$.
4. (10) (*Taken from sample final*) The cross section of an artery can be imagined to be a circle. Suppose the radius of a given artery is 1.5 cm and that fatty deposits are being uniformly built up inside the artery at the rate of 0.2 cm per month. When the deposit is 0.4 cm thick, at what rate is the cross-sectional area of the artery opening changing?
5. (12) A window is in the form of a rectangle surmounted by a semicircle. THE TOTAL PERIMETER IS FIXED, I.E., A CONSTANT. Find the length and the width of the rectangle section that gives the complete window the largest area.

($\Rightarrow$ Remainder of exam on other side!!!)

6. (12) A certain county fair charges \$10.00 as the entrance fee and the attendance averages about 5,000 visitors per day. Comparing records with previous years, it was determined that an increase of \$1.00 would lead to a decrease of about 200 visitors. Each visitor spends an average of \$10 for food, drink, and miscellaneous. Using Calculus techniques, determine what entrance fee should be charged to maximize revenue.
7. (12) A ladder 10 feet tall is resting against a vertical wall. The bottom of the ladder starts slipping away from the wall at a constant rate of 1 foot per second. How fast is the top of the ladder sliding down the wall when the bottom of the ladder is 6 feet away from the wall?
8. (20) Find $\frac{dy}{dx}$
- (a) $y = (\ln x)^{\sin x^2}$
- (b) $y = (e^{3x^2})(\arcsin x^2)$
9. (10) Given $y^2 = xy + 3x$, find the equation of the tangent line at $(4, -2)$.
10. (10) Find the linearization $L(x)$ of $f(x) = (x^2 - 1)^{-2}$ at $x = 2$.
11. (9) Given the general Newton's Method formula of $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$, given $x_0 = 1$ and $f(x) = 5x - x^2 - 6$, find x_2 .

125 points total

P.S. Have a restful spring break!