CALCULUS I
Final Exam, Wednesday, April 27, 2016

Name (Print last name first): ....

Instructor: ....

$\boxed{\textbf{Show all your work and justify your answer!}}$

$\boxed{\textbf{No partial credit will be given for the answer only!}}$

$\boxed{\textbf{PART I}}$

You must simplify your answer when possible but don't simplfiy numbers!
All problems in Part I are 6 points each.

1. Use the defintion of the derivative to show that $(x^2)' = 2x$.

2. Find the derivative of $f(x) = x\cos(x)$.

3. Find the derivative of $f(x) = \sin(x^5)$.

4. Find the derivative of $f(x) = \dfrac{x^3 + 1}{x^3 - 1}$.

5. Find the derivative of $f(x) = \displaystyle\int_0^x e^{t^2}\, dt$.

6. Evaluate $\int x^2(x+1)\,dx$.

7. Evaluate $\displaystyle\int \frac{x^3 - 1}{x}\,dx$.

8. Evaluate $\displaystyle\int x^2\,e^{x^3}\,dx$.

9. Use a Riemann sum with 3 terms and the midpoint rule to approximate the value of $\int_1^3 \sin(x^2)\, dx$. [You do not need to multiply and add the resulting sum of numbers!]

10. Use Newton's method to compute the second approximate solution to the equation
$$f(x) = \sin(x) - \frac{x}{3} = 0$$
if the first approximate solution $x_1 = 2$.

PART II

All problems in Part II are 10 points each.

1. Evaluate $\displaystyle\int_1^2 \frac{\sin(\sqrt{x})}{\sqrt{x}}\, dx$

2. Find the absolute maximum and minimum of the function

$$f(x) = x\, e^x$$

on the interval $[-2, 1]$.

3. Graph the function $f(x) = x\,(x+1)^2$. Indicate x and y intercepts, horizontal and vertical asymptotes (if any). Find intervals where the function is in-/de-creasing and mark any Local/Absolute Max/Min on the graph.

   You can use decimal numbers and your calculator to compute approximate values–additional scratch paper is on the back of the last page.

   Use the coordinate system on the next page to draw your graph.
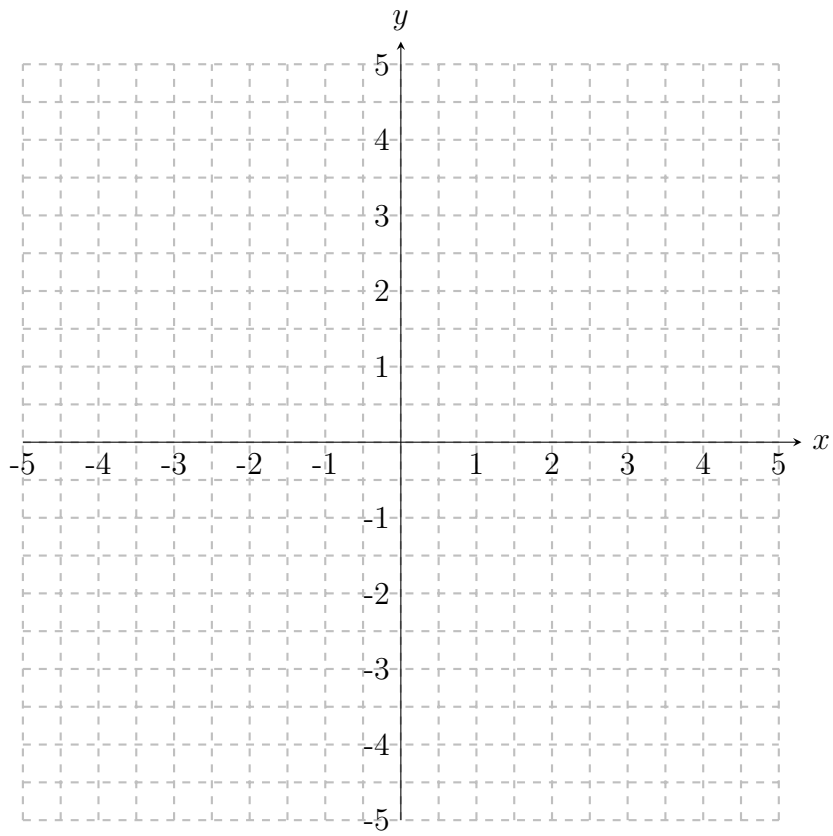
4. Suppose you want to make an open box out of a piece of card board by cutting small squares at the four corners and folding up the sides. If the piece of card board is a square whose sides are $1\ m$. long, how big a square should you cut from the corners to maximize the volume of the box?

Scratch Paper