

Math 122D

SECOND HOUR EXAM

NAME _____

General Notes:

1. Show work.
2. Look over the test first, and then begin.
3. No calculators on this exam.

Friday, Oct 21, 2005
100 pts.

I. Differential equations

1. (10 pts.) Find a family of solutions to the differential equation $\frac{dy}{dx} = \frac{x}{y}$. Verify that your solution is correct.

II. Mean Value Theorem

1. (10 pts.) Verify the mean value theorem for integration for the function $y = x^3$ for $0 \leq x \leq 1$. Your answer should be a number in the interval.

III. Numerical analysis

1. (15 pts.) Use Simpson's rule with $n = 4$ to approximate $\int_0^1 x^2 dx$. Carry your answer to the point where only numbers remain.

2. (5 pts.) The error term for the trapezoid rule is $\frac{(b-a)^3}{12n^2} M$ where M is the maximum value of the second derivative on the interval $[a, b]$. What does this mean?

IV. Volumes.

1. (15 pts.) The area between the curves $y = x$ and $y = x^2$ is rotated about the x axis. Use the method of disks to compute the volume of the resulting solid.

III. Polar coordinates

1. (10 pts.) Convert
 - a. Polar coordinates $(2, \pi/6)$ to rectangular (x,y) coordinates.

 - b. Rectilinear coordinates $(1, \sqrt{3})$ to polar coordinates.

2. (15 pts.) Use integration in polar coordinates to find the area enclosed by $r = 2 - 2\cos(\theta)$ and $r = 2 - 2\cos(\theta)$ for $0 \leq \theta \leq \pi$.

VI. Arc length and surface area. In the following carry out your work to the point that only the integration is left to do.

1. (10 pts.) Find the arc length of the curve $y = e^x$ for $0 \leq x \leq 1$

2. (10 pts.) Find the surface area generated by the curve $y = e^x$ for $0 \leq x \leq 1$ rotated about the x-axis.