

MATH 152

Spring 1997

Exam II — 202 points

Test Form A

NAME

LAST

FIRST

ID#

INSTRUCTOR'S NAME

SECTION #

INSTRUCTIONS

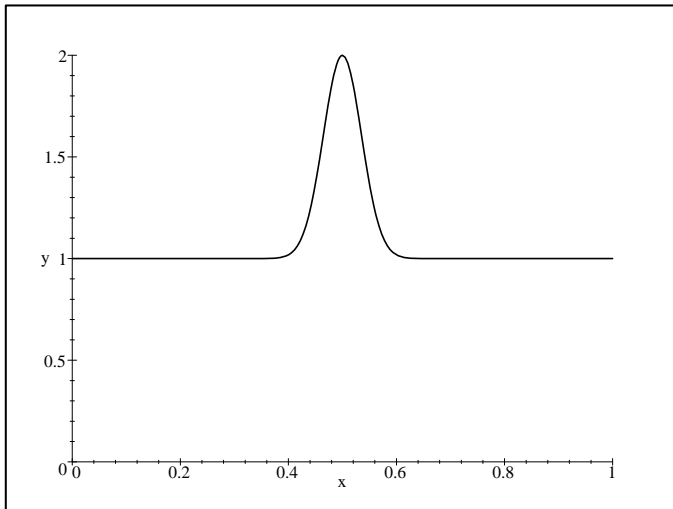
1. In Part I (Problems 1–10), mark the correct choice on your SCANTRON sheet using a #2 pencil. For your own records, record your responses on your exam (which will be returned to you). The SCANTRON will be collected after 1 hour and will not be returned. Calculators may not be used for this part.
2. In Part II (Problems 11–16), write all solutions in the space provided. CLEARLY INDICATE YOUR FINAL ANSWER. Calculators may be used for this part.

Part I. MULTIPLE CHOICE, NO PART CREDIT, NO CALCULATORS

The SCANTRON forms will be collected at the end of 1 hour. Each question is worth 10 points.

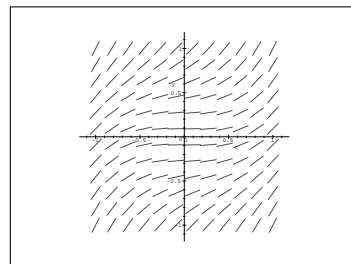
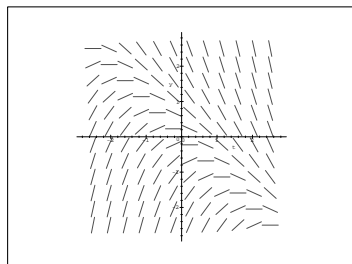
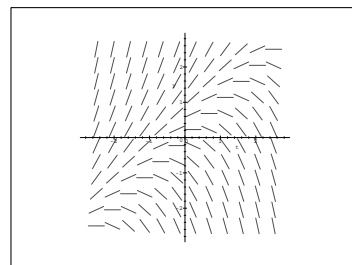
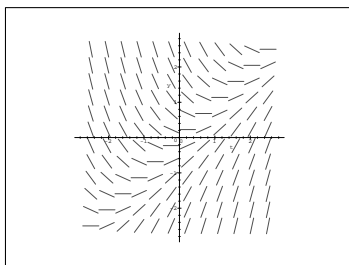
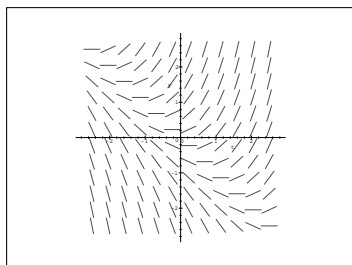
Part I - Multiple Choice

1. A plot of the graph of a function f on the interval $0 \leq x \leq 1$ is given below. Which of the following statements concerning the average value of f over this interval is correct?



- a) The average $= 3/2$ b) The average $< 3/2$ c) The average $> 3/2$
d) Not enough information to determine e) None of these
2. Solve the differential equation $\frac{dy}{dx} = \frac{e^x}{2y}$ for $y > 0$.
- a) $y = e^x$ b) $y = \sqrt{Ce^x}$ c) $y = \frac{1}{2}e^x + C$
d) $y = \sqrt{xe^x + C}$ e) $y = \sqrt{e^x + C}$

3. Which of the following figures represents the direction field for the differential equation $\frac{dy}{dx} = x - y$?



4. Solve the initial value problem $x \frac{dy}{dx} - 3y = x^2$, $y(1) = 1$.

- a) $y = \frac{x^3}{3} + \frac{2}{3}e^x$ b) $y = \frac{x^3}{4} + \frac{3}{4x}$ c) $y = \frac{-1}{3} + \frac{4}{3}e^{x^3}$
d) $y = -x^2 + 2x^3$ e) $y = xe^{3x} + 1$

5. Set up the integral that will compute the arclength of the curve $y = e^x \sin x$ from $(0,0)$ to $(\pi/2, e^{\pi/2})$.

- a) $\int_0^{\pi/2} \sqrt{e^{2x} + 2e^{2x} \cos x \sin x + 1} dx$ b) $\int_0^{\pi/2} \sqrt{e^{2x} \sin^2 x + 1} dx$ c) $\int_0^{\pi/2} \sqrt{e^{2x} \cos^2 x + 1} dx$
d) $\int_0^{\pi/2} \sqrt{e^{2x} + \sin^2 x + 1} dx$ e) $\int_0^{\pi/2} \sqrt{e^{2x} + \cos^2 x + 1} dx$

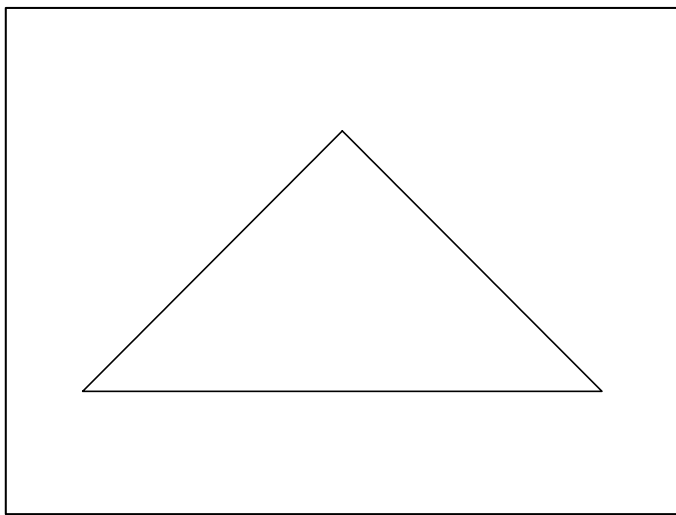
6. Set up the integral that will compute the area of the surface obtained by revolving the curve $x = (y - 1)^2$ from $(0, 1)$ to $(1, 2)$ about the y -axis.

a) $\int_1^2 \sqrt{1 + 4(y - 1)^2} dy$ b) $\int_0^1 2\pi(x - 1)^2 \sqrt{1 + 4(x - 1)^2} dx$ c) $\int_0^1 \sqrt{1 + 4(x - 1)^2} dx$
d) $\int_1^2 2\pi(y - 1)^2 \sqrt{1 + 4(y - 1)^2} dy$ e) $\int_1^2 \pi(y - 1)^4 dy$

7. The equation $x^2 + z^2 = 4$ represents what kind of region in three dimensional space R^3 ?

a) a circle of radius 2 b) a sphere of radius 2 c) a cylinder of radius 2 d) a parabola e) a line

8. Describe the vector **C** in terms of the vectors **A** and **B**.



a) **A + B** b) **A/B** c) **B - A** d) **A · B** e) **A - B**

9. Which of the following equations represents a plane in R^3 that is parallel to the x -axis and which contains the points $(0, 2, 0)$ and $(0, 0, 2)$?

a) $y + z = 2$ b) $x + z = 2$ c) $x + y = 2$ d) $x + y + z = 2$ e) $x - y + z = 2$

10. A force of 20 lbs is required to hold a spring that has been stretched from its natural length of 2 feet to a length of 4 feet. Which of the following integrals represents the work done by stretching this spring from its natural length to a length of 4 feet?

a) $\int_0^4 20x \, dx$ b) $\int_0^2 20x \, dx$ c) $\int_0^2 10x \, dx$ d) $\int_0^4 10x \, dx$ e) $\int_2^4 5x \, dx$

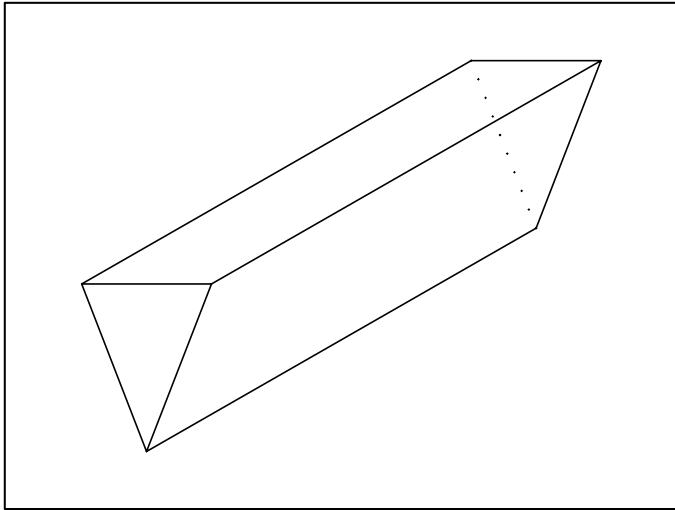
Part II. WORK OUT PROBLEMS, PART CREDIT may be given. CALCULATORS ARE PERMITTED after the SCANTRONS are collected.

Show all relevant steps in your solution. Clearly indicate your answer. Unsupported answers will not be given credit. Only work shown in the space provided will be graded. Clearly indicate your final answer. Each question is worth 17 points.

11. Solve the following initial value problem: $\frac{dy}{dt} + y = t$, $y(0) = 1/2$.

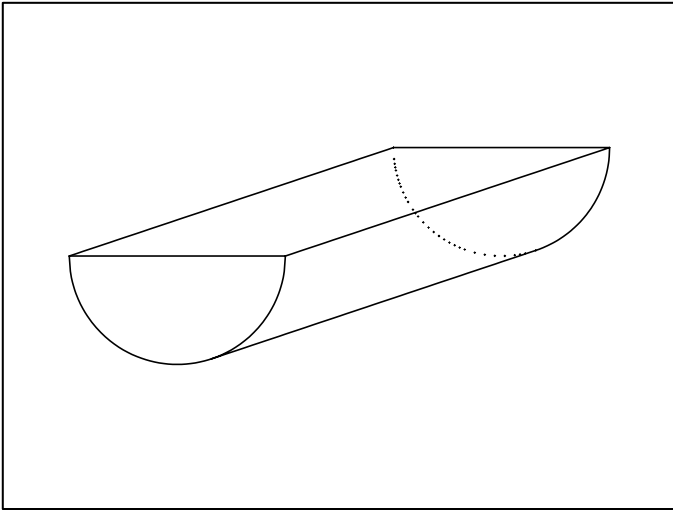
12. A tank contains 100 liters of salt water solution with 20 kg of dissolved salt. Salt water with a concentration of 3/10 kg per liter enters the tank at time $t = 0$ at the rate of 10 liters per minute. Well-stirred solution in the tank exits the tank at the same rate. Find the amount of the salt in the tank t minutes later.

13. A trough is 10 feet long with triangular ends that are 3 feet wide at the top and six feet tall. If the trough is full of water, find the amount of work required to pump the water out over the top of trough. The weight density of water is 62.5 lbs per cubic foot.



14. Find the center of mass of the system of objects that have masses 2 kg, 5 kg, 1 kg located at the points (1,2), (3,1), (4,3), respectively.

15. A trough is 10 feet long with semicircular ends of radius 1 foot. If the trough is full of water then *set up* the integral needed to compute the hydrostatic force on one end of the trough. You do NOT have to compute this integral.



16. Find the centroid (center of mass) of the quarter circular region in the first quadrant that is bounded by the x - and y - axes and the circle of radius one centered at the origin.