136.171 Test #1 – 12 February 2004

Time: 60 minutes

Instructor (please check one): Dr. T. G. Berry
Dr. K. Kopotun

NAME: _____ I.D.#: _____

INSTRUCTIONS:

1. Calculators are NOT permitted.
2. No aids are permitted EXCEPT for ONE INFORMATION PAGE (one side only, hand-written, bearing your name and student identification number).
3. ATTEMPT ALL PROBLEMS.
4. TOTAL MARKS: 50.

Problem	Mark
1	/10
2 (a)	/5
2 (b) (i)	/4
2 (b) (ii)	/5
2 (b) (iii)	/6
2 (b) (iv)	/5
3 (i)	/7
3 (ii)	/8

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10 1. Evaluate the integral

$$\int_0^3 \left(\frac{y^2 + 2y}{\sqrt{y+1}} \right) dy$$

simplifying your answer as much as possible. SHOW ALL YOUR WORK.

2. Consider the region R in the xy-plane bounded by the curves

$$x + y = 1 \text{ and } x = 2 - (y-1)^2 .$$

5 (a) Find the points of intersection of the above two curves, and sketch a graph of the region R.

problem 2 continued on next page

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(b) Using the diagram you have drawn on the previous page, set up, BUT DO NOT EVALUATE, all integrals necessary to evaluate the following physical quantities:

4 (i) the AREA of R :

5 (ii) the VOLUME of the solid of revolution obtained when R is revolved ABOUT THE LINE $y = 3$:

6 (iii) the FIRST MOMENT (OF MASS) of a thin plate of constant density ρ occupying R (i.e., lying in and completely covering R) ABOUT THE LINE $x = 5$:

5 (iv) the LENGTH of that portion of the boundary curve $x = 2 - (y-1)^2$ lying between the two points identified in part (a):

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3. A cylindrical oil drum of radius 0.5 metres and height 1.5 metres lies flat on its side on level ground. The drum is full of oil, having density of 920 kg./m.^{3}. Set up, BUT DO NOT EVALUATE, all integrals necessary to evaluate the following physical quantities. CLEARLY IDENTIFY THE COORDINATE SYSTEM USED.

7 (i) the MAGNITUDE OF THE TOTAL FLUID FORCE exerted on one of the circular ends of the drum by the oil in the drum:

8 (ii) the (MINIMUM) TOTAL WORK DONE to pump the oil from the drum to a height of 1 metre above the top edge of the drum [you may ignore all frictional and viscous forces]:

Total
50