

136.171 Test #1

Tuesday 7 February 2006 (5:30-6:30 pm)

Time: 60 minutes

Name: _____ ID#: _____

INSTRUCTOR (please check one): ☐ BERRY (L01) ☐ KOPOTUN (L02)

VALUE

- [10] 1. Evaluate the integral $\int_{\sqrt{2}}^{\sqrt{7}} \frac{x^3}{\sqrt{x^2+2}} dx$ (SHOW ALL YOUR WORK AND SIMPLIFY YOUR ANSWER!)

- [4] 2. Set up (BUT DO NOT EVALUATE) integrals to determine the following physical quantities:

(a) The AREA of the region enclosed by the curves $x = 0$, $y = e^x$ and $y = e^{2x} - 2$:

- [5] (b) The LENGTH of that portion of the curve given by $x = y(y-1)$ which lies between the points $(0,0)$ and $(12,-3)$:

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Set up (BUT DO NOT EVALUATE) integrals to determine the following physical quantities (continued):

- (c) The VOLUME of the solid of revolution obtained when the disk enclosed by $x^2 + \frac{y^2}{4} = 1$ is revolved ABOUT THE LINE $y = 2$, using

[5] (i) the “washers” method :

[6] (ii) the “cylindrical shells” method :

- [5] (d) The minimum amount of WORK DONE to pump the oil, having a constant density ρ [kilograms per cubic metre] from a right circular conical tank (with horizontal planar top) of height 1 metre and radius 1 metre, to a height 1 metre above the top of the tank. [You may ignore frictional forces.]:

- [5] (e) The TOTAL FLUID FORCE exerted on one face of a circular plate, of radius 1 metre, which is immersed vertically into a fluid of density ρ [kilograms per cubic metre] so that its top edge is 1 metre below the surface of the fluid: