CALCULUS 3 EXAM 3

SPRING 2005

NAME_____

REC. INSTR._____

REC. TIME_____

TO RECEIVE CREDIT YOU MUST SHOW YOUR WORK

(15) 1. Use a triple integral to find the volume of the 3D-region which is enclosed by the surfaces $y = x^2$, $y = 2x$, $z = x$, and $z = 4$.

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(15) 2. A mass distribution occupies the 3D-region which is enclosed by the surfaces $z = x^2 + y^2$ and $z = 4$. the mass density function is $\delta = 2z$ units of mass/unit volume. Find the total mass in the region.

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(15) 3. A mass distribution occupies the 3D-region which is enclosed by the surfaces $z = (x^2 + y^2)^{\frac{1}{2}}$ and $z = 2$. The mass density function is $\delta = x^2 + y^2 + z^2$ units of mass /unit volume.

Use a triple integral in <u>spherical coordinates</u> to find the total mass in the region.

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(10) 5. Show that the force field $\mathbf{F} = (2xy + 2)\,\mathbf{i} + (x^2 + y^{-1})\,\mathbf{j}$ is conservative in the region $y > 0$ by finding a potential function for it. Then use this potential function to calculate the work done by $\mathbf{F}$ as it acts on an object which moves in the upper half plane from (0,2) to (2,1).

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(15) 6. The force field $\mathbf{F} = y^2\,\mathbf{i} + x\,\mathbf{j}$ acts on an object as it moves in the plane. Calculate the work done by $\mathbf{F}$ as the object moves from (5,0) to (-4,3) along the parabola $x = 5 - y^2$.