MATH 2415	Calculus III SI Session	11/16/2011
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Wednesdays Rm 1245		03:00 PM - 05:00 PM and 05:00 PM - 07:00 PM

1. Find an equation in spherical coordinates for the equation given in rectangular coordinates.
   (a) $z = 2$ (b) $x^2 + y^2 - 3z^2 = 0$ (c) $x = 10$ (d) $x^2 + y^2 + z^2 - 9z = 0$

2. Find an equation in rectangular coordinates for the equation given in spherical coordinates, and describe its graph.
   (a) $\theta = \frac{3\pi}{4}$ (b) $\phi = \frac{\pi}{2}$ (c) $\rho = 3\sec(\phi)$ (d) $\rho = 4\csc(\phi)\sec(\theta)$

3. Let V be the volume of the solid inside the sphere $x^2 + y^2 + z^2 = 4$ and below the plane $z = -1$. Express V as an integral in (a) cylindrical coordinates and (b) spherical coordinates.

4. Let Q be the solid inside the sphere $x^2 + y^2 + z^2 = 4$ and outside the cylinder $x^2 + y^2 = 1$. Express the volume of Q as an iterated integral in in (a) cylindrical coordinates and (b) spherical coordinates.

5. Rewrite the integral $\int_0^4 \int_0^{y/2} \int_0^{y-2x} xyz\,dz\,dx\,dy$ as an iterated integral in the order $dy\,dz\,dx$.

6. Let Q be the wedge in the first octant cut from the cylinder $y^2 + z^2 = 1$ by the planes $y = x$ and $x = 0$. Express $\int\int\int z\,dV$ as a triple iterated integral.

7. Evaluate the integral $\int_{-1}^3 \int_y^3 \int_{2z}^{2y-z} z\,dx\,dz\,dy$.

8. A thin plate has the shape of the triangular region D with vertices $(0, 0)$, $(1, 0)$, $(0, 1)$. If the density of D at the point (x, y) is $\delta(x, y) = xy$, calculate the mass of D.

9. Find the divergence for the vector field $\mathbf{F}$.
   (a) $\mathbf{F}(x, y, z) = x\,e^x\,\hat{i} + y\,e^y\,\hat{j}$ (b) $\mathbf{F}(x, y, z) = \ln(x^2 + y^2)\hat{i} + xy\hat{j} + \ln(y^2 + z^2)\hat{k}$

10. Find $\operatorname{curl}\mathbf{F}$ for the vector field at the given point.
    (a) $\mathbf{F}(x, y, z) = x^2z\hat{i} - 2xz\hat{j} + yz\hat{k}$, $(2, -1, 3)$ (b) $\mathbf{F}(x, y, z) = e^{-xyz}(\hat{i} + \hat{j} + \hat{k})$, $(3, 2, 0)$

11. Determine if the following vector field is conservative by finding a potential function.
    (a)$\mathbf{F}(x, y) = (2x - y^2, y^3 - 2xy)$ (b) $\mathbf{F}(x, y, z) = y^2z^3\hat{i} + 2xyz^3\hat{j} + 3xy^2z^2\hat{k}$