1-9	/54
10	/20
11	/20
12	/ 6
Total	/100

Name_________________________

MATH 251 Exam 2 Fall 2012

Sections 515 P. Yasskin

Multiple Choice: (6 points each. No part credit.)

1. Compute $\int_0^3 \int_y^3 4x^2\, dx\, dy$.

a. 81

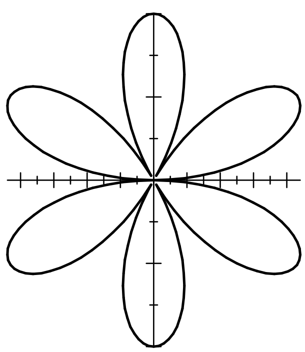
b. 72

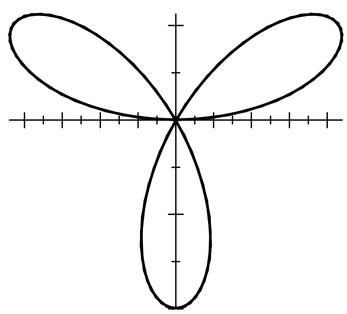
c. 60

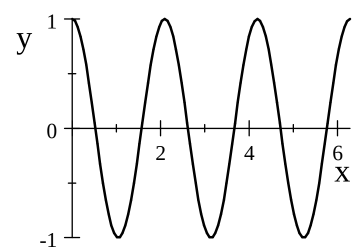
d. 48

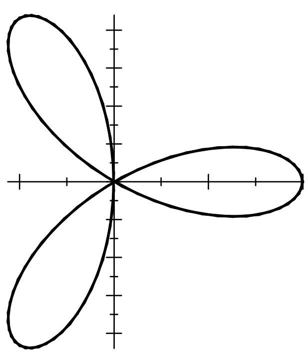
e. 32

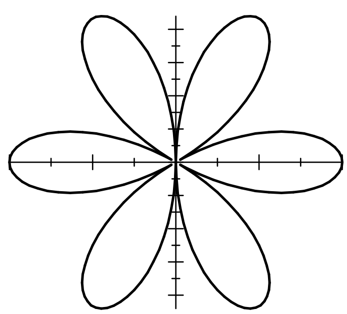
2. Which of the following is the polar plot of $r = \cos(3\theta)$?

a. 

b. 

c. 

d. 

e. 

3. Find the mass of a triangular plate whose vertices are $(0,0)$, $(1,0)$ and $(1,3)$, if the density is $\rho = 2x$.

a. 1

b. 2

c. 3

d. 4

e. 5

4. Find the x-component of the center of mass of a triangular plate whose vertices are $(0,0)$, $(1,0)$ and $(1,3)$, if the density is $\rho = 2x$.

a. $\frac{1}{4}$

b. $\frac{1}{2}$

c. $\frac{3}{4}$

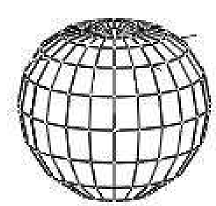
d. $\frac{3}{2}$

e. 3

5. The surface of an apple is given in spherical coordinates by

$$\rho = 3 - 3\cos\varphi$$

Its volume is given by the integral:



a. $V = \int_0^{2\pi}\int_0^{\pi/2}\int_0^{3-3\cos\varphi} 1\,d\rho\,d\varphi\,d\theta$

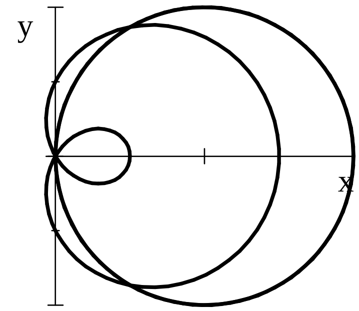
b. $V = \int_0^{2\pi}\int_0^{\pi}\int_0^{3-3\cos\varphi} 1\,d\rho\,d\varphi\,d\theta$

c. $V = \int_0^{2\pi}\int_0^{\pi/2}\int_0^{3-3\cos\varphi} \rho^2\sin\varphi\,d\rho\,d\varphi\,d\theta$

d. $V = \int_0^{2\pi}\int_0^{\pi}\int_0^{3-3\cos\varphi} \rho^2\sin\varphi\,d\rho\,d\varphi\,d\theta$

e. $V = \int_0^{2\pi}\int_0^{\pi}\int_0^{1}(3-3\cos\varphi)\rho^2\sin\varphi\,d\rho\,d\varphi\,d\theta$

6. Find the area inside the circle $r = 4\cos\theta$ and outside the limacon $r = 1 + 2\cos\theta$.



a. $4\pi - \sqrt{3}$

b. $\frac{5\pi}{3} + \frac{\sqrt{3}}{2}$

c. $2\pi + \frac{\sqrt{3}}{2}$

d. $\frac{5\pi}{3} - \frac{\sqrt{3}}{2}$

e. $2\pi - \frac{\sqrt{3}}{2}$

7. Hyperbolic coordinates in quadrant I are given by $u = \sqrt{\frac{y}{x}}$ and $v = \sqrt{yx}$. So the area element is $dA = dx\,dy =$

a. $-2\frac{v}{u}\,du\,dv$

b. $2\frac{v}{u}\,du\,dv$

c. $-2\frac{u}{v}\,du\,dv$

d. $2\frac{u}{v}\,du\,dv$

e. $2\frac{u^2}{v^2}\,du\,dv$

8. If $\vec{F} = (xe^{yz}, ye^{xz}, ze^{xy})$, then $\vec{\nabla} \cdot \vec{\nabla} \times \vec{F} =$

a. $2ze^{xy} - 2xe^{yz} - 2xyze^{xy} + 2xyze^{yz}$
b. $2ze^{xy} + 2xe^{yz} - 2xyze^{xy} - 2xyze^{yz}$
c. $2ze^{xy} - 2xe^{yz} + 2xyze^{xy} - 2xyze^{yz}$
d. $2ze^{xy} + 2xe^{yz} + 2xyze^{xy} + 2xyze^{yz}$
e. 0

9. If $f = \sin(x - y)$, then $\vec{\nabla} \cdot \vec{\nabla} f =$

a. $2\sin(x - y)$
b. $-2\sin(x - y)$
c. $2\cos(x - y)$
d. $-2\cos(x - y)$
e. 0

Work Out: (Points indicated. Part credit possible. Show all work.)

10. (20 points) Compute $\int\int \vec{\nabla} \times \vec{F} \cdot d\vec{S}$ for the vector field $\vec{F} = (yz, -xz, z^2)$ over the cone $z = 9 - \sqrt{x^2 + y^2}$ for $z \geq 5$ oriented down and in.

Note: The cone may be parametrized as $\vec{R}(r,\theta) = (r\cos\theta, r\sin\theta, 9 - r)$.

11. (20 points) Compute $\iiint \vec{\nabla} \bullet \vec{F}\, dV$ for the vector field $\vec{F} = (x^3, y^3, x^2 z + y^2 z)$ over the solid region below the paraboloid $z = 9 - x^2 - y^2$ and above the plane $z = 5$.

12. (6 points) At the right is the contour plot of a function $f(x,y)$. If you **start** at the dot at $(5,6)$ and move so that your velocity is always in the direction of $\vec{\nabla} f$, the gradient of f, roughly sketch your path on the plot.

NOTE : The numbers on the right are the values of f on each level curve.