1-8	/48
9	/12
10	/20
11	/20
Total	/100

Name__________________________ Section_____________

MATH 253 Exam 2 Fall 2012

Sections 201-202 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

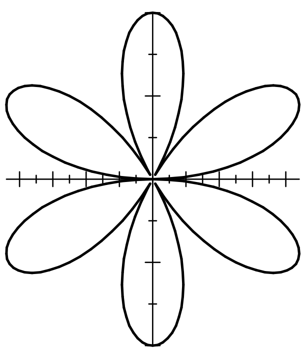
c. 60

d. 48

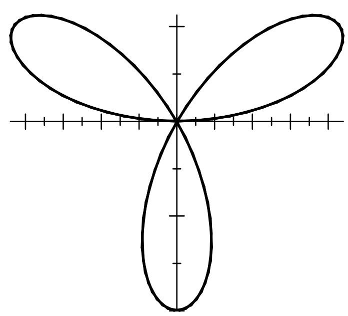
e. 32

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

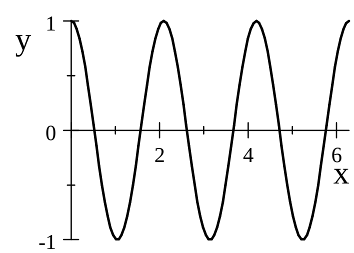
a.



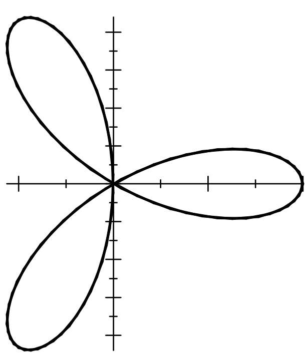
b.



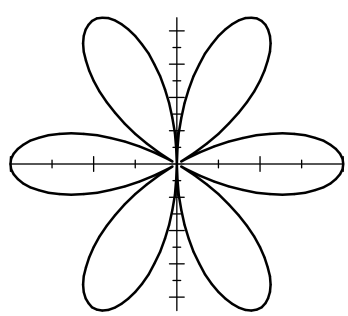
c.



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. $\frac{3}{4}$

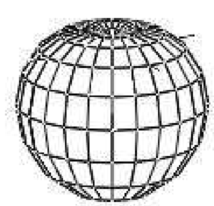
d. $\frac{3}{2}$

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

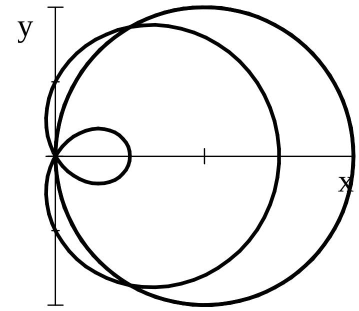
b. $V = \int_0^{2\pi}\int_0^{\pi}\int_0^{3-3\cos\varphi} 1\,d\rho\,d\varphi\,d\theta$

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. $\dfrac{5\pi}{3} + \dfrac{\sqrt{3}}{2}$

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

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

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

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

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

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

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

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

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

8. 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.)

9. (12 points) Determine whether or not each of these limits exists. If it exists, find its value.

a. $\lim_{(x,y)\to(0,0)} \dfrac{3x^2y^2}{x^6 + 3y^3}$

b. $\lim_{(x,y)\to(0,0)} \dfrac{xy^2}{x^2 + y^2}$

10. (20 points) Compute $\iint \vec{\nabla} \times \vec{F} \cdot d\vec{S}$ 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 $\iiint \vec{\nabla} \cdot \vec{F}\, dV$ 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 $z = 5$.