

Name \_\_\_\_\_

MATH 251      Exam 1A      Fall 2016

Sections 504      P. Yasskin

Multiple Choice: (7 points each. No part credit.)

1-9	/63
10	/20
11	/20
Total	/103

1. Find the distance from the point  $\langle 3, 4, 12 \rangle$  to the sphere  $x^2 + y^2 + z^2 = 64$ .

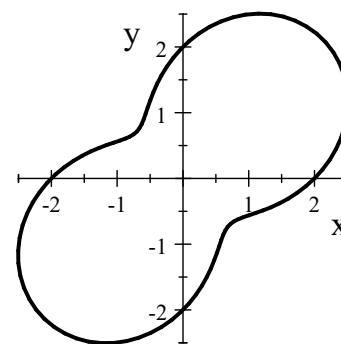
- a. 1
- b. 5
- c. 8
- d. 13
- e. 105

2. Find  $a$  and  $b$  so that  $a(1,2) + b(2,1) = (0,3)$ . What is  $a + b$ ?

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5

3. The plot at the right is which polar curve?

- a.  $r = 2 - \cos(2\theta)$
- b.  $r = 2 + \cos(2\theta)$
- c.  $r = 2 - \sin(2\theta)$
- d.  $r = 2 + \sin(2\theta)$
- e.  $r = \theta$



4. Find a vector perpendicular to the plane thru the points  $P = (2, 3, 0)$ ,  $Q = (4, -1, -1)$  and  $R = (2, 0, 2)$ .
- a.  $\langle 11, -4, -6 \rangle$
  - b.  $\langle -11, 3, -2 \rangle$
  - c.  $\langle -11, -4, -6 \rangle$
  - d.  $\langle -11, -3, -2 \rangle$
  - e.  $\langle -11, 4, -6 \rangle$
5. A triangle has vertices at  $P = (1, 0, 4)$ ,  $Q = (1, 0, 2)$  and  $R = (2, \sqrt{3}, 0)$ . Find the angle at  $Q$ .
- a.  $30^\circ$
  - b.  $45^\circ$
  - c.  $60^\circ$
  - d.  $120^\circ$
  - e.  $135^\circ$
6. Find the plane tangent to the graph of the function  $z = f(x, y) = x^2 \sin(y) + x \cos(y)$  at the point  $(x, y) = (2, \pi)$ . Its  $z$ -intercept is
- a.  $4\pi$
  - b.  $2\pi$
  - c.  $2$
  - d.  $-2\pi$
  - e.  $-4\pi$

7. A plane is flying from WEST to EAST, directly over the equator at a constant altitude of 100 kilometers above sea level. (Since the Earth is a sphere, the path of the plane is part of a great circle.) In what direction do  $\hat{N}$  and  $\hat{B}$  point?
- $\hat{N}$  points SOUTH and  $\hat{B}$  points DOWN
  - $\hat{N}$  points SOUTH and  $\hat{B}$  points UP
  - $\hat{N}$  points DOWN and  $\hat{B}$  points NORTH
  - $\hat{N}$  points DOWN and  $\hat{B}$  points SOUTH
  - $\hat{N}$  points UP and  $\hat{B}$  points NORTH
8. Find the mass of a wire in the shape of the semi-circle  $\vec{r}(\theta) = (3 \cos \theta, 3 \sin \theta)$  for  $0 \leq \theta \leq \pi$  if the linear density is given by  $\delta = y$ .
- $\pi$
  - $3\pi$
  - 6
  - 12
  - 18
9. A bead is pushed along a wire in the shape of the twisted cubic  $\vec{r}(t) = (t^2, t^3, t)$  by the force  $\vec{F} = \langle x, z, -y \rangle$  from  $(1, 1, 1)$  to  $(4, 8, 2)$ . Find the work done.
- 15
  - 16
  - $\frac{45}{2}$
  - 45
  - 48

Work Out: (20 points each. Part credit possible. Show all work.)

10. Find a parametric equation for the line of intersection of the two planes

$$2x - y + 3z = 7 \quad \text{and} \quad 3x + y + 2z = 3$$

HINTS: Find the normal vectors,  $\vec{N}_1$  and  $\vec{N}_2$ , to the 2 planes, the direction vector,  $\vec{v}$ , of the line of intersection and any one point,  $P$ , on the intersection.

11. As Duke Skywater flies the Century Eagle through the galaxy he wants to maximize the Power of the Force which is given by  $F = \frac{1}{D}$  where  $D$  is the dark matter density given by  $D = x^2 + y^2 + z^2$ . If his current position is  $\vec{r} = (1, 2, 1)$  and his current velocity is  $\vec{v} = (0.2, 0.5, -0.3)$ , what is the current rate of change of the Power of the Force,  $\frac{dF}{dt}$ ? (Plug in numbers but you don't need to simplify.)