Name_____

MATH 251 Exam 1B Fall 2016

Sections 504 P. Yasskin

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

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

1. Find the distance from the point $\langle 3,4,12\rangle$ to the sphere $x^2+y^2+z^2=36$.

a. 1

b. 6

c. 7

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

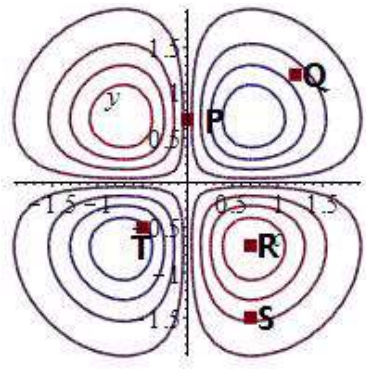
b. 2

c. 3

d. 4

e. 5

3. In the plot at the right, which point could be a local maximum?



a. $P=\left(0,\frac{1}{\sqrt{2}}\right)$

b. $Q=\left(\sqrt{2},\sqrt{2}\right)$

c. $R=\left(\frac{1}{\sqrt{2}},\frac{-1}{\sqrt{2}}\right)$

d. $S=\left(\frac{1}{\sqrt{2}},-\sqrt{2}\right)$

e. $T=\left(\frac{-1}{2},\frac{-1}{2}\right)$

4. Find a vector perpendicular to the plane thru the points $P = (2,3,-1)$, $Q = (4,-1,0)$ and $R = (2,0,2)$.

a. $\langle 9,-6,-6\rangle$

b. $\langle -9,5,5\rangle$

c. $\langle -9,-5,5\rangle$

d. $\langle -9,-6,-6\rangle$

e. $\langle -9,6,-6\rangle$

5. A triangle has vertices at $P = (-2,1,0)$, $Q = (-1,1,1)$ and $R = (1,3,1)$. Find the angle at Q.

a. $30°$

b. $45°$

c. $60°$

d. $120°$

e. $135°$

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. -4π

b. -2π

c. 2

d. 2π

e. 4π

7. A plane is flying from EAST to WEST, 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?

a. $\hat{N}$ points SOUTH and $\hat{B}$ points DOWN

b. $\hat{N}$ points SOUTH and $\hat{B}$ points UP

c. $\hat{N}$ points DOWN and $\hat{B}$ points NORTH

d. $\hat{N}$ points DOWN and $\hat{B}$ points SOUTH

e. $\hat{N}$ 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 $\delta = y$.

a. 18

b. 12

c. 6

d. 3π

e. π

9. A bead is pushed along a wire in the shape of the twisted cubic $\vec{r}(t) = (t^3, t^2, t)$ by the force $\vec{F} = \langle z^3, yz^2, xz^2 \rangle$ from $(1,1,1)$ to $(8,4,2)$. Find the work done.

a. 186

b. $\frac{384}{7}$

c. $\frac{381}{7}$

d. 63

e. 64

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 $\vec{r} = (2,1,1)$ and his current velocity is $\vec{v} = (0.6, -0.2, 0.8)$, 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.)