MA 261 EXAM 1 Spring 2003

Name _____

Student ID _____

Recitation Instructor _____

Recitation Time _____

Directions

1. Write your name, student ID number, recitation instructor's name and recitation time in the spaces provided above.
2. Write your name, your student ID number and division and section number of your recitation section on your answer sheet, and fill in the corresponding circles.
3. Mark the letter of your answer for each question on the answer sheet as well as in the test papers.
4. The exam has 13 problems. Problem 10 is worth 4 points. All others are worth 8 points each.
5. No books, notes or calculators may be used in this exam.

1. Find a vector perpendicular to both $\mathbf{a} = \mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = -2\mathbf{i} + \mathbf{j} - 5\mathbf{k}$.

   A. $11\mathbf{i} - 12\mathbf{j} - 2\mathbf{k}$

   B. $13\mathbf{i} + \mathbf{j} - 5\mathbf{k}$

   C. $\mathbf{j} + \mathbf{j} + \mathbf{k}$

   D. $2\mathbf{i} - \mathbf{j} - \mathbf{k}$

   E. $2\mathbf{i} - 4\mathbf{j} + 5\mathbf{k}$

2. Find symmetric equations of the line containing $P = (3, 4, 5)$ with direction vector $\mathbf{V} = \langle 2, -3, 6 \rangle$.

   A. $x = 3 + \frac{t}{2},\ y = 4 - \frac{t}{3},\ z = 5 + \frac{t}{6}$

   B. $\frac{x-2}{3} = \frac{y+3}{4} = \frac{z-6}{5}$

   C. $\frac{x+3}{2} = \frac{y+4}{-3} = \frac{z+5}{6}$

   D. $\frac{x-3}{2} = \frac{y-4}{-3} = \frac{z-5}{6}$

   E. $\frac{x+2}{3} = \frac{y-3}{4} = \frac{z+6}{5}$

3. Find equation of the plane that contains $P = (-1, 2, 3)$ and is perpendicular to the vector $\langle 2, 0, -3 \rangle$.

A. $-x + 2y + 3z = 14$

B. $2x - 3z = 0$

C. $\dfrac{x+1}{2} = \dfrac{z-3}{-3}$

D. $\dfrac{x-1}{2} = \dfrac{z+3}{-3}$

E. $2x - 3z = -11$

4. Convert the equation in cylindrical coordinates $\dfrac{1}{r^2} = z \sin 2\theta$ to rectangular coordinates. $(\sin 2\theta = 2 \sin\theta \cos\theta)$

A. $x + y = z$

B. $xyz = \frac{1}{2}$

C. $(x^2 + y^2)z = 1$

D. $\dfrac{xy}{z} = 1$

E. $x^2y^2z = 1$

5. In spherical coordinates, the surface $\tan\varphi - 1 = 0$ is a

A. half cone

B. sphere

C. right circular cylinder

D. plane

E. saddle surface

6. Find symmetric equations of the tangent line to $\mathbf{r}(t) = (t^2 + t)\mathbf{i} + \cos t\mathbf{j} + 2e^t\mathbf{k}$ at the point $(0, 1, 2)$.

A. $x = y = \dfrac{z}{2}$

B. $\dfrac{x}{2} = y - 1 = \dfrac{z-2}{2}$

C. $x = \dfrac{z-2}{2},\ y = 1$

D. $x = z - 2,\ y = 1$

E. $x = y = z$

7. Find the length of the helix $\mathbf{r}(t) = 2t\mathbf{i} + \sin t\mathbf{j} + \cos t\mathbf{k}$ from $t = 0$ to $t = \pi$.

A. $\sqrt{5}$

B. 0

C. $\sqrt{5}\pi$

D. 5π

E. π

8. A particle moves in the plane with $\mathbf{r}(0) = 0$, $\mathbf{r}'(0) = \mathbf{j}$, $\mathbf{r}''(t) = 2\mathbf{i} + 2\mathbf{j}$. Where is the particle when $t = 5$?

A. $(25, 25)$

B. $(30, 30)$

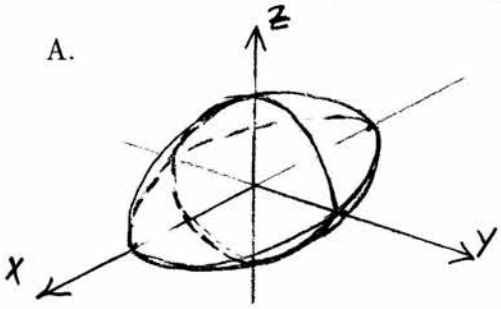
C. $(0, 0)$

D. $(30, 25)$

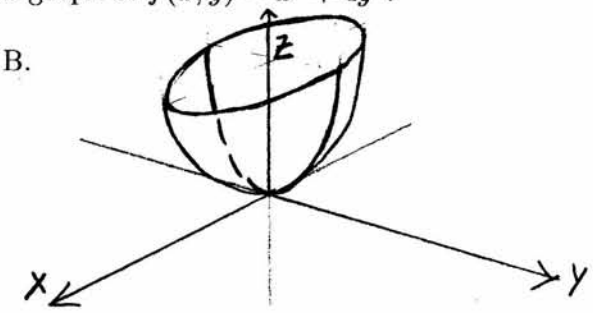
E. $(25, 30)$

9. Which of the following surfaces represents the graph of $f(x,y) = x^2 + 4y^2$.

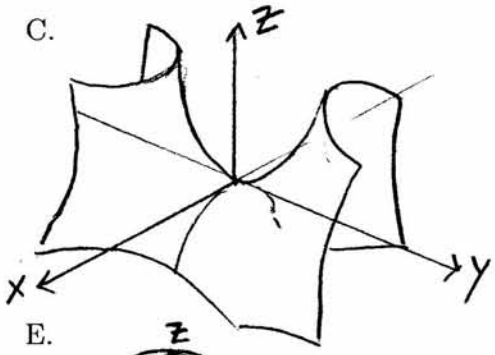
A.



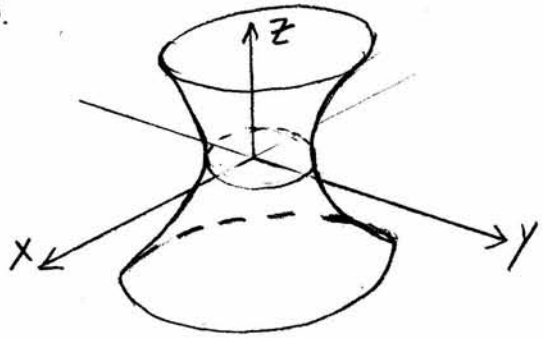
B.



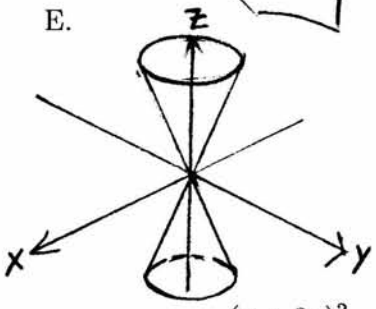
C.



D.



E.



10. Let $f(x,y) = \dfrac{(x+2y)^2}{x^2+4y^2}$. Then $\lim\limits_{(x,y)\to(0,0)} f(x,y) =$

A. 1

B. $\dfrac{9}{5}$

C. $\dfrac{1}{5}$

D. limit does not exist

E. 0

11. Which of the following functions is a solution of the equation $u_{xx} + u_{yy} = 0$?

A. $u = x^2 + y^2$

B. $u = e^{x-y}$

C. $u = e^{-x}\cos y - e^{-y}\cos x$

D. $u = \sin x \cos y$

E. $u = x^3 + 3xy^2$

12. Find an equation of the tangent plane to the graph of $f(x, y) = 3x^2 + 2y^2 + 4x - y + 5$ at the point $(-1, 1, 5)$.

A. $2x - 3y + z = 0$

B. $2x - 3y + z = 5$

C. $2x - 3y - z = 10$

D. $10x + 3y - z = 10$

E. $10x - 5y - z = 10$

13. Let $f(x,y) = 2x^2y + xy^3$ and $x = g(s,t),\ y = h(s,t)$ are functions of s and t. Suppose $g(1,2) = 1,\ h(1,2) = -1$ and $\dfrac{\partial g}{\partial t}(1,2) = 2,\ \dfrac{\partial h}{\partial t}(1,2) = 1$. Then at $(s,t) = (1,2)$, $\dfrac{\partial f}{\partial t}$ equals

A. 0

B. -10

C. 10

D. 5

E. -5