Calculus Test Chapter 10 – Vectors  
Name ____________________

Given the \( \mathbf{v} = <2,1,3> \) and \( \mathbf{u} = \mathbf{i} - 3\mathbf{k} \) and \( \mathbf{w} = <-3, 0, -1> \), find:

1. \( 3\mathbf{v} - \mathbf{u} \)
2. \( \mathbf{v} \times \mathbf{w} \)
3. \( \mathbf{u} \cdot \mathbf{w} \)
4. Find the direction cosines for \( \mathbf{v} \).
5. Find the area of the parallelogram formed by \( \mathbf{v} \) and \( \mathbf{u} \).
6. Find the unit vector in the direction of \( \mathbf{w} \).
7. What does \( |\mathbf{v} \cdot (\mathbf{u} \times \mathbf{w})| \) represent?
8. \( \text{proj}_\mathbf{v} \mathbf{u} \)
9. Find the parametric equations for the line that contains the points (1, -1, 0) and (-3, 4, 6).
10. Find the parametric equations for the line that passes through (2, 3, -1) and is parallel to the line: \( \frac{x+4}{5} = \frac{y-2}{2} = \frac{z}{3} \)
11. Find the equation of the plane that contains the points (2, 0, 4), (1, -3, 2) and (1, 4, -1).
12. Find the equation of the plane that contains the point (-1, 1, 4) and the line: \( x = 2 + 5t; y = 1 - 4t; z = 3 + 5t \)
13. Change the rectangular coordinates (-2, -2, 0) to cylindrical coordinates.
14. Change the cylindrical coordinates (8, \( \frac{5\pi}{4} \), 4) to rectangular coordinates.
15. Change the spherical coordinates (4, \( \frac{5\pi}{3} \), 0) to cylindrical coordinates.
16. Change \( x^2 + y^2 = 4z \) to a cylindrical equation.

17. Change \( r \cos \theta = 4 \) to a rectangular equation.

18. Change \( \rho \cos \phi = 5 \) to a rectangular equation.

Identify the graphs of the following.

19. \( x^2 - y^2 - 2z^2 = 3 \)

20. \( x^2 - y^2 = 9 \)

21. \( \rho = 6 \)

22. \( 3x^2 + 4y^2 = z^2 \)

23. \( 4x + y = 5 \)

24. \( r = 6 \sin \theta \)

25. \( \phi = \frac{\pi}{6} \)