1. Given the vectors **u and v,** find $\mathbf{u}\times\mathbf{v}$ and $\mathbf{v}\times\mathbf{v}$.

$$\mathbf{u}=\langle -8,6,2\rangle,\quad \mathbf{v}=\langle 6,-3,-4\rangle$$

$\mathbf{u}\times\mathbf{v}$ $\mathbf{v}\times\mathbf{v}$

2. Given the vectors **u** nd **v,** find the cross product and determine whether it is orthogonal to both **u** and **v.**

$$\mathbf{u}=\langle -1,8,2\rangle,\quad \mathbf{v}=\langle 4,10,5\rangle$$

$\mathbf{u}\times\mathbf{v}$ $(\mathbf{u}\times\mathbf{v}).\mathbf{u}$ $(\mathbf{u}\times\mathbf{v}).\mathbf{v}$

3. Find the area of a parallelogram that has the given vectors as adjacent sides.

$$\mathbf{u}=\langle -2,5,2\rangle,\quad \mathbf{v}=\langle 6,2,3\rangle$$

4. Find the triple scalar product of the vectors

$$\mathbf{u}=\langle -6,7,5\rangle,\quad \mathbf{v}=\langle 5,6,-3\rangle,\quad \mathbf{w}=\langle -4,0,-7\rangle$$

5. Use the triple scalar product to find the volume of the parallelepiped having adjacent edges given by the vectors

$$\mathbf{u} = \langle 3,7,2 \rangle, \ \ \mathbf{v} = \langle 0,9,4 \rangle, \ \ \mathbf{w} = \langle 2,8,-2 \rangle$$

6. Find a set of parametric equations of the line through the point $(-6,9,4)$ parallel to the vector **v**=(6, 8,2).

7. Find a set of symmetric equations of the line through the point $(7,9,4)$ parallel to the vector **v**=(6, 6,8).

8. Find a set of parametric equations of the line through the points $(-7,6,4)$ and $(-17,2,-10)$.

9. Find a set of symmetric equations of the line through the points $(8,5,4)$ and $(1,3,-2)$.

10. Find the set of parametric equations of the line through the point $(-8,8,3)$ and is parallel to the line x=2 + 8t, y=9+8 t, and z=–2+6t.

11. Determine whether any of the lines given below are parallel or identical.

$L_1: \ x = -7 - 4t, \ y = 3 - 8t, \ z = -4 - 7t$
$L_2: \ x = 1 + 8t, \ y = 19 + 16t, \ z = 10 + 14t$
$L_3: \ x = 4t, \ y = 2 - 8t, \ z = 1 - 7t$
$L_4: \ x = 1 - 8t, \ y = 19 - 16t, \ z = 10 - 14t$

12. Determine whether any of the lines given below are parallel or identical.

$L_1: \ \frac{x-4}{2} = \frac{y-4}{8} = \frac{z-7}{4}$
$L_2: \ \frac{x-1}{-6} = \frac{y-7}{-24} = \frac{z-10}{12}$
$L_3: \ \frac{x}{2} = \frac{y-2}{-8} = \frac{z-1}{-4}$
$L_4: \ \frac{x-1}{6} = \frac{y-7}{24} = \frac{z-10}{-12}$

13. Determine whether the lines given below meet. and, if so, where.

$x = -8 + 7t, \ y = 8 + 4t, \quad z = -3 + 2t$
$x = 2 + 3s, \ y = 14 + 2s, \quad z = 2 + 3s$

t = 1 s= –1

14. Determine whether the lines given below are parallel or where they meet.

$$\frac{x-7}{4}=\frac{y-8}{2}=\frac{z-0}{8}$$
$$\frac{x-5}{2}=\frac{y-19}{-3}=\frac{z-2}{2}$$

15. Find an equation of a plane passing through the point given and perpendicular to the given vector.

Point: $(1,6,6)$ Vector $\mathbf{v}=\langle 3,6,3\rangle$

16. Find an equation of a plane passing through the following three points.

$(-3,-1,-13)$, $(5,3,3)$, $(-2,0,-12)$

17. Find an equation of a plane passing through the points

$(-1,1,1)$, $(1,2,6)$

and perpendicular to the plane

$2x+y+5z+7=0$.

18. Determine whether the following planes are parallel, orthogonal, or neither. If they are neither parallel nor orthogonal, find the angle of intersection.

$$-4x - 0y + 4z + 4 = 0$$

$$2x + y + 2z - 4 = 0$$

19. Determine whether the following planes are parallel, orthogonal, or neither. If they are neither parallel nor orthogonal, find the angle of intersection.

$$-2x - 7y + 4z + 2 = 0$$

$$2x + 8y - 8z - 4 = 0$$

20. Find the distance between the point (1, 2, 3) and the plane given below.

$$5x - 8y + 7z = 14$$

21. Find the distance between the planes given below.

$$7x - 4y + 2z - 5 = 0$$

$$14x - 8y + 4z - 16 = 0$$

22. Identify the following quadratic surface.

$$\frac{x^2}{3}+\frac{y^2}{14}+\frac{z^2}{4}=1$$

23. Identify the following quadratic surface.

$$\frac{x^2}{4}+\frac{y^2}{8}-\frac{z^2}{16}=1$$

24. Identify the following quadratic surface.

$$\frac{x^2}{4}-\frac{y^2}{6}-\frac{z^2}{12}=1$$

25. Identify the following quadratic surface.

$$\frac{x^2}{2}+\frac{y^2}{16}-\frac{z^2}{10}=0$$

26. Identify the following quadratic surface.

$$z=\frac{x^2}{4}+\frac{y^2}{4}$$

27. Identify the following quadratic surface.

$$z = \frac{x^2}{8} - \frac{y^2}{4}$$

28. **OMIT**

29. **OMIT**

30. **OMIT**

31. **O M I T**

32. Convert the following point from cylindrical coordinates to rectangular coordinates.

$$\left(8, \frac{\pi}{6}, 6\right)$$

33. Convert the following point from rectangular coordinates to cylindrical coordinates. Give any angles in radians.

$$(4,1,4)$$

34. Find an equation in cylindrical coordinates for the equation given in rectangular coordinates.

$$z = 49x^2 + 49y^2 - 4$$

35. Find an equation in cylindrical coordinates for the equation given in rectangular coordinates.

$$9x^2 + 9y^2 = 2x$$

36. Find an equation in cylindrical coordinates for the equation given in rectangular coordinates.

$$25x^2 + 25y^2 - 4z^2 = \mathrm{g}$$

37. Find an equation in rectangular coordinates for the equation given in cylindrical coordinates.

$$r = 5\sin\theta$$

38. Find an equation in rectangular coordinates for the equation given in cylindrical coordinates

$$r = 4z$$

39. Find an equation in rectangular coordinates for the equation given in cylindrical coordinates.

$$r^2 + z^2 = 25$$

40. Convert the point from spherical coordinates to rectangular coordinates.

$$\left(4, \frac{\pi}{6}, \frac{\pi}{16}\right)$$

41. Find an equation in spherical coordinates for the equation given in rectangular coordinates.

    $y = 2$

42. Find an equation in spherical coordinates for the equation given in rectangular coordinates.

    $x^2 + y^2 - 6z^2 = 3$

43. Find an equation in rectangular coordinates for the equation given in spherical coordinates.

    $\theta = \frac{\pi}{8}$

    The coefficients below are given to two decimal places.

44. Find an equation in rectangular coordinates for the equation given in spherical coordinates.

    $\rho = 3\csc\varphi \;\; csc\theta$

45. Convert the following point from cylindrical coordinates to spherical coordinates.

    $\left(6, \frac{\pi}{3}, 8\right)$

46. Convert the following point from spherical coordinates to cylindrical coordinates.

$$\left(7, \frac{\pi}{16}, \frac{\pi}{4}\right)$$