1. Show that the equation
$$x^2 + y^2 + z^2 - 8x + 6y + 2z + 17 = 0$$
represents a sphere, and find its center and radius.

2. Find a unit vector that has the same direction as $10\mathbf{i} - 11\mathbf{j} + 12\mathbf{k}$.

3. Find the direction cosines and direction angles of the vector $\frac{1}{2}\mathbf{i} + \mathbf{j} + \mathbf{k}$.

4. Find the cross product $\mathbf{a} \times \mathbf{b}$ and verify that it is orthogonal to both $\mathbf{a}$ and $\mathbf{b}$ for $\mathbf{a} = \mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$ and $\mathbf{b} = -\mathbf{i} + 5\mathbf{k}$.

5. Find the volume of the parallelepiped determined by the vectors $\mathbf{a} = \mathbf{i} + \mathbf{j}$, $\mathbf{b} = \mathbf{j} + \mathbf{k}$, and $\mathbf{c} = \mathbf{i} + \mathbf{j} + \mathbf{k}$.

6. Find parametric equations for the line.
   a) The line through the point $(3, 6, 2)$ and parallel to the vector $2\mathbf{i} - \mathbf{j} + 5\mathbf{k}$.
   b) The line through the points $(0, 0, 1)$ and $(1, 0, 0)$.

7. Determine whether the lines L_1 and L_2 are parallel, skew, or intersecting. If they intersect, find the point of intersection.
$$\begin{aligned} L_1 &: \ x = 5 - 12t \qquad y = 3 + 9t \qquad z = 1 - 3t \\ L_2 &: \ x = 3 + 8s \qquad y = -6s \qquad z = 7 + 2s \end{aligned}$$

8. Find an equation of the plane.
   a) The plane through the point $(1, \frac{1}{2}, \frac{1}{3})$ and parallel to the plane $x + y + z = 0$.
   b) The plane through the points $(0, 0, 0)$, $(2, 4, -6)$, and $(5, 1, 3)$.
   c) The plane consisting of all points that are equidistant from the points $(2, 5, 5)$ and $(-6, 3, 1)$.

Course Homework due Feb 12, Wed.

Feb 3, Mon. : **12.4** 1, 5, 9, 13, 27, 33. **12.5** 3, 7, 11, 19, 25, 27, 31, 61
Feb 5, Wed. : **12.6** 3, 5, 9, 13, 19, 21-28 (total 8 problems), 41, 43
Feb 7, Fri. : **13.1** 9, 19-24 (total 6 problems), 25, 35. **13.2** 9, 11, 13, 15, 19