Section 9.5 Problems

1. The vector $\vec{k}$ is normal to which of the following planes?

$$x = 1 \qquad y = 1 \qquad z = 1$$

2. Which of the following planes is **not** parallel to the plane $x + y + z = 1$?

$$2x + 2y + 2z = 1 \qquad x + y + z = 3 \qquad x - y + z = 0$$

3. Which of the following planes contains the z-axis?

$$z = 1 \qquad x + y = 1 \qquad x - y = 0$$

4. Describe the following lines using vector functions, parametric equations, and symmetric equations.

   (a) The line passing through the points $(1, 2, 3)$ and $(1, 2, -1)$.

   (b) The line passing through $(1, 1, 1)$ parallel to the line through $(2, 0, -1)$ and $(4, 1, 3)$.

   (c) The line passing through the point $(0, 0, 5)$ and perpendicular to the plane $x - y + 3x - 6 = 0$.

   (d) The line passing through the point $(0, 1, 2)$ that is parallel to the plane $x + y + z = 2$ and orthogonal to the line $\langle 1 + t, 1 - t, 2t \rangle$.

5. Find the scalar equation for the following planes.

   (a) The plane containing the point $(4, 1, 9)$ and parallel to $x + y + z = 3$.

   (b) The plane containing the point $(-1, 0, 1)$ and the line $\langle 1 + t, 2t, 3t - 1 \rangle$.

   (c) The plane containing the lines $\langle t, 2t, 3t \rangle$ and $\langle 3t, t, 8t \rangle$.

   (d) The plane containing $(0, 0, 5)$ and orthogonal to $x - y + 3z - 6 = 0$. How many planes meet this description?

6. Find the distance from the point $(3, 1, 0)$ to the line $\langle 3 - t, 2, -t \rangle$.

7. Find the distance from the point $(2, 2, 0)$ to the plane $x + y - z = 7$.

8. Find the distance from the line $\langle 4 + t, -2t, 3 - t \rangle$ and the plane $2x + y = 10$.

9. Find two planes parallel to $3x - 4y + z = 10$ which are three units distance.

10. Show that the planes $x + y + z = 1$ and $x + 2y + 3z = 1$ intersect and then find the line of intersection. What is the angle of intersection of the planes?

11. Determine if the lines are intersecting, skew, or parallel. If intersecting, find the point of intersection. If skew or parallel, find the distance between the lines.

    (a) $\langle 4 + t, -2t, 3 - t \rangle$ and $\langle 1 + 2t, 3 - t, 2 \rangle$.

    (b) $\langle 1 - 3t, t, 0 \rangle$ and $\langle 2t, 1, 1 + t \rangle$.