39–42 Use intercepts to help sketch the plane.

39. $2x + 5y + z = 10$

42. $6x + 5y - 3z = 15$

43–45 Find the point at which the line intersects the given plane.

43. $x = 3 - t,\ y = 2 + t,\ z = 5t;\quad x - y + 2z = 9$

45. $x = y - 1 = 2z;\quad 4x - y + 3z = 8$

46. Where does the line through $(1, 0, 1)$ and $(4, -2, 2)$ intersect the plane $x + y + z = 6$?

47. Find direction numbers for the line of intersection of the planes $x + y + z = 1$ and $x + z = 0$.

48. Find the cosine of the angle between the planes $x + y + z = 0$ and $x + 2y + 3z = 1$.

49–54 Determine whether the planes are parallel, perpendicular, or neither. If neither, find the angle between them.

49. $x + 4y - 3z = 1,\quad -3x + 6y + 7z = 0$

50. $2z = 4y - x,\quad 3x - 12y + 6z = 1$

51. $x + y + z = 1,\quad x - y + z = 1$

55–56 (a) Find parametric equations for the line of intersection of the planes and (b) find the angle between the planes.

55. $x + y + z = 1,\quad x + 2y + 2z = 1$

57–58 Find symmetric equations for the line of intersection of the planes.

57. $5x - 2y - 2z = 1,\quad 4x + y + z = 6$

59. Find an equation for the plane consisting of all points that are equidistant from the points $(1, 0, -2)$ and $(3, 4, 0)$.

61. Find an equation of the plane with x-intercept a, y-intercept b, and z-intercept c.

62. (a) Find the point at which the given lines intersect:

$$\mathbf{r} = \langle 1, 1, 0\rangle + t\langle 1, -1, 2\rangle$$

$$\mathbf{r} = \langle 2, 0, 2\rangle + s\langle -1, 1, 0\rangle$$

(b) Find an equation of the plane that contains these lines.

63. Find parametric equations for the line through the point $(0, 1, 2)$ that is parallel to the plane $x + y + z = 2$ and perpendicular to the line $x = 1 + t,\ y = 1 - t,\ z = 2t$.

65. Which of the following four planes are parallel? Are any of them identical?

P_1: $4x - 2y + 6z = 3$ $\quad P_2$: $4x - 2y - 2z = 6$

P_3: $-6x + 3y - 9z = 5$ $\quad P_4$: $z = 2x - y - 3$

66. Which of the following four lines are parallel? Are any of them identical?

L_1: $x = 1 + t,\ y = t,\ z = 2 - 5t$

L_2: $x + 1 = y - 2 = 1 - z$

L_3: $x = 1 + t,\ y = 4 + t,\ z = 1 - t$

L_4: $\mathbf{r} = \langle 2, 1, -3\rangle + t\langle 2, 2, -10\rangle$

73. Show that the distance between the parallel planes $ax + by + cz + d_1 = 0$ and $ax + by + cz + d_2 = 0$ is

$$D = \frac{|d_1 - d_2|}{\sqrt{a^2 + b^2 + c^2}}$$

74. Find equations of the planes that are parallel to the plane $x + 2y - 2z = 1$ and two units away from it.

67–68 Use the formula in Exercise 43 in Section 13.4 to find the distance from the point to the given line.

67. $(4, 1, -2);\quad x = 1 + t,\ y = 3 - 2t,\ z = 4 - 3t$

71–72 Find the distance between the given parallel planes.

71. $2x - 3y + z = 4,\quad 4x - 6y + 2z = 3$

43. (a) Let P be a point not on the line L that passes through the points Q and R. Then the distance d from the point P to the line L is

$$d = \frac{|\mathbf{a} \times \mathbf{b}|}{|\mathbf{a}|}$$

where $\mathbf{a} = \overrightarrow{QR}$ and $\mathbf{b} = \overrightarrow{QP}$.

Crooked #43 is the exercise referenced in #67.