

Math 20C. Lecture Examples.

Section 12.5. Planes in three space[†]

Example 1 Give an equation of the plane through the point $(2, 3, 4)$ and perpendicular to the vector $\langle -6, 5, -4 \rangle$.

Answer: $-6(x - 2) + 5(y - 3) - 4(z - 4) = 0$

Example 2 Give an equation for the plane through $(6, 10, -3)$ and perpendicular to the line $x = -3t, y = 6 + t, z = 4 - 7t$.

Answer: $-3(x - 6) + (y - 10) - 7(z + 3) = 0$

Example 3 Give an equation of the plane through the point $(1, -1, 2)$ that is parallel to the plane $3x - 5y + 6z = 10$.

Answer: $3(x - 1) - 5(y + 1) + 6(z - 2) = 0$ or (written) $3x - 5y + 6z = 20$.

Example 4 Give an equation for the plane through the points $P = (1, 3, 2)$, $Q = (1, 4, 3)$, and $R = (2, 5, 0)$.

Answer: $-4(x - 1) + (y - 3) - (z - 2) = 0$, which simplifies to $-4x + y - z = -3$

Example 5 Check the equation from Example 4 by verifying that the coordinates of $P = (1, 3, 2)$, $Q = (1, 4, 3)$, and $R = (2, 5, 0)$ satisfy it.

Answer: For $P = (1, 3, 2)$: $4x - y + z = 4(1) - 3 + 2 = 3$ •

For $Q = (1, 4, 3)$: $4x - y + z = 4(1) - 4 + 3 = 3$ •

For $R = (2, 5, 0)$: $4x - y + z = 4(1) - 4 + 3 = 3$

Example 6 Give parametric equations of the line L through $(3, -4, 5)$ and perpendicular to the plane $3x - 2y = 5$.

Answer: $L: x = 3 + 3t, y = -4 - 2t, z = 5$

Interactive Examples

Work the following Interactive Examples on Shenk's web page, <http://www.math.ucsd.edu/~ashenk/>:[‡]

Section 12.5: Examples 3–5 and 6–9

[†]Lecture notes to accompany Section 12.5 of *Calculus, Early Transcendentals* by Rogawski.

[‡]The chapter and section numbers on Shenk's web site refer to his calculus manuscript and not to the chapters and sections of the textbook for the course.