

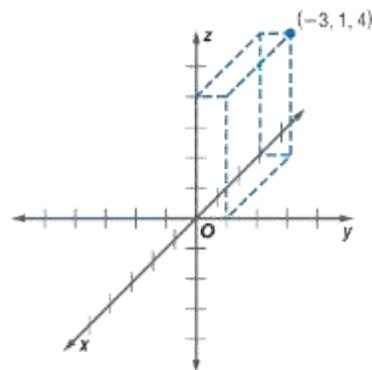
Lesson 8-3 Vectors in Three Dimensional Space

Example 1Locate the point $(-3, 1, 4)$.

Locate -3 on the x -axis, 1 on the y -axis, and 4 on the z -axis.

Now draw broken lines for parallelograms to represent the three planes.

The planes intersect at $(-3, 1, 4)$.

**Example 2**Write the ordered triple that represents the vector from $X(4, 2, -5)$ to $Y(3, -4, 1)$.

$$\begin{aligned}\overline{XY} &= (3, -4, 1) - (4, 2, -5) \\ &= \langle 3 - 4, -4 - 2, 1 - (-5) \rangle \\ &= \langle -1, -6, 6 \rangle\end{aligned}$$

Example 3

BASEBALL Suppose the flight of a baseball passed through points at $(2, 6, 9)$ and $(8, 4, 7)$, in which each unit represents a meter. What is the magnitude of the displacement the baseball experienced in traveling between these two points? Round to the nearest tenth.

$$\begin{aligned}\text{magnitude} &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2} \\ &= \sqrt{(8 - 2)^2 + (4 - 6)^2 + (7 - 9)^2} && \langle x_1, y_1, z_1 \rangle = \langle 2, 6, 9 \rangle \\ &= \sqrt{36 + 4 + 4} && \langle x_2, y_2, z_2 \rangle = \langle 8, 4, 7 \rangle \\ &\approx 6.6\end{aligned}$$

The magnitude of the displacement is about 6.6 meters.

Example 4

Find an ordered triple that represents $4\vec{p} - 3\vec{q}$ if $\vec{p} = \langle 2, 5, 3 \rangle$ and $\vec{q} = \langle 4, -2, 1 \rangle$.

$$\begin{aligned}4\vec{p} - 3\vec{q} &= 4\langle 2, 5, 3 \rangle - 3\langle 4, -2, 1 \rangle \\ &= \langle 8, 20, 12 \rangle - \langle 12, -6, 3 \rangle \\ &= \langle -4, 26, 9 \rangle\end{aligned}$$

Example 5

Write \overline{AB} as the sum of unit vectors for $A(4, 2, 6)$ and $B(-3, 8, -1)$.

First, express \overline{AB} as an ordered triple. Then, write the sum of the unit vectors.

$$\begin{aligned}\overline{AB} &= (-3, 8, -1) - (4, 2, 6) \\ &= \langle -3 - 4, 8 - 2, -1 - 6 \rangle \\ &= \langle -7, 6, -7 \rangle \\ &= -7\vec{i} + 6\vec{j} - 7\vec{k}\end{aligned}$$
