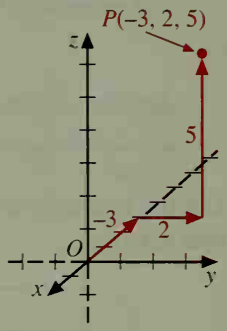
Appendices

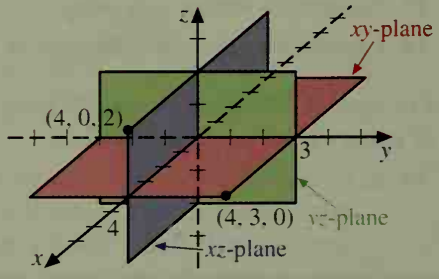
Coordinates in Three Dimensions (Chapter 13)

Objective: Use coordinates in three dimensions and apply the midpoint and distance formulas in three dimensions.

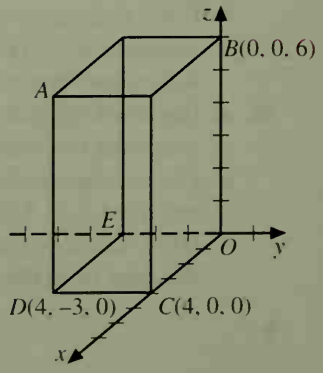
Robots are used throughout a car manufacturing plant. To describe the position of the arm you can use a three-dimensional coordinate system. This coordinate system is formed by three perpendicular axes which intersect at the origin. In the diagram at the right, the arrowheads on the x-axis, y-axis, and z-axis indicate the positive direction of each axis. In a three-dimensional coordinate system, each point in space is given by an ordered triple (x, y, z). For example, in the graph at the right, point P has coordinates $(-3, 2, 5)$. The red arrows in the diagram show that to graph P, you start at the origin, O, move 3 units in the negative direction on the x-axis, 2 units in the positive direction parallel to the y-axis, and 5 units in the positive direction parallel to the z-axis.



Each pair of axes determines a coordinate plane. Each point in a coordinate plane has at least one coordinate that is zero. Point $(4, 3, 0)$ lies in the xy-plane and point $(4, 0, 2)$ lies in the xz-plane.



Example 1 Find the coordinates of vertices A and E of the rectangular prism at the right.



Solution A has the same x-coordinate as C and D, the same y-coordinate as D, and the same z-coordinate as B. A has coordinates $(4, -3, 6)$.

E has the same y-coordinate as D. Its x- and z-coordinates are 0. E has coordinates $(0, -3, 0)$.