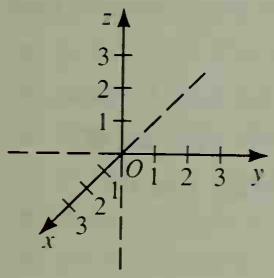
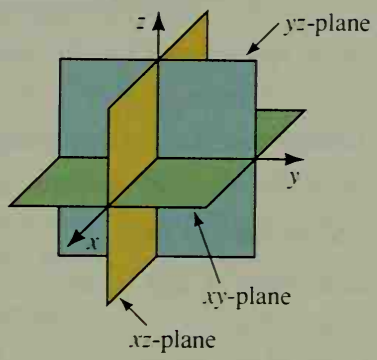
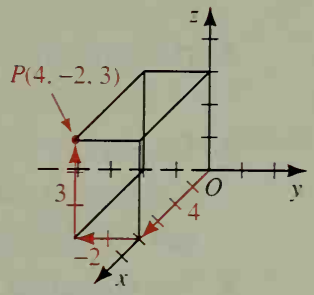
Extra

Points in Space

To locate points in three-dimensional space, three coordinate axes are needed. Think of the *y-axis* and *z-axis* as lying in the plane of the paper with the *x-axis* perpendicular to the plane of the paper. The axes intersect at the *origin*, or zero point, of each axis. The arrowhead on each axis indicates the positive direction.







The coordinate axes determine three *coordinate planes*, as shown in the middle diagram above. Each point in space has three coordinates: the *x-coordinate*, *y-coordinate*, and *z-coordinate*. For example, point P in the diagram at the right above, has coordinates $(4, -2, 3)$. The red arrows in the figure show that to *graph* P you start at O, move 4 units in the positive direction on the x-axis, -2 units parallel to the y-axis (that is 2 units in the negative direction parallel to the y-axis), and 3 units in the positive direction parallel to the z-axis.

Exercises

On which axis or axes does each point lie?

1. $(0, 7, 0)$ **2.** $(0, 0, -9)$ **3.** $(5, 0, 0)$ **4.** $(0, 0, 0)$

On which coordinate plane or planes does each point lie?

5. $(1, -3, 0)$ **6.** $(-7, 0, -1)$ **7.** $(0, 8, 5)$ **8.** $(0, 0, 0)$

Graph each point on a coordinate system in space.

9. $(-1, 4, 0)$ **10.** $(2, 3, 1)$ **11.** $(-2, -3, 4)$ **12.** $(0, 1, -5)$

Sketch the triangle in space whose vertices have the given coordinates.

13. $(4, 0, 0), (0, 8, 0), (0, 0, 2)$

14. $(1, 0, 0), (0, -5, 0), (0, 0, -5)$

15. $(-3, 0, 0), (0, -4, 0), (0, 0, 6)$

16. $(0, 0, 0), (3, 0, 3), (0, -4, 5)$