

# 1.2

## Points, Lines, and Planes

- Goals**
- Understand and use the basic undefined terms and defined terms of geometry.
  - Sketch the intersections of lines and planes.

### VOCABULARY

**Point** A point has no dimension. It is usually represented by a small dot.

**Line** A line extends in one dimension. It is usually represented by a straight line with two arrowheads.

**Plane** A plane extends in two dimensions. It is usually represented by a shape that looks like a tabletop or wall.

**Collinear points** Collinear points are points that lie on the same line.

**Coplanar points** Coplanar points are points that lie on the same plane.

**Line segment, Endpoint** A line segment is part of a line that consists of two points, called endpoints, and all points on the line between the endpoints.

**Ray, Initial point** A ray is part of a line that consists of a point, called an initial point, and all points on the line that extend in one direction.

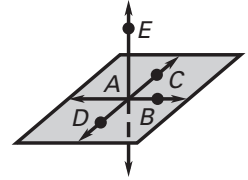
**Opposite rays** If  $C$  is between  $A$  and  $B$  on  $\overleftrightarrow{AB}$ , then  $\overrightarrow{CA}$  and  $\overrightarrow{CB}$  are opposite rays.

**Intersect** Two or more geometric figures intersect if they have one or more points in common.

**Intersection** The intersection of two or more geometric figures is the set of points that the figures have in common.

**Example 1** Naming Collinear and Coplanar Points

- Name three points that are collinear.
- Name three points that are coplanar.
- Name four points that are not coplanar.

**Solution**

- Points D, A, and C lie on the same line, so they are collinear.
- There are many correct answers. For instance, points D, A, and B lie on the same plane. Also, points B, A, and E are coplanar, although the plane containing them is not drawn.
- There are many correct answers. For instance, points A, B, C, and E do not lie on the same plane.

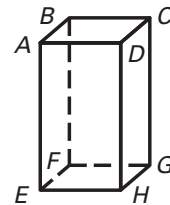
✔ **Checkpoint** Complete the following exercises.

- Name three points in the diagram that are not collinear.

*Sample answer: E, F, G*

- Name the point in the diagram that is coplanar with points A, D, and E.

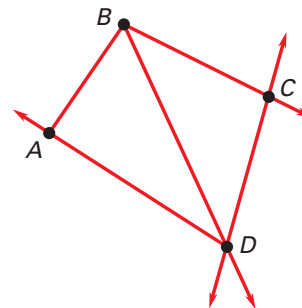
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**Example 2** Drawing Lines, Segments, and Rays

Draw four noncollinear points, A, B, C, and D. Then draw  $\overline{AB}$ ,  $\overrightarrow{BC}$ ,  $\overleftrightarrow{CD}$ ,  $\overrightarrow{DA}$ , and  $\overrightarrow{BD}$ .

A, B, C, and D are shown.

- Draw  $\overline{AB}$ .
- Draw  $\overrightarrow{BC}$ .
- Draw  $\overleftrightarrow{CD}$ .
- Draw  $\overrightarrow{DA}$ .
- Draw  $\overrightarrow{BD}$ .

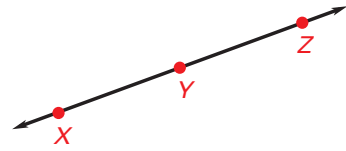


**Example 3** Drawing Opposite Rays

Draw a line. Label three points on the line and name a pair of opposite rays.

Draw points  $X$ ,  $Y$ , and  $Z$  on the given line so that  $Y$  is between  $X$  and  $Z$ .

The opposite rays are  $\overrightarrow{YX}$  and  $\overrightarrow{YZ}$ .

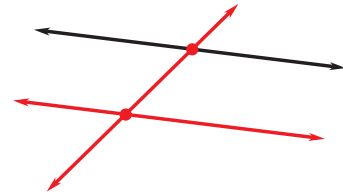


**Example 4** Sketching Intersections

Sketch two lines that do not intersect and a line that intersects each of the other lines.

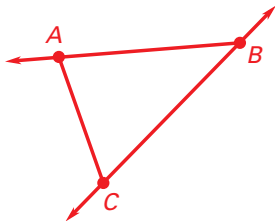
Draw a line that does not intersect the given line.

Then draw a third line that intersects the first two lines. Emphasize the points of intersection.



**✓ Checkpoint** Sketch the figure described.

3. Draw points  $A$ ,  $B$ , and  $C$  so that they are not collinear. Then sketch  $\overleftrightarrow{BC}$ ,  $\overline{AC}$ , and  $\overrightarrow{BA}$ .



4. Sketch two planes that do not intersect and a line that intersects each plane in a point.

