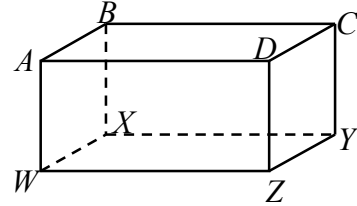


## LINES AND PLANES

### PARALLEL LINES AND PLANES IN SPACE

To visualize parallel lines and planes in space think about a right rectangular prism as shown at right. The edges represent part of a line and the faces represent part of a plane.  $\overline{AB}$  and  $\overline{CD}$  are parallel lines. Plane  $ABCD$  is parallel to plane  $WXYZ$ .



### Problems

1. Name a line parallel to  $\overline{WX}$ .
2. Name a plane parallel to plane  $ADZW$ .

### PERPENDICULAR LINES AND PLANES IN SPACE

Using the same diagram above,  $\overline{AW}$ ,  $\overline{ZW}$ , and  $\overline{XW}$  all form right angles at point  $W$ . Through any point not on plane, there is only one line through the point and perpendicular to the plane. For example, using point  $A$  and plane  $WXYZ$ , the only possible line through the point and perpendicular to the plane is the line  $\overline{AW}$ . Also, since  $\overline{AW}$  is perpendicular to plane  $WXYZ$  and line  $\overline{BX}$  is perpendicular to plane  $WXYZ$ , lines  $\overline{AW}$  and  $\overline{BX}$  are parallel.

### Problems

3. Which line is perpendicular to plane  $ABXW$  and passes through point  $C$ ?
4. In the diagram above, how many planes are perpendicular to plane  $CDZY$ ?

Tell if each of the following statements is true or false for figures in space. Use diagrams to justify your answers.

5. If two lines are parallel to a third line, then the two lines are parallel.
6. If two planes are parallel to a third plane, then the two planes are parallel.
7. If two planes are perpendicular to the same line, then the planes are parallel.
8. If two planes are perpendicular to a third plane, then the planes are parallel.
9. If two lines are perpendicular to the same plane, then the lines are parallel.
10. If two lines are perpendicular to the same line, then the lines are parallel.
11. If a line is perpendicular to each of two intersecting lines at their point of intersection, then the line is perpendicular to the plane determined by them.
12. If a line is parallel to one of two perpendicular planes, then it is parallel to the other plane.
13. Through a given point there passes one and only one plane perpendicular to a given line.
14. Two lines perpendicular to the same plane lie in the same plane.
15. Two planes are perpendicular to each other if and only if one plane contains a line perpendicular to the second plane.
16. If a line is perpendicular to a plane, then any line perpendicular to the given line at its point of intersection with the given plane is in the given plane.
17. If a line is perpendicular to a plane, then every plane containing the line is perpendicular to the given plane.
18. If a plane intersects two parallel planes, then the intersections are two parallel lines.

# Answers

1.  $\overline{AB}, \overline{DC}, \overline{ZY}$

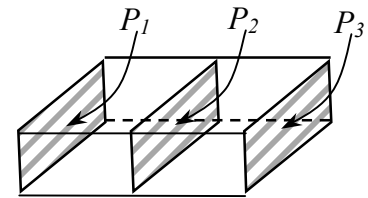
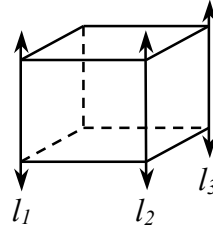
2. plane  $BCYX$

3.  $\overline{BC}$

4. 4

5. True

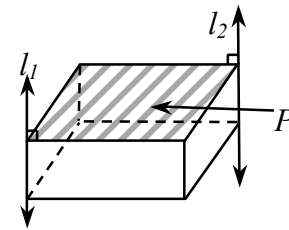
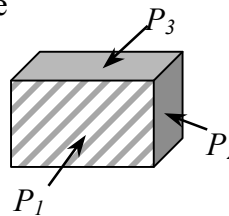
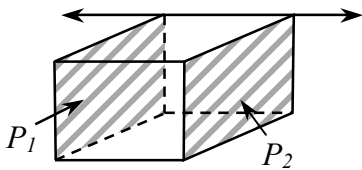
6. True



7. True

8. False

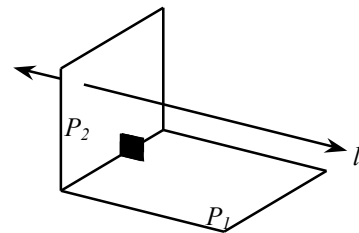
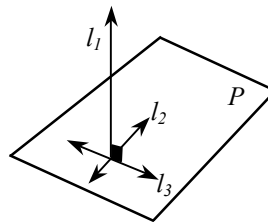
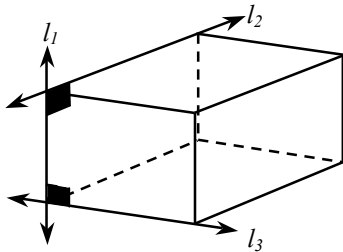
9. True



10. False

11. True

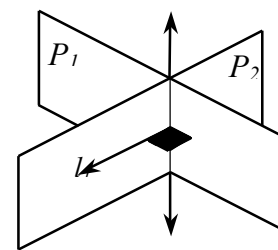
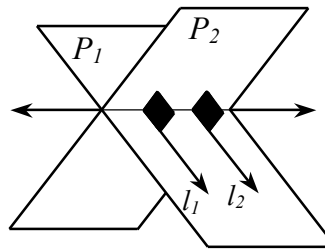
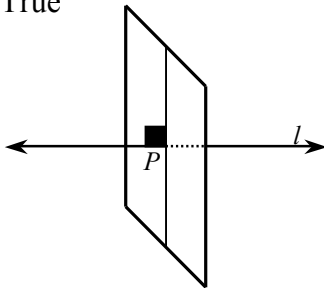
12. False



13. True

14. True

15. True



16. True

17. True

18. True

