

2.4

Use Postulates and Diagrams

Goal • Use postulates involving points, lines, and planes.

*Postulates or Axioms are rules that are accepted without proof.

*Theorems are rules that are proved.

*Postulates and theorems are often written in conditional form (if-then).

*Unlike the converse of a definition, the converse of a postulate or theorem cannot be assumed to be true.

We have already learned four postulates in Chapter 1:

Postulate 1: Ruler Postulate (p. 9)

Postulate 2: Segment Addition Postulate (p. 10)

Postulate 3: Protractor Postulate (p. 24)

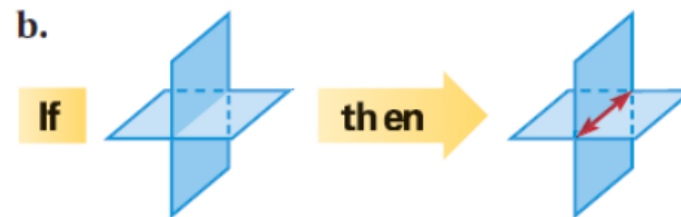
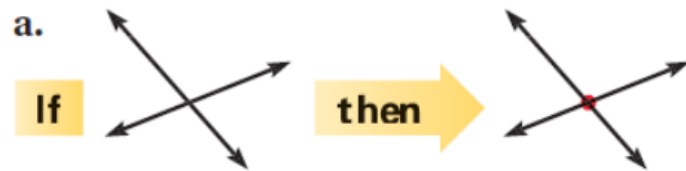
Postulate 4: Angle Addition Postulate (p. 25)

POSTULATES*For Your Notebook***Point, Line, and Plane Postulates**

- POSTULATE 5** Through any two points there exists exactly one line.
- POSTULATE 6** A line contains at least two points.
- POSTULATE 7** If two lines intersect, then their intersection is exactly one point.
- POSTULATE 8** Through any three noncollinear points there exists exactly one plane.
- POSTULATE 9** A plane contains at least three noncollinear points.
- POSTULATE 10** If two points lie in a plane, then the line containing them lies in the plane.
- POSTULATE 11** If two planes intersect, then their intersection is a line.

EXAMPLE 1 Identify a postulate illustrated by a diagram

State the postulate illustrated by the diagram.

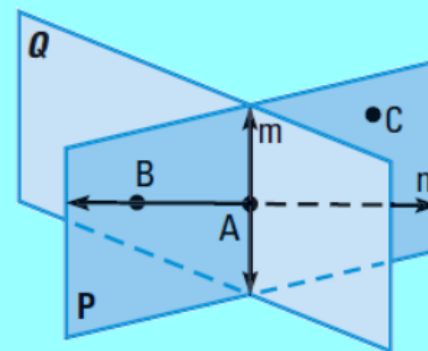



EXAMPLE 2 Identify postulates from a diagram

Use the diagram to write examples of Postulates 9 and 10.

Postulate 9 Plane P contains at least three noncollinear points, A , B , and C .

Postulate 10 Point A and point B lie in plane P , so line n containing A and B also lies in plane P .



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CONCEPT SUMMARY*For Your Notebook***Interpreting a Diagram**

When you interpret a diagram, you can only assume information about size or measure if it is marked.

YOU CAN ASSUME

All points shown are coplanar.

$\angle AHB$ and $\angle BHD$ are a linear pair.

$\angle AHF$ and $\angle BHD$ are vertical angles.

A , H , J , and D are collinear.

\vec{AD} and \vec{BF} intersect at H .

YOU CANNOT ASSUME

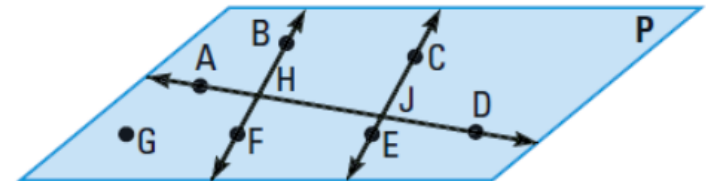
G , F , and E are collinear.

\vec{BF} and \vec{CE} intersect.

\vec{BF} and \vec{CE} do not intersect.

$\angle BHA \cong \angle CJA$

$\vec{AD} \perp \vec{BF}$ or $m\angle AHB = 90^\circ$



EXAMPLE 3 Use given information to sketch a diagram

Sketch a diagram showing \overleftrightarrow{TV} intersecting \overline{PQ} at point W , so that $\overline{TW} \cong \overline{WV}$.

Solution

STEP 1 Draw \overleftrightarrow{TV} and label points T and V .

STEP 2 Draw point W at the midpoint of \overline{TV} .
Mark the congruent segments.

STEP 3 Draw \overline{PQ} through W .



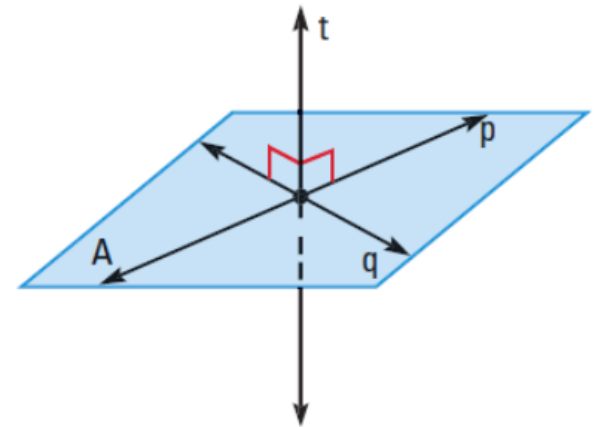
AVOID ERRORS

Notice that the picture was drawn so that W does not look like a midpoint of \overline{PQ} . Also, it was drawn so that \overline{PQ} is not perpendicular to \overline{TV} .

A line is perpendicular to a plane iff

- Intersects the plane at a point
- Is perpendicular to every line in the plane at that point

* In a diagram, a line perpendicular to a plane must be marked with a right angle symbol.



*In a diagram, a line \perp to a plane must be marked with a right angle symbol.

EXAMPLE 4 Interpret a diagram in three dimensions

Which of the following statements *cannot* be assumed from the diagram?

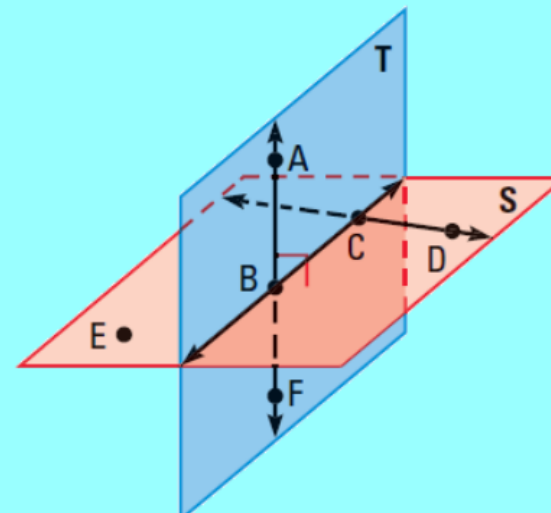
A , B , and F are collinear.

E , B , and D are collinear.

$\overline{AB} \perp$ plane S

$\overline{CD} \perp$ plane T

\overleftrightarrow{AF} intersects \overleftrightarrow{BC} at point B .



Solution:

Assignment:

p. 99 (1-24, 30-32, 46-
56 all)