Name _____ Date _____

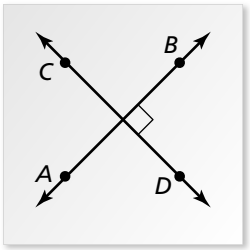
5.3 Postulates and Diagrams

For use with Exploration 5.3

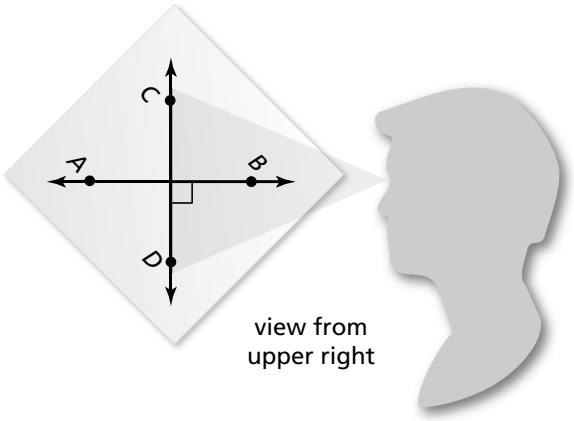
Essential Question In a diagram, what can be assumed and what needs to be labeled?

1 EXPLORATION: Looking at a Diagram

Work with a partner. On a piece of paper, draw two perpendicular lines. Label them $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$. Look at the diagram from different angles. Do the lines appear perpendicular regardless of the angle at which you look at them? Describe *all* the angles at which you can look at the lines and have them appear perpendicular.



view from above



view from upper right

2 EXPLORATION: Interpreting a Diagram

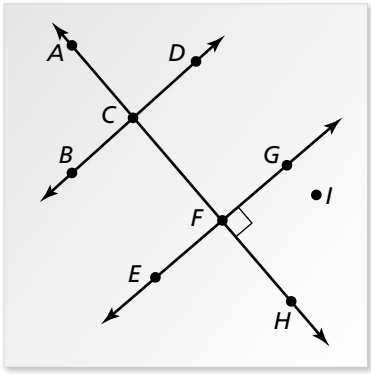
Work with a partner. When you draw a diagram, you are communicating with others. It is important that you include sufficient information in the diagram. Use the diagram to determine which of the following statements you can assume to be true. Explain your reasoning.

a. All the points shown are coplanar.

b. Points D, G, and I are collinear.

c. Points A, C, and H are collinear.

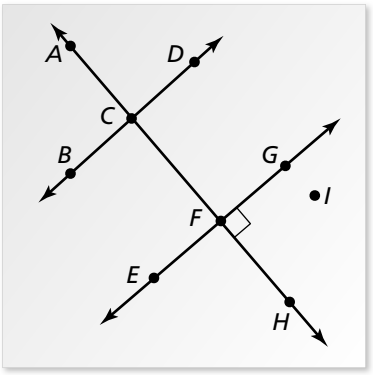
d. $\overleftrightarrow{EG}$ and $\overleftrightarrow{AH}$ are perpendicular.



Name_____ Date _____

5.3 Postulates and Diagrams (continued)

2 EXPLORATION: Interpreting a Diagram (continued)



e. $\angle BCA$ and $\angle ACD$ are a linear pair.

f. $\overleftrightarrow{AF}$ and $\overleftrightarrow{BD}$ are perpendicular.

g. $\overleftrightarrow{EG}$ and $\overleftrightarrow{BD}$ are parallel.

h. $\overleftrightarrow{AF}$ and $\overleftrightarrow{BD}$ are coplanar.

i. $\overleftrightarrow{EG}$ and $\overleftrightarrow{BD}$ do not intersect.

j. $\overleftrightarrow{AF}$ and $\overleftrightarrow{BD}$ intersect.

k. $\overleftrightarrow{EG}$ and $\overleftrightarrow{BD}$ are perpendicular.

l. $\angle ACD$ and $\angle BCF$ are vertical angles.

m. $\overleftrightarrow{AC}$ and $\overleftrightarrow{FH}$ are the same line.

Communicate Your Answer

3. In a diagram, what can be assumed and what needs to be labeled?

4. Use the diagram in Exploration 2 to write two statements you can assume to be true and two statements you cannot assume to be true. Your statements should be different from those given in Exploration 2. Explain your reasoning.

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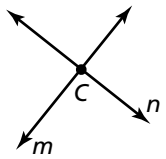
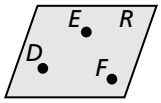
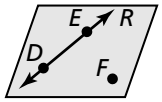
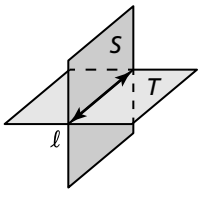
5.3 Practice
For use after Lesson 5.3

Postulates

Point, Line, and Plane Postulates

Postulate	Example	
Two Point Postulate Through any two points, there exists exactly one line. **Line-Point Postulate** A line contains at least two points.		Through points A and B, there is exactly one line ℓ. Line ℓ contains at least two points.
Line Intersection Postulate If two lines intersect, then their intersection is exactly one point.		The intersection of line m and line n is point C.
Three Point Postulate Through any three noncollinear points, there exists exactly one plane. **Plane-Point Postulate** A plane contains at least three noncollinear points		Through points D, E, and F, there is exactly one plane, plane R. Plane R contains at least three noncollinear points.
Plane-Line Postulate If two points lie in a plane, then the line containing them lies in the plane.		Points D and E lie in plane R, so $\overleftrightarrow{DE}$ lies in plane R.
Plane Intersection Postulate If two planes intersect, then their intersection is a line.		The intersection of plane S and plane T is line ℓ.

Notes:

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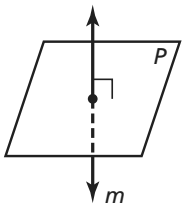
5.3 Practice (continued)

Worked-Out Examples

Example #1

Sketch a diagram of the description.

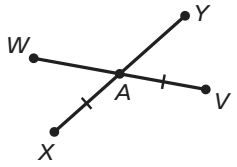
Plane P and line m intersect at a 90° angle.



Example #2

Sketch a diagram of the description.

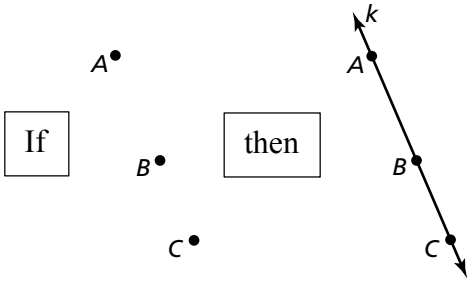
$\overline{XY}$ intersects $\overline{WV}$ at point A, so that $XA = VA$.



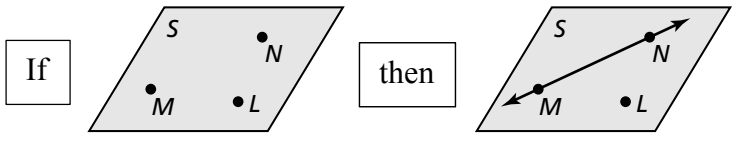
Practice A

In Exercises 1 and 2, state the postulate illustrated by the diagram.

1.



2.



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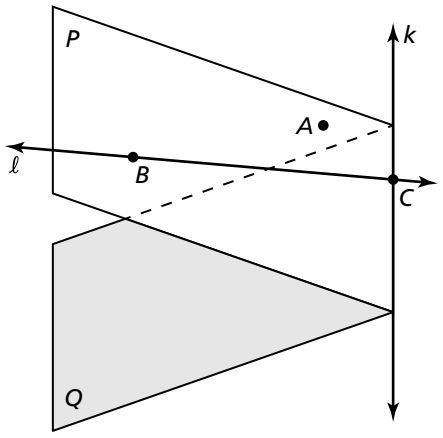
5.3 Practice (continued)

In Exercises 3–6, use the diagram to write an example of the postulate.



3. Two Point Postulate

4. Line-Point Postulate

5. Plane-Point Postulate

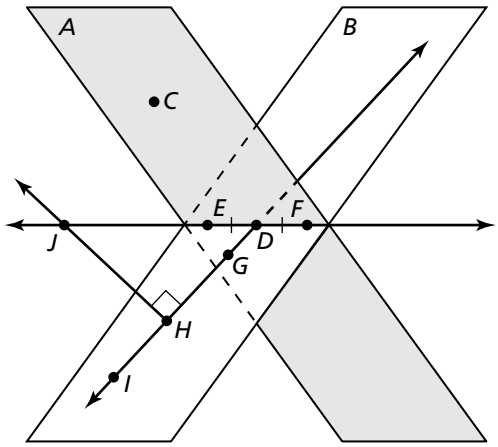
6. Plane Intersection Postulate

In Exercises 7 and 8, sketch a diagram of the description.

7. $\overrightarrow{RS}$ bisecting $\overline{KL}$ at point R

8. $\overleftrightarrow{AB}$ in plane U intersecting $\overleftrightarrow{CD}$ at point E, and point C not on plane U

In Exercises 9–14, use the diagram to determine whether you can assume the statement.



9. Planes A and B intersect at $\overleftrightarrow{EF}$.

10. Points C and D are collinear.

11. $\overrightarrow{HJ}$ and $\overleftrightarrow{ID}$ are perpendicular.

12. $\overleftrightarrow{GD}$ is a bisector of $\overleftrightarrow{EF}$ at point D.

13. $\overline{IH} = \overline{HG}$

14. $\angle HJD$ and $\angle HDJ$ are complementary angles.

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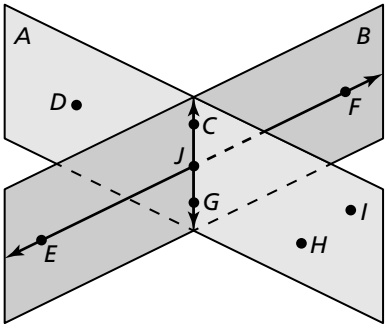
Practice B

In Exercises 1–6, use the diagram to write an example of the postulate.

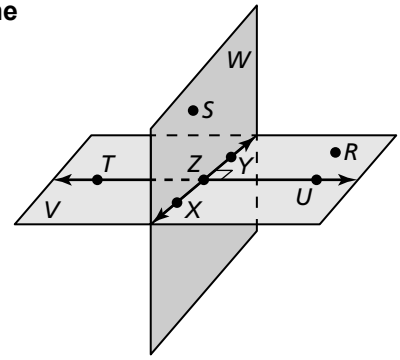


1. Two Point Postulate
2. Line-Point Postulate
3. Line Intersection Postulate
4. Three Point Postulate
5. Plane-Line Postulate
6. Plane Intersection Postulate

In Exercises 7 and 8, sketch a diagram of the description.

7. $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, and $\overleftrightarrow{BD}$ that intersect at exactly two points
8. planes S and T intersecting at a right angle, $\overline{AB}$ on plane S and plane T, and point C is the midpoint of $\overline{AB}$

In Exercises 9–12, use the diagram to determine whether you can assume the statement.



9. Planes W and V intersect at $\overleftrightarrow{TU}$.
10. Points T, U, and R are coplanar.
11. $\angle TZX$ and $\angle UZY$ are vertical angles.
12. $\overleftrightarrow{TU}$ lies in plane W.
13. The Plane Intersection Postulate is written in if-then form. Write the converse, inverse, and contrapositive and state which ones are true.
14. Is it possible for three planes to intersect along the same line? Explain your reasoning.
15. Your friend claims that if the Plane-Line Postulate is true, then all lines that pass through a point in a plane must also be in that same plane. Is your friend correct? Explain your reasoning.
16. $\overline{AB}$ and $\overline{CD}$ lie in plane Z. If $\overleftrightarrow{EF}$ bisects either $\overline{AB}$ or $\overline{CD}$, does $\overleftrightarrow{EF}$ lie in plane Z? If $\overleftrightarrow{EF}$ bisects both $\overline{AB}$ and $\overline{CD}$, does $\overleftrightarrow{EF}$ lie in plane Z? Explain your reasoning.