

EXAMPLE 4 Sketch intersections of planes

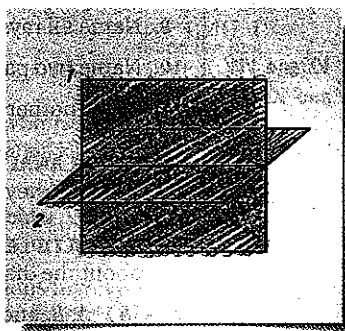
Sketch two planes that intersect in a line.

Solution

STEP 1 Draw a vertical plane. Shade the plane.

STEP 2 Draw a second plane that is horizontal. Shade this plane a different color. Use dashed lines to show where one plane is hidden.

STEP 3 Draw the line of intersection.



GUIDED PRACTICE for Examples 3 and 4

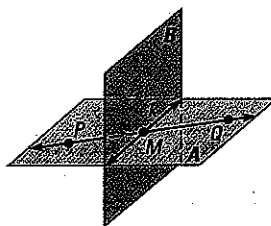
4. Sketch two different lines that intersect a plane at the same point. See margin.

Use the diagram at the right.

5. Name the intersection of \overleftrightarrow{PQ} and line k . point M

6. Name the intersection of plane A and plane B .
line k

7. Name the intersection of line k and plane A . line k



Extra Example 4

Sketch two planes that do not intersect in a line.



Key Question to Ask for Example 4

- Can two planes intersect in a segment? Explain. No; since the intersecting planes extend without end, their intersection must be a line.

Closing the Lesson

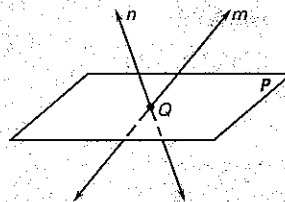
Have students summarize the major points of the lesson and answer the Essential Question: How do you name geometric figures?

- You can sketch and name points, lines, planes, segments, and rays.
- A line may intersect a plane in one point or lie in the plane.
- The intersection of two planes is a line.

Use one letter to name a point, two letters to name the endpoints of a segment, two letters to name the endpoint and one other point of a ray, and two letters to name any two points of a line. Use three letters for three noncollinear points in a plane to name the plane.

Guided Practice

4. Sample:



Skill Practice

2. Yes; no; collinear points are points that lie on the same line and therefore in the same plane, while coplanar points lie in the same plane but not necessarily on the same line.

1.1 EXERCISES

HOMEWORK KEY

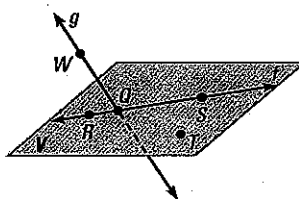
- = WORKED-OUT SOLUTIONS on p. WS1 for Exs. 15, 19, and 43
- ★ = STANDARDIZED TEST PRACTICE Exs. 2, 7, 13, 16, and 43

SKILL PRACTICE

- A** 1. **VOCABULARY** Write in words what each of the following symbols means.
- a. Q point Q b. \overline{MN} line segment MN c. \overrightarrow{ST} ray ST d. \overleftrightarrow{FG} line FG
2. ★ **WRITING** Compare collinear points and coplanar points. Are collinear points also coplanar? Are coplanar points also collinear? Explain. See margin.

NAMING POINTS, LINES, AND PLANES In Exercises 3–7, use the diagram.

3. Give two other names for \overleftrightarrow{WQ} . \overleftrightarrow{QW} , line g
4. Give another name for plane V . Sample answer: plane RTS
5. Name three points that are collinear. Then name a fourth point that is *not* collinear with these three points. Sample answer: points R, Q, S ; point T
6. Name a point that is *not* coplanar with R, S , and T . point W
7. ★ **WRITING** Is point W coplanar with points Q and R ? Explain. Yes; through any three points not on the same line, there is exactly one plane.



1.1 Identify Points, Lines, and Planes

5

4 PRACTICE AND APPLY

Assignment Guide

Answer Transparencies available for all exercises

Basic:

Day 1: SRH p. 876 Exs. 1–6
pp. 5–8
Exs. 1–16, 17–27 odd, 40–44, 47, 50, 53, 56

Average:

Day 1: pp. 5–8
Exs. 1, 2, 3–11 odd, 12–16, 20–26, 27–37 odd, 40–45, 48, 51, 54, 57

Advanced:

Day 1: pp. 5–8
Exs. 1, 5–7, 10, 11, 13–16, 20–38 even, 39–46*, 49, 52, 55, 58

Block:

pp. 5–8
Exs. 1, 2, 3–11 odd, 12–16, 20–26, 27–37 odd, 40–45, 48, 51, 54, 57 (with 1.2)

Differentiated Instruction

See *Differentiated Instruction Resources* for suggestions on addressing the needs of a diverse classroom.

Homework Check

For a quick check of student understanding of key concepts, go over the following exercises:

Basic: 4, 8, 14, 21, 40
Average: 5, 9, 14, 20, 41
Advanced: 6, 13, 22, 26, 42

Extra Practice

- Student Edition, p. 896
- Chapter Resource Book: Practice levels A, B, C

Practice Worksheet

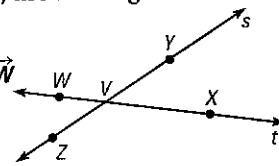
An easily-readable reduced practice page (with answers) for this lesson can be found on p. 1C.

EXAMPLE 2
on p. 4
for Exs. 8–13

10. \overleftrightarrow{VX} and \overleftrightarrow{VW} ,
 \overleftrightarrow{VY} and \overleftrightarrow{VZ}

NAMING SEGMENTS AND RAYS

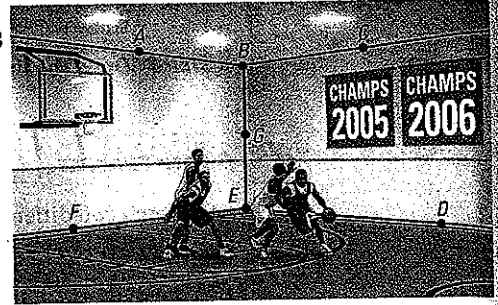
- In Exercises 8–12, use the diagram.
- What is another name for \overleftrightarrow{ZY} ? \overleftrightarrow{VZ}
 - Name all rays with endpoint V . \overrightarrow{VY} , \overrightarrow{VX} , \overrightarrow{VZ} , \overrightarrow{VW}
 - Name two pairs of opposite rays.
 - Give another name for \overleftrightarrow{WV} . \overleftrightarrow{WX}



- ERROR ANALYSIS** A student says that \overleftrightarrow{VW} and \overleftrightarrow{VZ} are opposite rays because they have the same endpoint. Describe the error. Point V must lie between points W and Z , which means the three points must be collinear.

- ★ **MULTIPLE CHOICE** Which statement about the diagram at the right is true? **B**

- (A) $A, B,$ and C are collinear.
(B) $C, D, E,$ and G are coplanar.
(C) B lies on \overleftrightarrow{GE} .
(D) \overleftrightarrow{EF} and \overleftrightarrow{ED} are opposite rays.



EXAMPLES 3 and 4
on pp. 4–5
for Exs. 14–23

SKETCHING INTERSECTIONS

- Sketch the figure described. 14, 15. See margin.
- Three lines that lie in a plane and intersect at one point
 - One line that lies in a plane, and one line that does not lie in the plane

- ★ **MULTIPLE CHOICE** Line AB and line CD intersect at point E , with point E between A and B and between C and D . Which rays are opposite rays? **A**
- (A) \overleftrightarrow{EC} and \overleftrightarrow{ED} (B) \overleftrightarrow{CE} and \overleftrightarrow{DE} (C) \overleftrightarrow{AB} and \overleftrightarrow{BA} (D) \overleftrightarrow{AE} and \overleftrightarrow{BE}

READING DIAGRAMMS

- In Exercises 17–22, use the diagram at the right.
- Name the intersection of \overleftrightarrow{PR} and \overleftrightarrow{HR} . point R

- Name the intersection of plane EFG and plane FGS . \overleftrightarrow{FG}

- Name the intersection of plane PQS and plane HGS . \overleftrightarrow{RS}

- Are points $P, Q,$ and F collinear? Are they coplanar? no; yes
- Are points P and G collinear? Are they coplanar? yes; yes

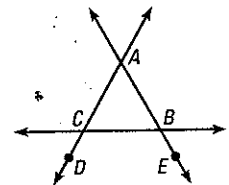
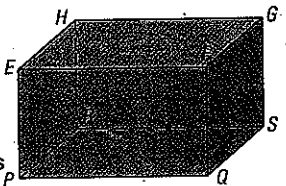
- Name three planes that intersect at point E .
Sample answer: plane PEF , plane PEH , plane HEF

- SKETCHING PLANES** Sketch plane J intersecting plane K . Then draw a line l in plane J that intersects plane K at a single point. See margin.

- NAMING RAYS** Name 10 different rays in the diagram at the right. Then name 2 pairs of opposite rays.

- SKETCHING** Draw three noncollinear points $J, K,$ and L . Sketch \overleftrightarrow{JK} and add a point M on \overleftrightarrow{JK} . Then sketch \overleftrightarrow{ML} . See margin.

- SKETCHING** Draw two points P and Q . Then sketch \overleftrightarrow{PQ} . Add a point R on the ray so that Q is between P and R . See margin.

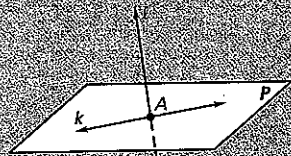


24. Sample answer:
 \overleftrightarrow{AC} (or \overleftrightarrow{AD}),
 \overleftrightarrow{AB} (or \overleftrightarrow{AE}),
 \overleftrightarrow{DC} (or \overleftrightarrow{DA}),
 \overleftrightarrow{EB} (or \overleftrightarrow{EA}),
 \overleftrightarrow{CB} , \overleftrightarrow{BC} , \overleftrightarrow{CD} ,
 \overleftrightarrow{CA} , \overleftrightarrow{CD} , and
 \overleftrightarrow{CA} , \overleftrightarrow{BA} and \overleftrightarrow{BE}

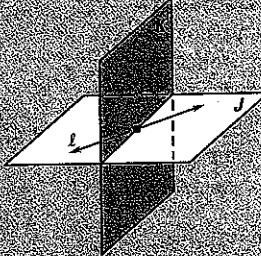
○ = WORKED-OUT SOLUTIONS on p. WS1

★ = STANDARDIZED TEST PRACTICE

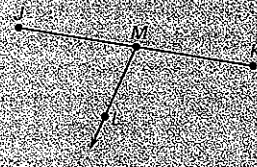
15. Sample:



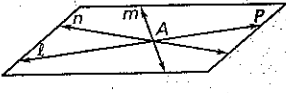
23. Sample:



25. Sample:



14. Sample:



REVIEW ALGEBRA
For help with equations of lines, see p. 878.

XV ALGEBRA In Exercises 27–32, you are given an equation of a line and a point. Use substitution to determine whether the point is on the line.

27. $y = x - 4$; $A(5, 1)$
on the line

28. $y = x + 1$; $A(1, 0)$
not on the line

29. $y = 3x + 4$; $A(7, 1)$
not on the line

30. $y = 4x + 2$; $A(1, 6)$
on the line

31. $y = 3x - 2$; $A(-1, -5)$
on the line

32. $y = -2x + 8$; $A(-4, 0)$
not on the line

GRAPHING Graph the inequality on a number line. Tell whether the graph is a segment, a ray or rays, a point, or a line. 33–38. See margin for art.

33. $x \leq 3$ ray

34. $x \geq -4$ ray

35. $-7 \leq x \leq 4$ segment

36. $x \geq 5$ or $x \leq -2$ rays

37. $x \geq -1$ or $x \leq 5$ line

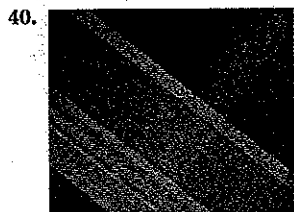
38. $|x| \leq 0$ point

- C** 39. **CHALLENGE** Tell whether each of the following situations involving three planes is possible. If a situation is possible, make a sketch. See margin for art.
- None of the three planes intersect. **possible**
 - The three planes intersect in one line. **possible**
 - The three planes intersect in one point. **possible**
 - Two planes do not intersect. The third plane intersects the other two. **possible**
 - Exactly two planes intersect. The third plane does not intersect the other two. **not possible**

PROBLEM SOLVING

EXAMPLE 3 A
on p. 4
for Exs. 40–42

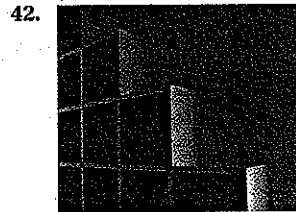
EVERYDAY INTERSECTIONS What kind of geometric intersection does the photograph suggest?



intersecting lines



intersection of a line and a plane



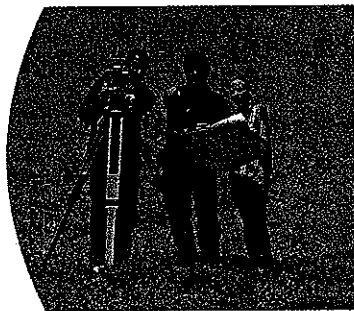
intersecting planes

43. Four points are not necessarily coplanar; no; three points determine a unique plane.

- 43. ★ SHORT RESPONSE** Explain why a four-legged table may rock from side to side even if the floor is level. Would a three-legged table on the same level floor rock from side to side? Why or why not?

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- B** 44. **SURVEYING** A surveying instrument is placed on a tripod. The tripod has three legs whose lengths can be adjusted.
- When the tripod is sitting on a level surface, are the tips of the legs coplanar? **yes**
 - Suppose the tripod is used on a sloping surface. The length of each leg is adjusted so that the base of the surveying instrument is level with the horizon. Are the tips of the legs coplanar? **Explain.**



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44b. Yes; three points determine a unique plane.

Vocabulary

Exercise 13 To help students remember the meaning of the terms collinear and coplanar, discuss other words that use the prefix *co-*, which means *together*.

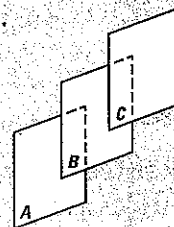
Reading Strategy

Exercises 17–22 Point out to students that in the figure different planes are shaded lighter or darker blue to help them visualize the shape.

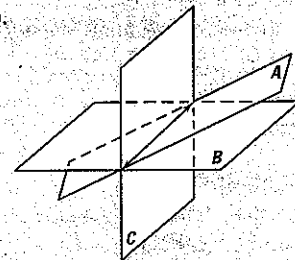
Teaching Strategy

Exercises 17–22 To help students better understand the diagram, you may wish to have them work in groups and provide each group with a three-dimensional model; a tissue box would work well. Students could label the corner points with a marker.

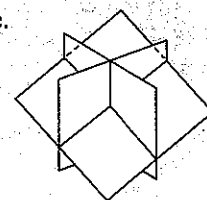
39a.



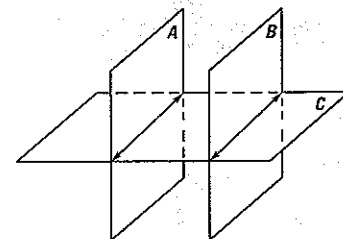
39b.



39c.



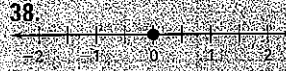
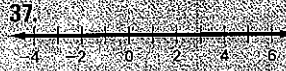
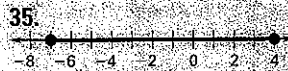
39d.



1.1 Identify Points, Lines, and Planes

7

26. Sample:

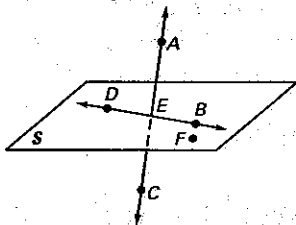


5 ASSESS AND RETEACH

Daily Homework Quiz

Transparency Available

Use this figure for Exercises 1–4.



- Give two other names for \overleftrightarrow{AE} .
EC, AC
- Give another name for plane S.
Sample answer: plane DEF
- Name three collinear points.
Sample answer: A, E, C
- Name the intersection of \overleftrightarrow{AC} and plane S. *E*

Online Quiz

Available at classzone.com

Diagnosis/Remediation

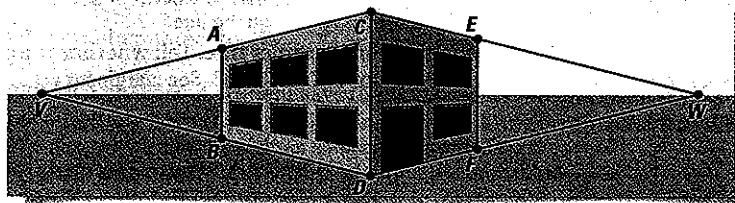
- Practice A, B, C in Chapter Resource Book
- Study Guide in Chapter Resource Book
- Practice Workbook
- @HomeTutor

Challenge

Additional challenge is available in the Chapter Resource Book.

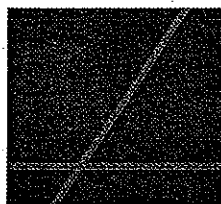
45a–c. See Additional Answers beginning on p. AA1.

45. **MULTI-STEP PROBLEM** In a *perspective drawing*, lines that do not intersect in real life are represented by lines that appear to intersect at a point far away on the horizon. This point is called a *vanishing point*. The diagram shows a drawing of a house with two vanishing points. 45a–c. See margin

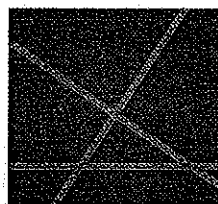


- Trace the black line segments in the drawing. Using lightly dashed lines, join points A and B to the vanishing point W. Join points E and F to the vanishing point V.
- Label the intersection of \overleftrightarrow{EV} and \overleftrightarrow{AW} as G. Label the intersection of \overleftrightarrow{FV} and \overleftrightarrow{BW} as H.
- Using heavy dashed lines, draw the hidden edges of the house: \overline{AG} , \overline{EG} , \overline{BH} , \overline{FH} , and \overline{GH} .

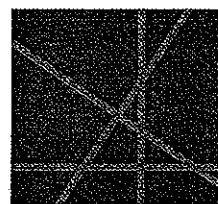
- C** 46. **CHALLENGE** Each street in a particular town intersects every existing street exactly one time. Only two streets pass through each intersection.



2 streets



3 streets



4 streets

- A traffic light is needed at each intersection. How many traffic lights are needed if there are 5 streets in the town? 6 streets? **10 traffic lights; 15 traffic lights**
- Describe a pattern you can use to find the number of additional traffic lights that are needed each time a street is added to the town. Let n represent the number of streets. To find the additional number of traffic lights needed, find $n - 1$.

MIXED REVIEW

Find the difference. (p. 869)

47. $-15 - 9 = -24$

48. $6 - 10 = -4$

49. $-25 - (-12) = -13$

50. $13 - 20 = -7$

51. $16 - (-4) = 20$

52. $-5 - 15 = -20$

Evaluate the expression. (p. 870)

53. $5 \cdot |-2 + 1| = 5$

54. $|-8 + 7| - 6 = -5$

55. $-7 \cdot |8 - 10| = -14$

Plot the point in a coordinate plane. (p. 878) 56–58. See margin.

56. $A(2, 4)$

57. $B(-3, 6)$

58. $E(6, 7.5)$

PREVIEW
Prepare for Lesson 1.2 in Exs. 53–58.

