

EXAMPLE 4 Sketch intersections of planes

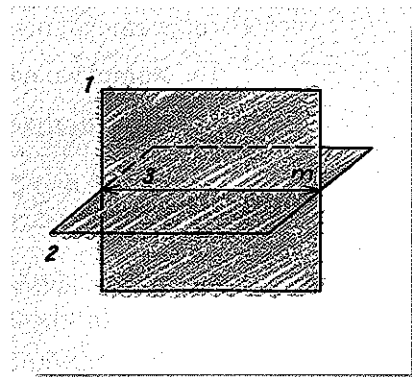
Sketch two planes that intersect in a line.

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.

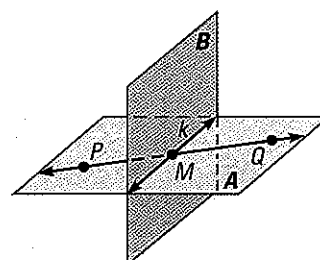


GUIDED PRACTICE for Examples 3 and 4

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

Use the diagram at the right.

5. Name the intersection of \overleftrightarrow{PQ} and line k .
 6. Name the intersection of plane A and plane B .
 7. Name the intersection of line k and plane A .



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

1. **VOCABULARY** Write in words what each of the following symbols means.

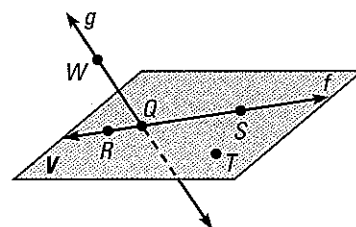
a. Q b. \overline{MN} c. \overrightarrow{ST} d. \overleftrightarrow{FG}

2. ★ **WRITING** Compare collinear points and coplanar points. Are collinear points also coplanar? Are coplanar points also collinear? Explain.

EXAMPLE 1
on p. 3
for Exs. 3–7

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

3. Give two other names for \overleftrightarrow{WQ} .
 4. Give another name for plane V .
 5. Name three points that are collinear. Then name a fourth point that is *not* collinear with these three points.
 6. Name a point that is *not* coplanar with R , S , and T .
 7. ★ **WRITING** Is point W coplanar with points Q and R ? Explain.

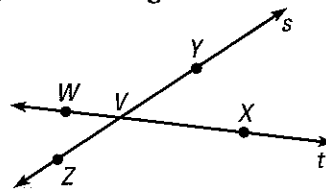


EXAMPLE 2

on p. 4
for Exs. 8–13

NAMING SEGMENTS AND RAYS In Exercises 8–12, use the diagram.

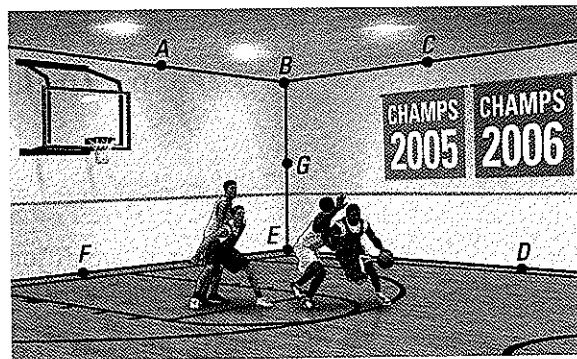
8. What is another name for \overline{ZY} ?
9. Name all rays with endpoint V .
10. Name two pairs of opposite rays.
11. Give another name for \overleftrightarrow{WV} .



12. **ERROR ANALYSIS** A student says that \overleftrightarrow{VW} and \overleftrightarrow{VZ} are opposite rays because they have the same endpoint. Describe the error.

13. **★ MULTIPLE CHOICE** Which statement about the diagram at the right is true?

- (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.

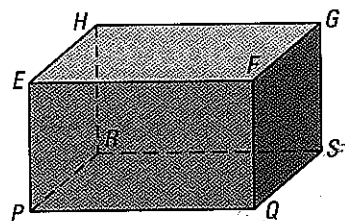
14. Three lines that lie in a plane and intersect at one point
- (15) One line that lies in a plane, and one line that does not lie in the plane

16. **★ MULTIPLE CHOICE** Line AB and line CD intersect at point E . Which of the following are opposite rays?

- (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.

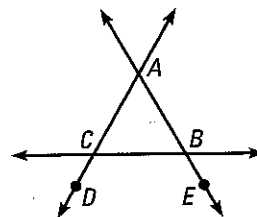
17. Name the intersection of \overleftrightarrow{PR} and \overleftrightarrow{HR} .
18. Name the intersection of plane EFG and plane FGS .
- (19) Name the intersection of plane PQS and plane HGS .
20. Are points $P, Q,$ and F collinear? Are they coplanar?
21. Are points P and G collinear? Are they coplanar?
22. Name three planes that intersect at point E .



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

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

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



26. **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 .

REVIEW ALGEBRA

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

31. 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. $y = x - 4$; $A(5, 1)$

28. $y = x + 1$; $A(1, 0)$

29. $y = 3x + 4$; $A(7, 1)$

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

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

32. $y = -2x + 8$; $A(-4, 0)$

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. $x \leq 3$

34. $x \geq -4$

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

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

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

38. $|x| \leq 0$

39. CHALLENGE Tell whether each of the following situations involving three planes is possible. If a situation is possible, make a sketch.

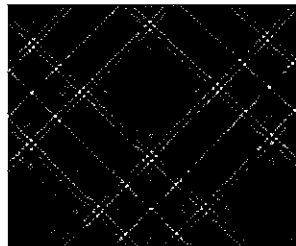
- a. None of the three planes intersect.
- b. The three planes intersect in one line.
- c. The three planes intersect in one point.
- d. Two planes do not intersect. The third plane intersects the other two.
- e. Exactly two planes intersect. The third plane does not intersect the other two.

PROBLEM SOLVING

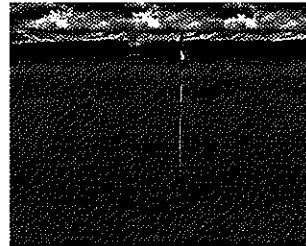
EXAMPLE 3
on p. 4
for Exs. 40–42

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

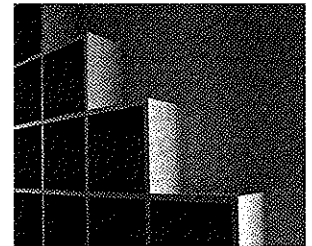
40.



41.



42.



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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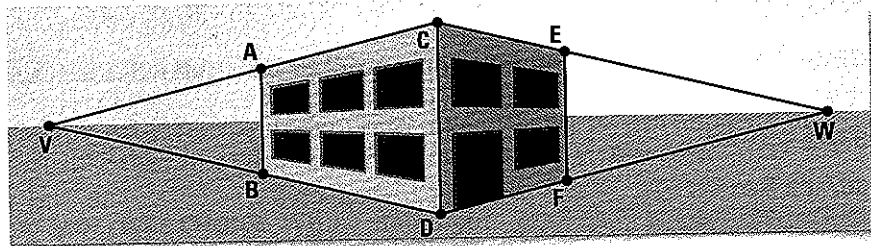
44. SURVEYING A surveying instrument is placed on a tripod. The tripod has three legs whose lengths can be adjusted.

- a. When the tripod is sitting on a level surface, are the tips of the legs coplanar?
- b. 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.

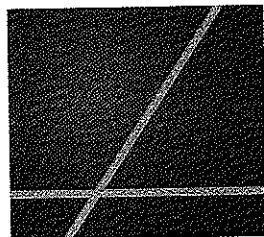
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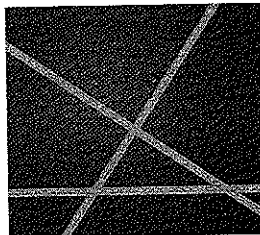
45. **MULTI-STEP PROBLEM** In a *perspective drawing*, lines that do not intersect in real life are represented by lines that appear to intersect at a point far away on the horizon. This point is called a *vanishing point*. The diagram shows a drawing of a house with two vanishing points.



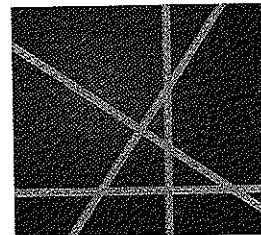
- Trace the black line segments in the drawing. Using lightly dashed lines, join points A and B to the vanishing point W . Join points E and F to the vanishing point V .
 - Label the intersection of \overrightarrow{EV} and \overrightarrow{AW} as G . Label the intersection of \overrightarrow{FV} and \overrightarrow{BW}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

MIXED REVIEW

Find the difference. (p. 869)

47. $-15 - 9$

48. $6 - 10$

49. $-25 - (-12)$

50. $13 - 20$

51. $16 - (-4)$

52. $-5 - 15$

PREVIEW

Prepare for
Lesson 1.2
in Exs. 53–58.

Evaluate the expression. (p. 870)

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

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

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

Plot the point in a coordinate plane. (p. 878)

56. $A(2, 4)$

57. $B(-3, 6)$

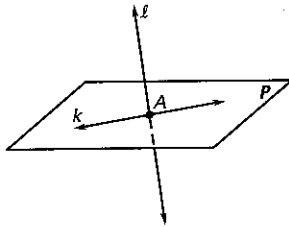
58. $E(6, 7.5)$

Selected Answers

Chapter 1

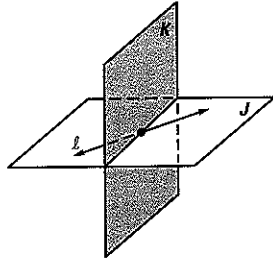
1.1 Skill Practice (pp. 5–7) 1. a. point Q b. line segment MN c. ray ST d. line FG 3. \overleftrightarrow{QW} , line g 5. *Sample answer:* points R, Q, S; point T 7. Yes; through any three points not on the same line, there is exactly one plane. 9. \overleftrightarrow{VY} , \overleftrightarrow{VX} , \overleftrightarrow{VZ} , \overleftrightarrow{VW} 11. \overleftrightarrow{WX}

15. *Sample:*

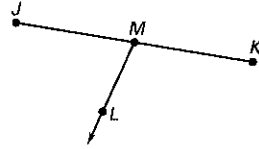


17. point R
19. \overleftrightarrow{RS}
21. yes; yes

23. *Sample:*



25. *Sample:*

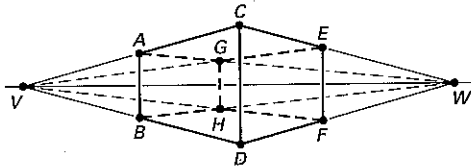


27. on the line 29. not on the line 31. on the line

33. ray

35. segment

1.1 Problem Solving (pp. 7–8) 41. intersection of a line and a plane 43. Four points are not necessarily coplanar; no; three points determine a unique plane. 45. a–c.



1.2 Skill Practice (pp. 12–13) 1. \overline{MN} means segment MN while MN is the length of \overline{MN} . 3. 2.1 cm 5. 3.5 cm 7. 44 9. 23 11. 13 13. congruent 15. not congruent 17. 7 19. 9 21. 10 23. 20 25. 30 29. $(3x - 16) + (4x - 8) = 60$; 12; 20, 40

1.2 Problem Solving (pp. 13–14)

33. a. 1883 mi b. about 50 mi/h

35. a. *Sample:*



1.3 Skill Practice (pp. 19–20) 1. Distance Formula

3. $10\frac{1}{4}$ in. 5. 26 cm 7. $4\frac{3}{4}$ in. 9. $2\frac{3}{8}$ in. 11. 10 13. 1

15. 70 17. (5, 5) 19. (1, 4) 21. $(1\frac{1}{2}, -1)$ 23. $(\frac{m}{2}, \frac{n}{2})$; when x_2 and y_2 are replaced by zero in the Midpoint Formula and x_1 and y_1 are replaced by m and n the result is $(\frac{m}{2}, \frac{n}{2})$. 25. (-3, 10) 27. (4, 8) 29. (-18, 22)

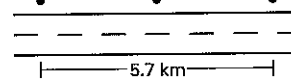
31. 4.5 33. 5.7 35. 7; $-\frac{1}{2}$ 37. 40; 5 39. 9; $-3\frac{1}{2}$

43. $AB = 3\sqrt{5}$, $CD = 2\sqrt{10}$; not congruent

45. $JK = 8\sqrt{2}$, $LM = \sqrt{130}$; not congruent

1.3 Problem Solving (pp. 21–22)

49. House Library School 2.85 km

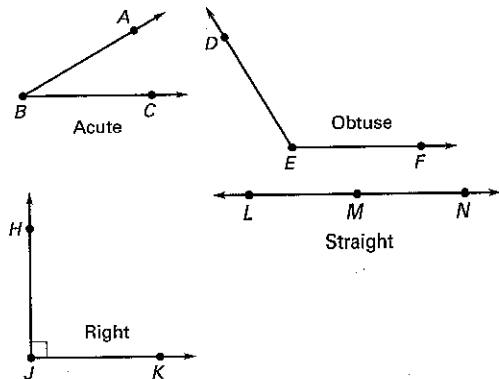


51. objects B and D; objects A and C 53. a. 191 yd

b. 40 yd c. About 1.5 min; find the total distance, about 230 yards, and divide by 150 yards per minute.

1.4 Skill Practice (pp. 28–31)

1. *Sample:*



3. $\angle ABC$, $\angle B$, $\angle CBA$; B , \overrightarrow{BA} , \overrightarrow{BC} 5. $\angle MTP$, $\angle T$, $\angle PTM$; T , \overrightarrow{TM} , \overrightarrow{TP} 7. straight 9. right 11. 90° ; right 13. 135° ; obtuse 15–19. *Sample answers are given.* 15. $\angle BCA$; right 17. $\angle DFB$; straight 19. $\angle CDB$; acute 23. 65° 25. 55° 29. $m\angle XWY = 104^\circ$, $m\angle ZWY = 52^\circ$