

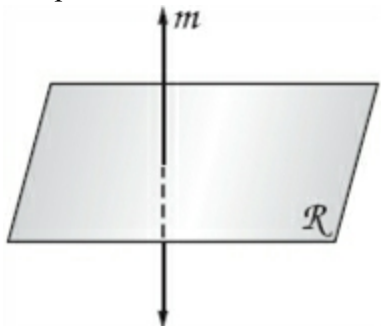
1-1 Points, Lines, and Planes

Draw and label a figure for each relationship.

32. Line m intersects plane R at a single point.

ANSWER:

Sample answer:



34. Points X and Y lie on $\overline{CD}$.

ANSWER:

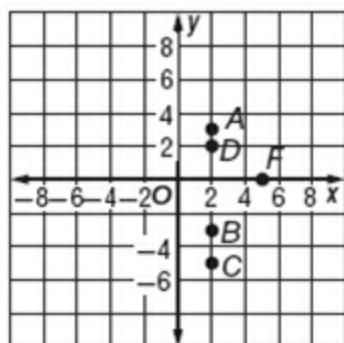
Sample answer:



36. Points $A(2, 3)$, $B(2, -3)$, C and D are collinear, but A , B , C , D , and F are not.

ANSWER:

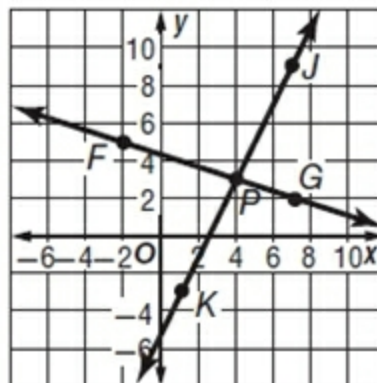
Sample answer:



38. $\overline{FG}$ and $\overline{JK}$ intersect at $P(4, 3)$, where point F is at $(-2, 5)$ and point J is at $(7, 9)$.

ANSWER:

Sample answer:



APPLY MATH When packing breakable objects such as glasses, movers frequently use boxes with inserted dividers like the one shown.



40. How many planes are modeled in the picture?

ANSWER:

15

41. What parts of the box model lines?

ANSWER:

edges

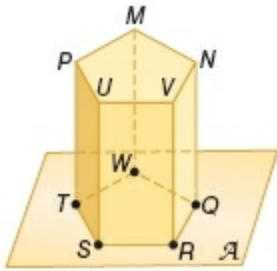
42. What parts of the box model points?

ANSWER:

vertices

1-1 Points, Lines, and Planes

Refer to the figure below.



44. How many planes appear in the figure?

ANSWER:

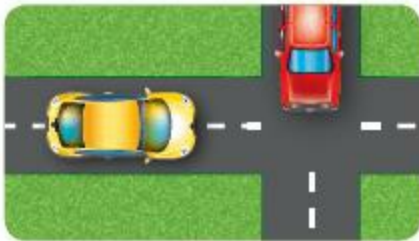
7

46. In what line do planes A and QRV intersect?

ANSWER:

$\overline{QR}$

53. **TRANSPORTATION** When two cars enter an intersection at the same time on opposing paths, one of the cars must adjust its speed or direction to avoid a collision. Two airplanes, however, can cross paths while traveling in different directions without colliding. Explain how this is possible.



ANSWER:

Sample answer: The airplanes are in different horizontal planes.

58. **ERROR ANALYSIS** Camille and Hiroshi are trying to determine the most number of lines that can be drawn using any two of four random points. Is either correct? Explain.

Camille

Because there are four points,
 $4 \cdot 3$ or 12 lines can be drawn
between the points.

Hiroshi

You can draw $3 \cdot 2 \cdot 1$ or
6 lines between the points.

ANSWER:

Sample answer: Hiroshi is correct; after you draw the line from the first point to the other three, one of the lines from the second point is already drawn.

67. Which undefined term is best modeled by a laptop screen?



- A line
- B parallel
- C plane
- D rectangle

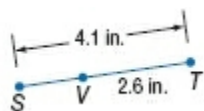
ANSWER:

C

1-2 Line Segments and Distance

Find each measure. Assume that each figure is not drawn to scale.

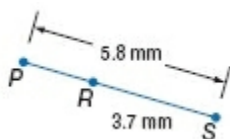
13. SV



ANSWER:

1.5 in.

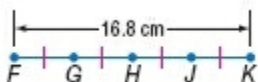
14. PR



ANSWER:

2.1 mm

15. FG



ANSWER:

4.2 cm

Find the value of the variable and YZ if Y is between X and Z .

19. $XY = 6b$, $YZ = 8b$, $XZ = 175$

ANSWER:

$b = 12.5$; $YZ = 100$

21. $XY = 11d$, $YZ = 9d - 2$, $XZ = 5d + 28$

ANSWER:

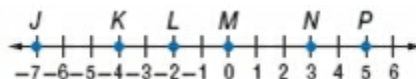
$d = 2$; $YZ = 16$

23. $XY = 3a - 4$, $YZ = 6a + 2$, $XZ = 5a + 22$

ANSWER:

$a = 6$; $YZ = 38$

Use the number line to find each measure.



25. JK

ANSWER:

3

Find the distance between each pair of points.

38. $M(-3, 8)$, $N(-5, 1)$

ANSWER:

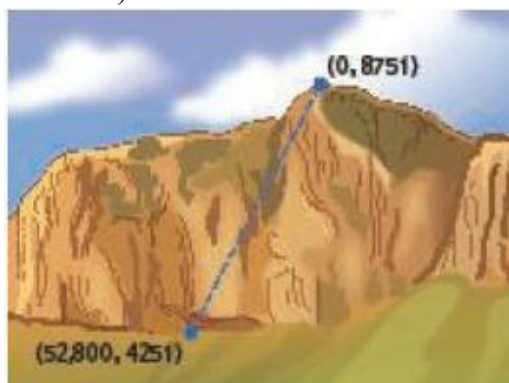
$\sqrt{53}$ or about 7.3 units

40. $A(2, 4)$, $B(5, 7)$

ANSWER:

$\sqrt{18}$ or about 4.2 units

42. **REASONING** Vivian is planning to hike to the top of Guadalupe Peak on her family vacation. The coordinates of the peak of the mountain and of the base of the trail are shown in feet. If the trail can be approximated by a straight line, estimate the length of the trail to the nearest tenth of a mile. (Hint: 1 mi = 5280 ft)



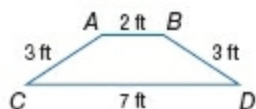
ANSWER:

10.0 mi

1-2 Line Segments and Distance

Determine whether each pair of segments is congruent.

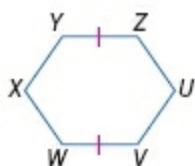
44. $\overline{AC}, \overline{BD}$



ANSWER:

yes

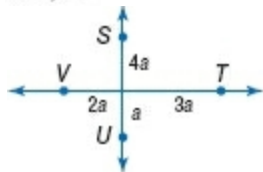
46. $\overline{VW}, \overline{UZ}$



ANSWER:

Cannot be determined from the information given.

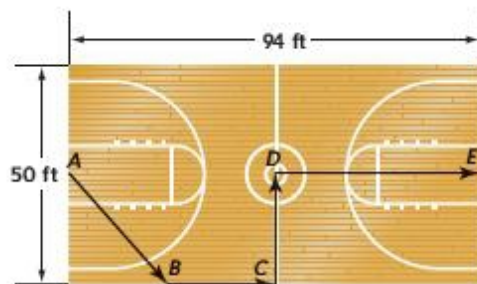
48. $\overline{SU}, \overline{VT}$



ANSWER:

yes

53. **MULTI-STEP** Coach Willis designs a play that requires the ball to be passed from point A to point E as shown below. The arrows represent quick passes to different members of his team. Randi can throw the ball from under the basket to midcourt, Jen and Mandy can throw the ball half the width of the court, Makayla can throw the ball to the free throw line from under the basket, and Kim can throw the ball farther than Jen.



- In which position should each girl be?
- Describe your solution process.
- What assumptions did you make?

ANSWER:

- A: Kim, B: Jen or Mandy, C: Jen or Mandy, D: Randi, E: Makayla
- I know that Makayla can throw the shortest distance of all 5 team members and that Randi can throw the farthest. So I chose to place these players at points E and D , respectively. Jen and Mandy can each throw 25 feet (half the width of the court), so I placed them at either point B or point C . Kim will be at point A , and the team will be able to complete the play provided Kim can throw at least 33.3 feet.
- I assumed that the player at point B would be 25 feet from point C .

55. **WRITING IN MATH** If point B is between points A and C , explain how you can find AC if you know AB and BC . Explain how you can find BC if you know AB and AC .

ANSWER:

If point B is between points A and C , and you know AB and BC , add AB and BC to find AC . If you know AB and AC , subtract AB from AC to find BC .

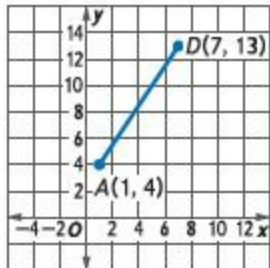
1-2 Line Segments and Distance

57. **REASONING** Determine whether the statement *If point M is between points C and D , then CD is greater than either CM or MD* is sometimes, never, or always true. Explain.

ANSWER:

Always; if point M is between points C and D , then $CM + MD = CD$. Since measures cannot be negative, CD , which represents the whole, must always be greater than either of the lengths of its parts, CM or MD .

58. **CHALLENGE** Point P is located on the segment between point $A(1, 4)$ and point $D(7, 13)$. The distance from A to P is twice the distance from P to D . What are the coordinates of point P ?



ANSWER:

(5, 10)

59. **WRITING IN MATH** Explain how the Pythagorean Theorem is used to derive the Distance Formula.

ANSWER:

Sample answer: The Pythagorean Theorem relates the lengths of the legs of a right triangle to the length of the hypotenuse using the formula $c^2 = a^2 + b^2$. If you take the square root of the formula, you get

$c = \sqrt{a^2 + b^2}$. Think of the hypotenuse of the triangle as the distance between the two points, the a value as the horizontal distance $x_2 - x_1$, and the b value as the vertical distance $y_2 - y_1$. If you substitute, the Pythagorean Theorem becomes the Distance

Formula, $c = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

1-3 Locating Points and Midpoints

Find the coordinates of the midpoint of a segment with the given endpoints.

20. $W(12, 2), X(7, 9)$

ANSWER:

$(9.5, 5.5)$

22. $V(-2, 5), Z(3, -17)$

ANSWER:

$(0.5, -6)$

Find the coordinates of the missing endpoint if B is the midpoint of $\overline{AC}$.

30. $C(-6, -2), B(-3, -5)$

ANSWER:

$A(0, -8)$

32. $C\left(\frac{5}{3}, -6\right), B\left(\frac{8}{3}, 4\right)$

ANSWER:

$A\left(\frac{11}{3}, 14\right)$

Suppose M is the midpoint of $\overline{FG}$. Find the missing measure.

34. $FM = 5y + 13, MG = 5 - 3y, FG = ?$

ANSWER:

16

36. $FM = 8a + 1, FG = 42, a = ?$

ANSWER:

2.5

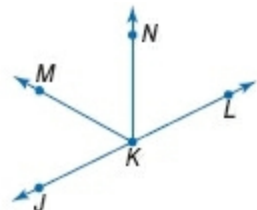
50. **GEOMETRY** One endpoint of $\overline{AB}$ has coordinates $(-3, 5)$. If the coordinates of the midpoint of $\overline{AB}$ are $(2, -6)$, what is the length of $\overline{AB}$?

ANSWER:

24.2

1-4 Angle Measure

ALGEBRA In the figure, $\overrightarrow{KJ}$ and $\overrightarrow{KL}$ are opposite rays, $\overrightarrow{KN}$ bisects $\angle LKM$.



9. If $m\angle LKM = 7x - 5$ and $m\angle NKM = 3x + 9$, find $m\angle LKM$.

ANSWER:

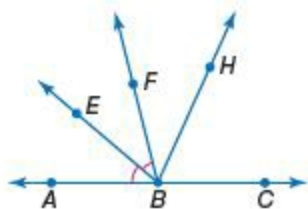
156

10. If $m\angle NKL = 7x - 9$ and $m\angle JKM = x + 3$, find $m\angle JKN$.

ANSWER:

98

ALGEBRA In the figure, $\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays. $\overrightarrow{BH}$ bisects $\angle EBC$.



37. If $m\angle ABE = 2n + 7$ and $m\angle EBF = 4n - 13$, find $m\angle ABE$.

ANSWER:

27

38. If $m\angle EBH = 6x + 12$ and $m\angle HBC = 8x - 10$, find $m\angle EBH$.

ANSWER:

78

39. If $m\angle ABF = 7b - 24$ and $m\angle ABE = 2b$, find $m\angle EBF$.

ANSWER:

16

40. If $m\angle EBC = 31a - 2$ and $m\angle EBH = 4a + 45$, find $m\angle HBC$.

ANSWER:

61

41. If $m\angle ABF = 8s - 6$ and $m\angle ABE = 2(s + 11)$, find $m\angle EBF$.

ANSWER:

47

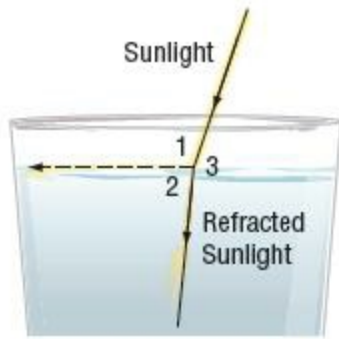
42. If $m\angle EBC = 3r + 10$ and $m\angle ABE = 2r - 20$, find $m\angle EBF$.

ANSWER:

56

1-4 Angle Measure

47. **PHYSICS** When you look at a pencil in water, it looks bent. This illusion is due to *refraction*, or the bending of light when it moves from one substance to the next.
Refer to Page 43.



- What is $m\angle 1$? Classify this angle as *acute*, *right*, or *obtuse*.
- What is $m\angle 2$? Classify this angle as *acute*, *right*, or *obtuse*.
- Without measuring, determine how many degrees the path of the light changes after it enters the water. Explain your reasoning.

ANSWER:

- about 110; obtuse
- about 85; acute
- about 15; If the original path of the light is extended, the measure of the angle the original path makes with the refracted path represents the number of degrees the path of the light changed. The sum of the measure of this angle and the $m\angle 3$ is 180. The measure of $\angle 3$ is $360 - (110 + 85)$ or 165, so the measure of the angle the original path makes with the refracted path is $180 - 165$ or 15.

51. **ARGUMENTS** Is the sum of two acute angles *sometimes*, *always*, or *never* an obtuse angle? Explain.

ANSWER:

Sometimes; sample answer: For example, if you add an angle measure of 4 and an angle measure of 6, you will have an angle measure of 10, which is still acute. But if you add angles with measure of 50 and 60, you will have an obtuse angle with a measure of 110.

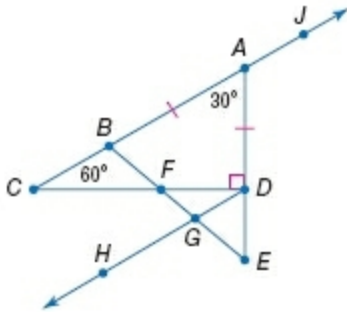
52. **CHALLENGE** $\overline{MP}$ bisects $\angle LMN$, $\overline{MQ}$ bisects $\angle LMP$, and $\overline{MR}$ bisects $\angle QMP$. If $m\angle RMP = 21$, find $m\angle LMN$. Explain your reasoning.

ANSWER:

168; If $m\angle RMP = 21$ and $\overline{MR}$ bisects $\angle QMP$, then $m\angle QMP = 2(21)$ or 42. If $m\angle QMP = 42$ and $\overline{MQ}$ bisects $\angle LMP$, then $m\angle LMP = 2(42)$ or 84. If $m\angle LMP = 84$ and $\overline{MP}$ bisects $\angle LMN$, then $m\angle LMN = 2(84)$ or 168.

1-5 Angle Relationships

Name an angle or angle pair that satisfies each condition.



12. two complementary nonadjacent angles

ANSWER:

$\angle BCF$, $\angle BAD$

15. an angle complementary to $\angle FDG$

ANSWER:

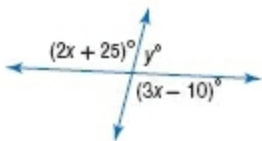
$\angle GDE$

17. an angle supplementary to $\angle JAE$

ANSWER:

$\angle CAE$

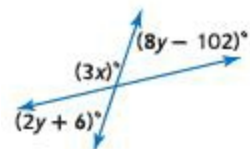
Find the value of each variable.



- 21.

ANSWER:

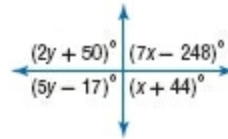
$x = 35$; $y = 85$



- 22.

ANSWER:

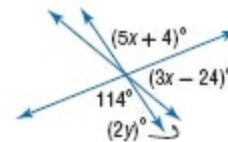
$x = 46$; $y = 18$



- 23.

ANSWER:

$x = 48$; $y = 21$



- 24.

ANSWER:

$x = 22$; $y = 12$

25. **ALGEBRA** $\angle E$ and $\angle F$ are supplementary. The measure of $\angle E$ is 54 more than the measure of $\angle F$. Find the measures of each angle.

ANSWER:

$m\angle F = 63^\circ$; $m\angle E = 117^\circ$

26. **ALGEBRA** The measure of an angle's supplement is 76 less than the measure of the angle. Find the measure of the angle and its supplement.

ANSWER:

128° ; 52°

27. **ALGEBRA** The measure of the supplement of an angle is 40 more than two times the measure of the complement of the angle. Find the measure of the angle.

ANSWER:

40°

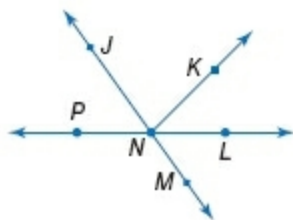
28. **ALGEBRA** $\angle 3$ and $\angle 4$ form a linear pair. The measure of $\angle 3$ is four more than three times the measure of $\angle 4$. Find the measure of each angle.

ANSWER:

$m\angle 3 = 136^\circ$; $m\angle 4 = 44^\circ$

1-5 Angle Relationships

ALGEBRA Use the figure below.



29. If $m\angle KNL = 6x - 4$ and $m\angle LNM = 4x + 24$, find the value of x so that $\angle KNM$ is a right angle.

ANSWER:

7

30. If $m\angle JNP = 3x - 15$ and $m\angle JNL = 5x + 59$, find the value of x so that $\angle JNP$ and $\angle JNL$ are supplements of each other.

ANSWER:

17

31. If $m\angle LNM = 8x + 12$ and $m\angle JNL = 12x - 32$, find $m\angle JNP$.

ANSWER:

92°

32. If $m\angle JNP = 2x + 3$, $m\angle KNL = 3x - 17$, and $m\angle KNJ = 3x + 34$, find the measure of each angle.

ANSWER:

$m\angle JNP = 43^\circ$; $m\angle KNL = 43^\circ$; $m\angle KNJ = 94^\circ$

35. **ALGEBRA** $\overleftrightarrow{WX}$ and $\overleftrightarrow{YZ}$ intersect at point V . If $m\angle WVY = 4a + 58$ and $m\angle XVY = 2b - 18$, find the values of a and b so that $\overleftrightarrow{WX}$ is perpendicular to $\overleftrightarrow{YZ}$.

ANSWER:

$a = 8$; $b = 54$

49. **REASONING** Are there angles that do not have a complement? Explain.

ANSWER:

Yes; angles that are right or obtuse do not have complements because their measures are greater than or equal to 90° .

56. The measures of two complementary angles are in a $5 : 7$ ratio. Find the measure of the smaller angle.

ANSWER:

37.5°

57. There is half of an apple pie left. You want to eat twice as much as your little sister, but you also want to save a piece for your mom. You cut your mom a 30° piece. What is the measure of your piece of pie in degrees?

ANSWER:

100°

58. The measures of two supplementary angles are in the ratio of $11 : 4$. What is the measure of the larger angle?

ANSWER:

C