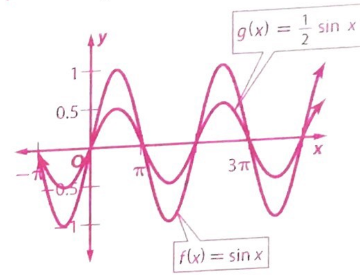
amplitude of $g(x)$ is $\frac{1}{2}$, and the period is 2π.



4-5 Graphing Other Trigonometric Functions (pp. 269–279)

Locate the vertical asymptotes, and sketch the graph of each function. **45–52. See Chapter 4 Answer Appendix.**

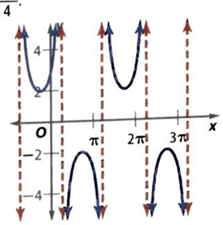
45. $y = 3 \tan x$
46. $y = \frac{1}{2} \tan\left(x - \frac{\pi}{2}\right)$
47. $y = \cot\left(x + \frac{\pi}{3}\right)$
48. $y = -\cot(x - \pi)$
49. $y = 2 \sec\left(\frac{x}{2}\right)$
50. $y = -\csc(2x)$
51. $y = \sec(x - \pi)$
52. $y = \frac{2}{3} \csc\left(x + \frac{\pi}{2}\right)$

Example 5

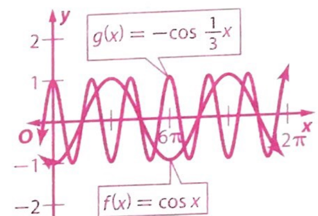
Locate the vertical asymptotes, and sketch the graph of $y = 2 \sec\left(x + \frac{\pi}{4}\right)$.

Because the graph of $y = 2 \sec\left(x + \frac{\pi}{4}\right)$ is the graph of $y = 2 \sec x$ shifted to the left $\frac{\pi}{4}$ units, the vertical asymptotes for one period are located at $-\frac{3\pi}{4}, \frac{\pi}{4}$, and $\frac{5\pi}{4}$.

Graph two cycles on the interval $\left[-\frac{3\pi}{4}, \frac{13\pi}{4}\right]$.



40. The graph of $g(x)$ is the graph of $f(x)$ expanded horizontally and reflected in the x-axis. The amplitude of $g(x)$ is 1, and the period is 6π.



4-6 Inverse Trigonometric Functions (pp. 280–290)

Find the exact value of each expression, if it exists.

53. $\sin^{-1}(-1)$ $-\frac{\pi}{2}$
54. $\cos^{-1}\frac{\sqrt{3}}{2}$ $\frac{\pi}{6}$
55. $\tan^{-1}\left(-\frac{\sqrt{3}}{3}\right)$ $-\frac{\pi}{6}$
56. arcsin 0 0
57. arctan (-1) $-\frac{\pi}{4}$
58. arccos $\frac{\sqrt{2}}{2}$ $\frac{\pi}{4}$
59. $\sin^{-1}\left[\sin\left(-\frac{\pi}{3}\right)\right]$ $-\frac{\pi}{3}$
60. $\cos^{-1}[\cos(-3\pi)]$ π

Example 6

Find the exact value of arctan $-\sqrt{3}$.

Find a point on the unit circle in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ with a tangent of $-\sqrt{3}$. When $t = -\frac{\pi}{3}$, $\tan t = -\sqrt{3}$.

Therefore, arctan $-\sqrt{3} = -\frac{\pi}{3}$.

(61.) $B = 12°$, $C = 146°$, $c = 16.4$
(62.) $B = 48°$, $C = 90°$, $c = 13.5$ and $B = 132°$, $C = 6°$, $c = 1.4$
(63.) $B = 29°$, $C = 73°$, $c = 19.5$
(64.) no solution
(65.) $A = 78°$, $B = 65°$, $C = 37°$
(66.) $c = 6.7$, $A = 36°$, $B = 48°$

4-7 The Law of Sines and the Law of Cosines (pp. 291–301)

Find all solutions for the given triangle, if possible. If no solution exists, write *no solution*. Round side lengths to the nearest tenth and angle measurements to the nearest degree. **61–64. See margin.**

61. $a = 11, b = 6, A = 22°$
62. $a = 9, b = 10, A = 42°$
63. $a = 20, b = 10, A = 78°$
64. $a = 2, b = 9, A = 88°$

65–66. See margin.
Solve each triangle. Round side lengths to the nearest tenth and angle measures to the nearest degree.

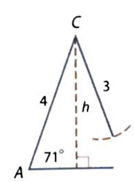
65. $a = 13, b = 12, c = 8$
66. $a = 4, b = 5, C = 96°$

Example 7

Solve the triangle if $a = 3$, $b = 4$, and $A = 71°$.

In the figure, $h = 4 \sin 71°$ or about 3.8

Because $a \leq h$, there is no triangle that can be formed with sides $a = 3$, $b = 4$, and $A = 71°$. Therefore, this problem has no solution.



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Lesson-by-Lesson Review

Intervention If the given examples are not sufficient to review the topics covered by the questions, remind students that the page references tell them where to review that topic in their textbooks.

Two-Day Option Have students complete the Lesson-by-Lesson Review on pp. 526–528. Then you can use McGraw-Hill eAssessment to customize another review worksheet that practices all the objectives of this chapter or only the objectives on which your students need more help.

Additional Answers

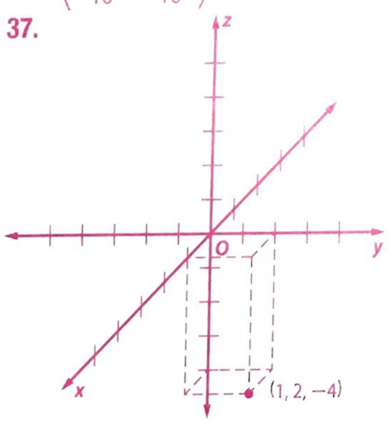
27. $\left\langle -\frac{7\sqrt{53}}{53}, \frac{2\sqrt{53}}{53} \right\rangle$

28. $\left\langle \frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2} \right\rangle$

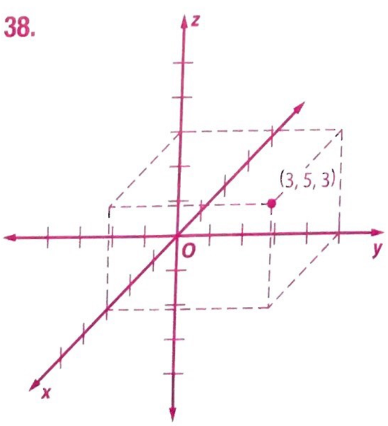
29. $\left\langle -\frac{5\sqrt{89}}{89}, -\frac{8\sqrt{89}}{89} \right\rangle$

30. $\left\langle \frac{3\sqrt{10}}{10}, \frac{\sqrt{10}}{10} \right\rangle$

37.



38.



CHAPTER 8 Study Guide and Review *Continued*

Lesson-by-Lesson Review

8-1 Introduction to Vectors (pp. 482–491)

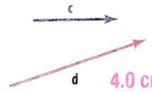
State whether each quantity described is a *vector* quantity or a *scalar* quantity.

11. a car driving 50 miles an hour due east **vector**

12. a gust of wind blowing 5 meters per second **scalar**

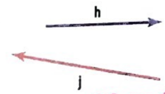
Find the resultant of each pair of vectors using either the triangle or parallelogram method. State the magnitude of the resultant to the nearest tenth of a centimeter and its direction relative to the horizontal.

13.



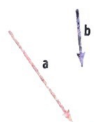
4.0 cm, 11°

14.



0.8 cm, 140°

15.



2.8 cm, 297°

16.

3.6 cm, 196°

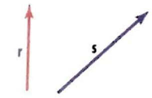
Determine the magnitude and direction of the resultant of each vector sum.

17. 70 meters due west and then 150 meters due east **80 m due east**

18. 8 newtons directly backward and then 12 newtons directly backward **20 N backward**

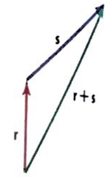
Example 1

Find the resultant of r and s using either the triangle or parallelogram method. State the magnitude of the resultant in centimeters and its direction relative to the horizontal.



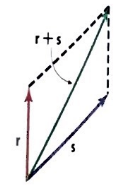
Triangle Method

Translate r so that the tip of r touches the tail of s. The resultant is the vector from the tail of r to the tip of s.



Parallelogram Method

Translate s so that the tail of s touches the tail of r. Complete the parallelogram that has r and s as two of its sides. The resultant is the vector that forms the indicated diagonal of the parallelogram.



The magnitude of the resultant is 3.4 cm and the direction is 59°.

19. $\langle 6, 1 \rangle$; $\sqrt{37} \approx 6.1$ **20.** $\langle -16, 8 \rangle$; $8\sqrt{5} \approx 17.9$

8-2 Vectors in the Coordinate Plane (pp. 492–499)

Find the component form and magnitude of $\overrightarrow{AB}$ with the given initial and terminal points.

19. $A(-1, 3)$, $B(5, 4)$

20. $A(7, -2)$, $B(-9, 6)$

21. $A(-8, -4)$, $B(6, 1)$ **$\langle 14, 5 \rangle$; $\sqrt{221} \approx 14.9$**

22. $A(2, -10)$, $B(3, -5)$ **$\langle 1, 5 \rangle$; $\sqrt{26} \approx 5.1$**

Find each of the following for $\mathbf{p} = \langle 4, 0 \rangle$, $\mathbf{q} = \langle -2, -3 \rangle$, and $\mathbf{t} = \langle -4, 2 \rangle$.

23. $2\mathbf{q} - \mathbf{p}$ **$\langle -8, -6 \rangle$**

24. $\mathbf{p} + 2\mathbf{t}$ **$\langle -4, 4 \rangle$**

25. $\mathbf{t} - 3\mathbf{p} + \mathbf{q}$ **$\langle -18, -1 \rangle$**

26. $2\mathbf{p} + \mathbf{t} - 3\mathbf{q}$ **$\langle 10, 11 \rangle$**

Find a unit vector **u** with the same direction as **v**. **27–30. See margin.**

27. $\mathbf{v} = \langle -7, 2 \rangle$

28. $\mathbf{v} = \langle 3, -3 \rangle$

29. $\mathbf{v} = \langle -5, -8 \rangle$

30. $\mathbf{v} = \langle 9, 3 \rangle$

Example 2

Find the component form and magnitude of $\overrightarrow{AB}$ with initial point $A(3, -2)$ and terminal point $B(4, -1)$.

$\overrightarrow{AB} = \langle x_2 - x_1, y_2 - y_1 \rangle$ Component form

$= \langle 4 - 3, -1 - (-2) \rangle$ Substitute.

$= \langle 1, 1 \rangle$ Subtract.

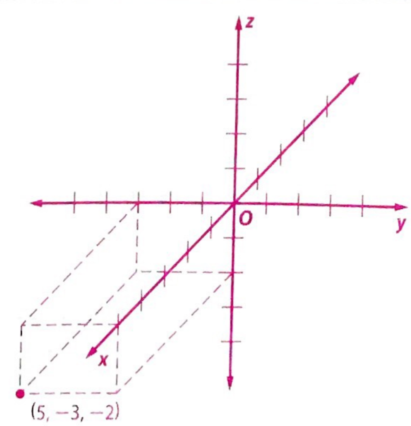
Find the magnitude using the Distance Formula.

$|\overrightarrow{AB}| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ Distance Formula

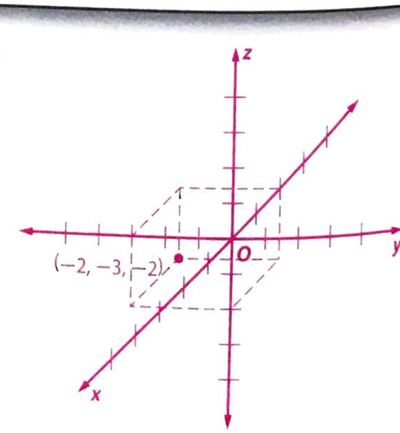
$= \sqrt{[(4 - 3)]^2 + [-1 - (-2)]^2}$ Substitute.

$= \sqrt{2}$ or about 1.4 Simplify.

39.



40.



8-3 Dot Products and Vector Projections (pp. 500–508)

Find the dot product of **u** and **v**. Then determine if **u** and **v** are orthogonal.

31. **u** = ⟨−3, 5⟩, **v** = ⟨2, 1⟩ **−1; not orthogonal**
32. **u** = ⟨4, 4⟩, **v** = ⟨5, 7⟩ **48; not orthogonal**
33. **u** = ⟨−1, 4⟩, **v** = ⟨8, 2⟩ **0; orthogonal**
34. **u** = ⟨−2, 3⟩, **v** = ⟨1, 3⟩ **7; not orthogonal**

Find the angle θ between **u** and **v** to the nearest tenth of a degree.

35. **u** = ⟨5, −1⟩, **v** = ⟨−2, 3⟩ **135.0°**
36. **u** = ⟨−1, 8⟩, **v** = ⟨4, 2⟩ **70.6°**

Example 3

Find the dot product of **x** = ⟨2, −5⟩ and **y** = ⟨−4, 7⟩. Then determine if **x** and **y** are orthogonal.

$\mathbf{x} \cdot \mathbf{y} = x_1 y_1 + x_2 y_2$ — Dot product

$= 2(-4) + -5(7)$ — Substitute.

$= -8 + (-35)$ or -43 — Simplify.

Since $\mathbf{x} \cdot \mathbf{y} \neq 0$, **x** and **y** are not orthogonal.

8-4 Vectors in Three-Dimensional Space (pp. 510–516)

Plot each point in a three-dimensional coordinate system. **37–40. See margin.**

37. (1, 2, −4)
38. (3, 5, 3)
39. (5, −3, −2)
40. (−2, −3, −2)

41. $2\sqrt{38} \approx 12.3$; (−1, 5, 6)

Find the length and midpoint of the segment with the given endpoints.

$2\sqrt{29} \approx 10.8$; (−7, 2, 1)

41. (−4, 10, 4), (2, 0, 8)
42. (−5, 6, 4), (−9, −2, −2)
43. (3, 2, 0), (−9, −10, 4)
44. (8, 3, 2), (−4, −6, 6)

$4\sqrt{19} \approx 17.4$; (−3, −4, 2) **$\sqrt{241} \approx 15.5$; (2, −1.5, 4)**

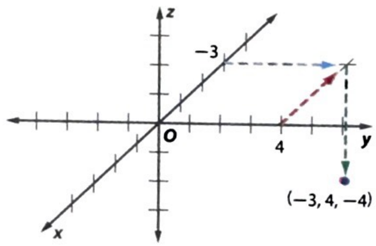
Locate and graph each vector in space. **45–48. See margin.**

45. **a** = ⟨0, −3,4⟩
46. **b** = −3**i** + 3**j** + 2**k**
47. **c** = −2**i** − 3**j** + 5**k**
48. **d** = ⟨−4, −5, −3⟩

Example 4

Plot (−3, 4, −4) in a three-dimensional coordinate system.

Locate the point (−3, 4) in the *xy*-plane and mark it with a cross. Then plot a point 4 units down from this location parallel to the *z*-axis.



8-5 Vectors in Three-Dimensional Space (pp. 518–524)

Find the dot product of **u** and **v**. Then determine if **u** and **v** are orthogonal.

49. **u** = ⟨2, 5, 2⟩, **v** = ⟨8, 2, −13⟩ **0; orthogonal**
50. **u** = ⟨5, 0, −6⟩, **v** = ⟨−6, 1, 3⟩ **−48; not orthogonal**

Find the cross product of **u** and **v**. Then show that **u** × **v** is orthogonal to both **u** and **v**. **51–52. See margin.**

51. **u** = ⟨1, −3, −2⟩, **v** = ⟨2, 4, −3⟩
52. **u** = ⟨4, 1, −2⟩, **v** = ⟨5, −4, −1⟩

Example 5

Find the cross product of **u** = ⟨−4, 2, −3⟩ and **v** = ⟨7, 11, 2⟩. Then show that **u** × **v** is orthogonal to both **u** and **v**.

$$\mathbf{u} \times \mathbf{v} = \begin{vmatrix} 2 & -3 \\ 11 & 2 \end{vmatrix}\mathbf{i} - \begin{vmatrix} -4 & -3 \\ 7 & 2 \end{vmatrix}\mathbf{j} + \begin{vmatrix} -4 & 2 \\ 7 & 11 \end{vmatrix}\mathbf{k}$$

$= \langle 37, -13, -58 \rangle$

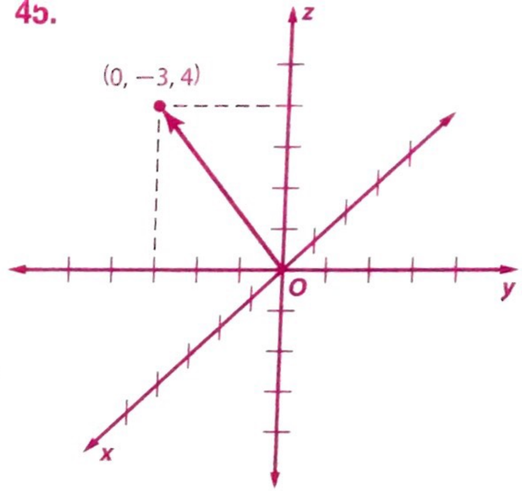
$(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{u} = \langle 37, -13, -58 \rangle \cdot \langle -4, 2, -3 \rangle$

$= -148 - 26 + 174$ or 0 ✔

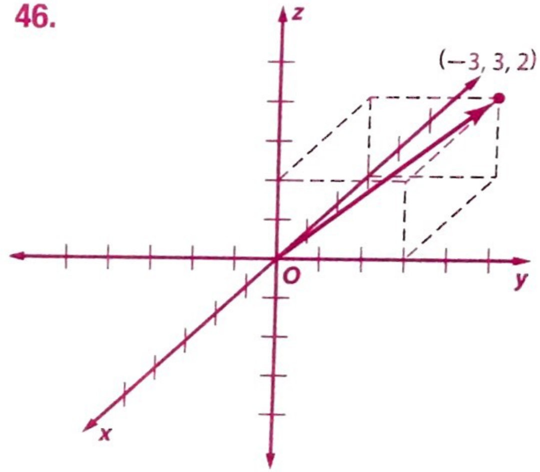
$(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{v} = \langle 37, -13, -58 \rangle \cdot \langle 7, 11, 2 \rangle$

$= 259 - 143 - 116$ or 0 ✔

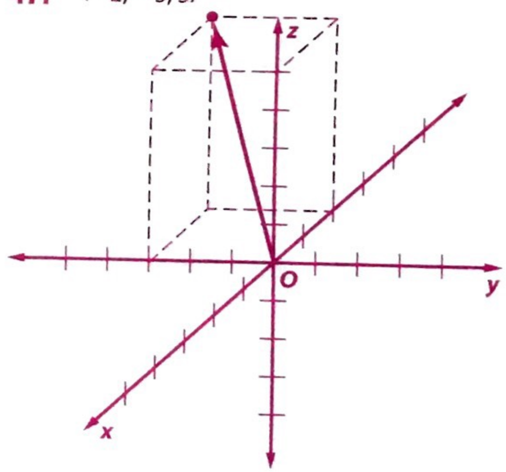
45.



46.



47. (−2, −3, 5)



48.