HW_1_Units_and_Vectors_Ch_1_and_2

Problems Ch.1: 31, 41, 48, Ch.2: 28, 29, 31, 43, 45, 49, 53, 62, 69, 74, Total = 13

Chapter 1

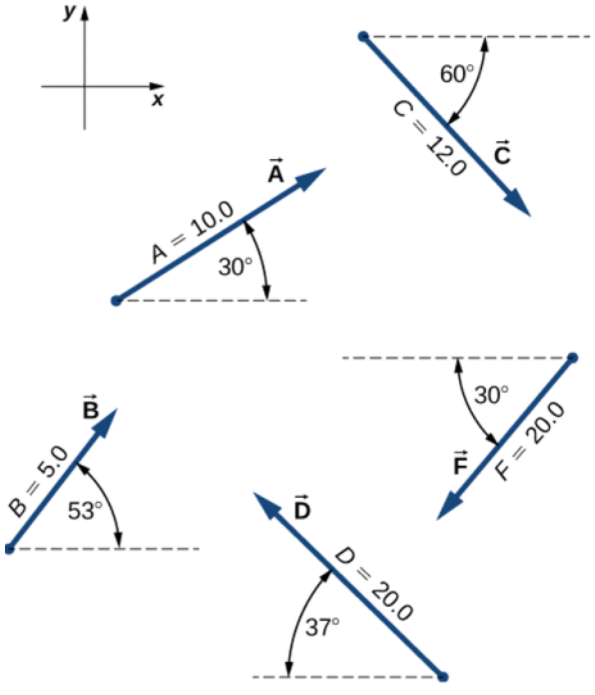
31. The speed limit on some interstate highways is roughly 100 km/h. (a) What is this in meters per second? (b) How many miles per hour is this?

41. The density of nuclear matter is about 10^{18} kg/m^3. Given that 1 mL is equal in volume to cm^3, what is the density of nuclear matter in megagrams per microliter (that is, Mg/μL)?

48. An electron has a mass of 9.11×10^{-31} kg. A proton has a mass of 1.67×10^{-27} kg. What is the mass of a proton in electron-masses?

Chapter 2

28. For the vectors given in the following figure, use a graphical method to find the following resultants: (a) $\vec{\mathbf{A}} + \vec{\mathbf{B}}$, (b) $\vec{\mathbf{C}} + \vec{\mathbf{B}}$, (c) $\vec{\mathbf{D}} + \vec{\mathbf{F}}$, (d) $\vec{\mathbf{A}} - \vec{\mathbf{B}}$, (e) $\vec{\mathbf{D}} - \vec{\mathbf{F}}$, (f) $\vec{\mathbf{A}} + 2\vec{\mathbf{F}}$, (g); and (h) $\vec{\mathbf{A}} - 4\vec{\mathbf{D}} + 2\vec{\mathbf{F}}$.



29. A delivery man starts at the post office, drives 40 km north, then 20 km west, then 60 km northeast, and finally 50 km north to stop for lunch. Use a graphical method to find his net displacement vector.

31. In an attempt to escape a desert island, a castaway builds a raft and sets out to sea. The wind shifts a great deal during the day and he is blown along the following directions: 2.50 km and 45.0° north of west, then 4.70 km and 60.0° south of east, then 1.30 km and 25.0° south of west, then 5.10 km straight east, then 1.70 km and 5.00° east of north, then 7.20 km and 55.0° south of west, and finally 2.80 km and 10.0° north of east. Use a graphical method to find the castaway's final position relative to the island.

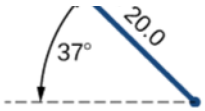
43. Two points in a plane have polar coordinates $P_1(2.500\,\text{m}, \pi/6)$ and $P_2(3.800\,\text{m}, 2\pi/3)$. Determine their Cartesian coordinates and the distance between them in the Cartesian coordinate system. Round the distance to a nearest centimeter.

45. Two points in the Cartesian plane are A(2.00 m, −4.00 m) and B(−3.00 m, 3.00 m). Find the distance between them and their polar coordinates.

49. Given two displacement vectors $\vec{\mathbf{A}} = (3.00\hat{\mathbf{i}} - 4.00\hat{\mathbf{j}} + 4.00\hat{\mathbf{k}})\text{m}$ and $\vec{\mathbf{B}} = (2.00\hat{\mathbf{i}} + 3.00\hat{\mathbf{j}} - 7.00\hat{\mathbf{k}})\text{m}$, find the displacements and their magnitudes for (a) $\vec{\mathbf{C}} = \vec{\mathbf{A}} + \vec{\mathbf{B}}$ and (b) $\vec{\mathbf{D}} = 2\vec{\mathbf{A}} - \vec{\mathbf{B}}$.

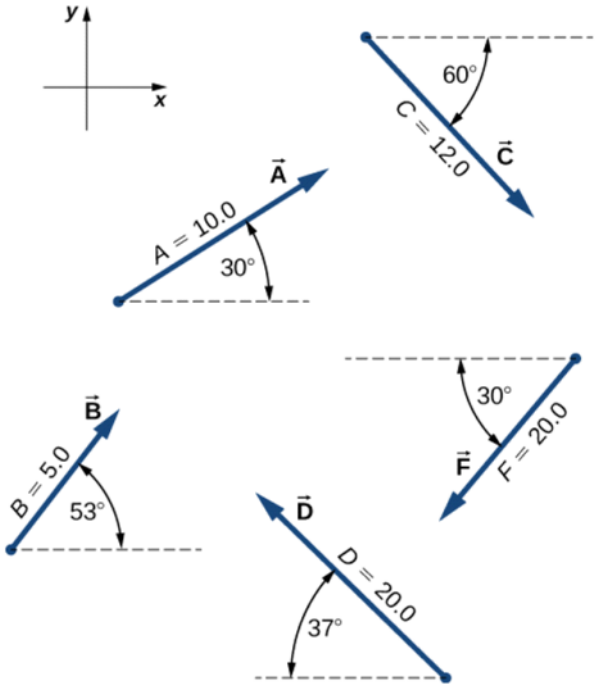
53. Given the vectors in the preceding figure, find vector $\vec{\mathbf{R}}$ that solves equations (a) $\vec{\mathbf{D}} + \vec{\mathbf{R}} = \vec{\mathbf{F}}$ and (b) $\vec{\mathbf{C}} - 2\vec{\mathbf{D}} + 5\vec{\mathbf{R}} = 3\vec{\mathbf{F}}$. Assume the +$x$-axis is horizontal to the right.

57. Given the displacement vector $\vec{\mathbf{D}} = (3\hat{\mathbf{i}} - 4\hat{\mathbf{j}})\text{m}$, find the displacement vector $\vec{\mathbf{R}}$ so that



57. Given the displacement vector $\vec{\mathbf{D}} = (3\,\hat{\mathbf{i}} - 4\,\hat{\mathbf{j}})\text{m}$, find the displacement vector $\vec{\mathbf{R}}$ so that $\vec{\mathbf{D}} + \vec{\mathbf{R}} = -4D\,\hat{\mathbf{j}}$.

62. Assuming the +*x*-axis is horizontal to the right for the vectors in the following figure, find the following scalar products: (a) $\vec{\mathbf{A}} \cdot \vec{\mathbf{C}}$, (b) $\vec{\mathbf{A}} \cdot \vec{\mathbf{F}}$, (c) $\vec{\mathbf{D}} \cdot \vec{\mathbf{C}}$, (d) $\vec{\mathbf{A}} \cdot (\vec{\mathbf{F}} + 2\,\vec{\mathbf{C}})$, (e) $\hat{\mathbf{i}} \cdot \vec{\mathbf{B}}$, (f) $\hat{\mathbf{j}} \cdot \vec{\mathbf{B}}$, (g)



74. Vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ have identical magnitudes of 5.0 units. Find the angle between them if $\vec{\mathbf{A}} + \vec{\mathbf{B}} = 5\sqrt{2}\,\hat{\mathbf{j}}$.

69. For the following vectors

$$\begin{aligned}\vec{A} &= 5\hat{i} - 7\hat{j} + 2\hat{z}\\ \vec{B} &= 0\hat{i} + 3\hat{j} + 11\hat{z}\\ \vec{C} &= -9\hat{i} + 4\hat{j} - 9\hat{z}\\ \vec{D} &= 1\hat{i} + 0\hat{j} - 3\hat{z}\end{aligned}$$

find

(a) $\left(\vec{A} \times \vec{B}\right) \cdot \vec{D}$

(b) $\left(\vec{A} \times \vec{C}\right) \cdot \left(\vec{D} \times \vec{B}\right)$

(c) $\left(\vec{A} \cdot \vec{B}\right)\left(\vec{C} \times \vec{D}\right)$