

3.A: Vectors (Answers)

Check Your Understanding

2.1. a. not equal because they are orthogonal;

b. not equal because they have different magnitudes;

c. not equal because they have different magnitudes and directions;

d. not equal because they are antiparallel;

e. equal.

2.2. 16 m; $\vec{D} = -16m\hat{u}$

2.3. $G = 28.2$ cm, $\theta_G = 291^\circ$

2.4. $\vec{D} = (-5.0\hat{i} - 3.0\hat{j})\text{cm}$; the fly moved 5.0 cm to the left and 3.0 cm down from its landing site.

2.5. 5.83 cm, 211°

2.6. $\vec{D} = (-20m)\hat{j}$

2.7. 35.1 m/s = 126.4 km/h

2.8. $\vec{G} = (10.25\hat{i} - 26.22\hat{j})\text{cm}$

2.9. $D = 55.7$ N; direction 65.7° north of east

2.10. $\hat{v} = 0.8\hat{i} + 0.6\hat{j}$, 36.87° north of east

2.11. $\vec{A} \cdot \vec{B} = -57.3$, $\vec{F} \cdot \vec{C} = 27.8$

2.13. 131.9°

2.14. $W_1 = 1.5J$, $W_2 = 0.3J$

2.15. $\vec{A} \times \vec{B} = -40.1\hat{k}$ or, equivalently, $|\vec{A} \times \vec{B}| = 40.1$, and the direction is into the page; $\vec{C} \times \vec{F} = +157.6\hat{k}$ or, equivalently, $|\vec{C} \times \vec{F}| = 157.6$, and the direction is out of the page.

2.16. a. $-2\hat{k}$,

b. 2,

c. 153.4° ,

d. 135°

Conceptual Questions

1. scalar

3. answers may vary

5. parallel, sum of magnitudes, antiparallel, zero

7. no, yes

9. zero, yes

11. no

13. equal, equal, the same

15. a unit vector of the x-axis

17. They are equal.

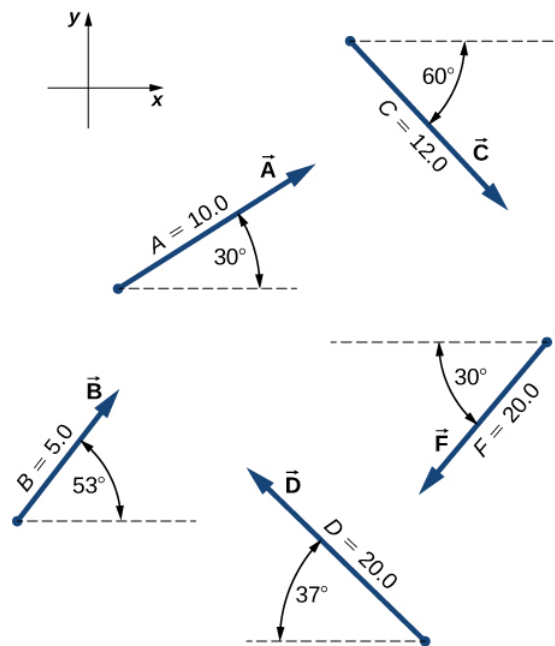
19. yes

21. a. $C = \vec{A} \cdot \vec{B}$
b. $\vec{C} = \vec{A} \cdot \vec{B}$ or $\vec{C} = \vec{A} - \vec{B}$
c. $\vec{C} = \vec{A} \times \vec{B}$,
d. $\vec{C} = A\vec{B}$,
e. $\vec{C} + 2\vec{A} = \vec{B}$,
f. $\vec{C} = \vec{A} \times \vec{B}$,
g. left side is a scalar and right side is a vector,
h. $\vec{C} = 2\vec{A} \times \vec{B}$,
i. $\vec{C} = \vec{A}/B$,
j. $\vec{C} = \vec{A}/B$

23. They are orthogonal.

Problems

25. $\vec{h} = -49m\hat{u}, 49\text{ m}$
27. 30.8 m, 35.7° west of north
29. 134 km, 80°
31. 7.34 km, 63.5° south of east
33. 3.8 km east, 3.2 km north, 7.0 km
35. 14.3 km, 65°
37. a. $\vec{A} = +8.66\hat{i} + 5.00\hat{j}$,
b. $\vec{B} = +3.01\hat{i} + 3.99\hat{j}$,
c. $\vec{C} = +6.00\hat{i} - 10.39\hat{j}$,
d. $\vec{D} = -15.97\hat{i} + 12.04\hat{j}$,
f. $\vec{F} = -17.32\hat{i} - 10.00\hat{j}$



39. a. 1.94 km, 7.24 km;
b. proof
41. 3.8 km east, 3.2 km north, 2.0 km, $\vec{D} = (3.8\hat{i} + 3.2\hat{j})\text{km}$
43. $P_1(2.165m, 1.250m)$, $P_2(-1.900m, 3.290m)$, 5.27m
45. 8.60 m, $A(2\sqrt{5}m, 0.647\pi)$, $B(3\sqrt{2}m, 0.75\pi)$
47. a. $\vec{A} + \vec{B} = -4\hat{i} - 6\hat{j}$, $|\vec{A} + \vec{B}| = 7.211$, $\theta = 236.3^\circ$;
b. $\vec{A} - \vec{B} = -2\hat{i} + 2\hat{j}$, $|\vec{A} - \vec{B}| = 2\sqrt{2}$, $\theta = 135^\circ$
49. a. $\vec{C} = (5.0\hat{i} - 1.0\hat{j} - 3.0\hat{k})m$, $C = 5.92m$;
b. $\vec{D} = (4.0\hat{i} - 11.0\hat{j} + 15.0\hat{k})m$, $D = 19.03m$.
51. $\vec{D} = (3.3\hat{i} - 6.6\hat{j})km$, \hat{i} is to the east, 7.34km, -63.5°
53. a. $\vec{R} = -1.35\hat{i} - 22.04\hat{j}$,
b. $\vec{R} = -17.98\hat{i} + 0.89\hat{j}$
55. $\vec{D} = (200\hat{i} + 300\hat{j})yd$, $D = 360.5$ yd, 56.3° north of east; The numerical answers would stay the same but the physical unit would be meters. The physical meaning and distances would be about the same because 1 yd is comparable with 1 m.
57. $\vec{R} = -3\hat{i} - 16\hat{j}$
59. $\vec{E} = E\hat{E}$, $E_x = +178.9V/m$, $E_y = -357.8V/m$, $E_z = 0.0V/m$, $\theta_E = -\tan^{-1}(2)$
61. a. $\vec{R}_B = (12.278\hat{i} + 7.089\hat{j} + 2.500\hat{k})km$, $\vec{R}_D = (-0.262\hat{i} + 3.000\hat{k})km$;
b. $|\vec{R}_B - \vec{R}_D| = 14.414km$ $|\vec{R} \rightarrow B - \vec{R} \rightarrow D| = 14.414km$
63. a. 8.66,
b. 10.39,
c. 0.866,
d. 17.32
65. $\theta_i = 64.12^\circ$, $\theta_j = 150.79^\circ$, $\theta_k = 77.39^\circ$

67. a. $-119.98\hat{k}$

b. $0\hat{k}$,

c. $+93.69\hat{k}$,

d. $-240.0\hat{k}$

e. $+3.993\hat{k}$

f. $-3.009\hat{k}$

g. $+14.99\hat{k}$

h. 0

69. a. 0,

b. 173,194,

c. $+199,993\hat{k}$

Additional Problems

71. a. 18.4 km and 26.2 km,

b. 31.5 km and 5.56 km

73. a. $(r, \varphi + \pi/2)$,

b. $(2r, \varphi + 2\pi)$ (,

c. $(3r, -\varphi)$

75. $d_{PM} = 33.12\text{ nmi} = 61.34\text{ km}$, $d_{NP} = 35.47\text{ nmi} = 65.69\text{ km}$

77. proof

79. a. 10.00 m,

b. $5\pi\text{ m}$,

c. 0

81. 22.2 km/h, 35.8° south of west

83. 240.2 m, 2.2° south of west

85. $\vec{B} = -4.0\hat{i} + 3.0\hat{j}$ or $\vec{B} = 4.0\hat{i} - 3.0\hat{j}$

87. proof

Challenge Problems

89. $G_\perp = 2375\sqrt{17} \approx 9792$

91. proof

This page titled [3.A: Vectors \(Answers\)](#) is shared under a [CC BY](#) license and was authored, remixed, and/or curated by [OpenStax](#).