

chap 2 vectors

$$\begin{aligned} 1) \vec{E} + \vec{C} &= \vec{D}, \quad \vec{A} + \vec{F} = \vec{G}, \quad \vec{A} + \vec{D} = \vec{C}, \quad \vec{E} + \vec{A} = \vec{0} \\ \vec{E} + 2\vec{A} &= \vec{A}, \quad \vec{A} - \vec{B} = \vec{A} + \vec{F} = \vec{G}, \quad \vec{B} - \vec{A} = \vec{B} + \vec{E} = \vec{C} \\ \vec{C} - \vec{A} &= \vec{C} + \vec{E} = \vec{D} \end{aligned}$$

$$2) c = A + B \quad \text{if } \theta = 0 \quad \text{maximum}$$

$$c = |A - B| \quad \text{if } \theta = 180^\circ \quad \text{minimum}$$

$$3) \vec{A} = -10\hat{x} + 3\hat{y} \quad \left\{ \begin{aligned} A &= \sqrt{A_x^2 + A_y^2} = \sqrt{(-10)^2 + (3)^2} = 10.44 \\ \tan \theta &= \frac{A_y}{A_x} \Rightarrow \theta = \tan^{-1} \left| \frac{3}{-10} \right| \Rightarrow \theta = 16.7^\circ \end{aligned} \right.$$

above -x

$$4) \vec{A} = 3\hat{i} + 2\hat{j}, \quad \vec{B} = 4\hat{i} - \hat{j}$$

$$\vec{A} + \vec{B} = \vec{C}$$

$$C_x = A_x + B_x = 3 + 4 = 7$$

$$C_y = A_y + B_y = 2 - 1 = 1$$

$$|\vec{A} + \vec{B}| = |\vec{C}| = \sqrt{C_x^2 + C_y^2} = \sqrt{7^2 + 1^2} = 7.07$$

$$\vec{A} - \vec{B} = \vec{R}$$

$$R_x = A_x - B_x = 3 - 4 = -1$$

$$R_y = A_y - B_y = 2 + 1 = 3$$

$$|\vec{A} - \vec{B}| = |\vec{R}| = \sqrt{R_x^2 + R_y^2} = \sqrt{(-1)^2 + 3^2} = 3.16$$

$$\vec{F} = 2\vec{B} = 8\hat{i} - 2\hat{j}$$

$$|\vec{F}| = |2\vec{B}| = \sqrt{F_x^2 + F_y^2} = \sqrt{8^2 + (-2)^2} = 8.25$$

5. $\vec{A} = 2\hat{x} + 4\hat{y}$

2

$$\begin{cases} A = \sqrt{2^2 + 4^2} = 4.47 \\ \theta = \tan^{-1} \frac{4}{2} \approx 63.4^\circ \\ \text{above } +x \text{ axis} \end{cases}$$

$$\begin{cases} |\vec{-A}| = \sqrt{(-2)^2 + (-4)^2} = 4.47 \\ \theta = \tan^{-1} \left| \frac{-4}{-2} \right| = 63.4^\circ \\ \text{below } -x \text{ axis.} \end{cases}$$

6. ~~12.5x~~
x-component

$$A_x = 5$$

$$B_x = 12 \cos 72 = 3.71$$

y-component.

$$A_y = 0$$

$$B_y = 12 \sin 72 = 11.41$$

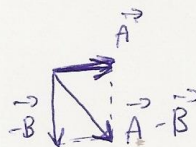
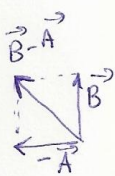
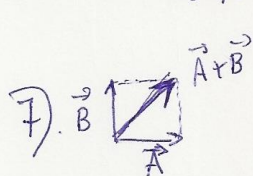
$$\vec{C} = \vec{A} + \vec{B}$$

$$C_x = A_x + B_x = 5 + 3.71 = 8.71$$

$$C_y = A_y + B_y = 0 + 11.41 = 11.41$$

$$C = \sqrt{C_x^2 + C_y^2} = \sqrt{(8.71)^2 + (11.41)^2} = 14.36$$

$$\theta = \tan^{-1} \left(\frac{11.41}{8.71} \right) = 52.6^\circ \quad \text{above } +x \text{ axis.}$$



8. x-comp

$$A_x = -10$$

$$B_x = 15 \cos 45 = 10.61$$

$$C_x = 0$$

$$D_x = 12 \cos 30 = 10.39$$

y-comp.

$$A_y = 0$$

$$B_y = 15 \sin 45 = 10.61$$

$$C_y = 8$$

$$D_y = -12 \sin 30 = -6$$

$$\vec{E} = \vec{A} + \vec{B} + \vec{C} + \vec{D}$$

$$E_x = 11$$

$$E_y = 23.61$$

$$\Rightarrow \begin{cases} E = \sqrt{E_x^2 + E_y^2} = \sqrt{11^2 + (23.61)^2} = 26.05 \\ \theta = \tan^{-1} \left(\frac{23.61}{11} \right) = 65^\circ \end{cases} \quad \text{above } +x \text{ axis.}$$

9]

X-comp

$$A_x = -10$$

$$B_x = 15 \cos 45 = 10.61$$

$$C_x = 0$$

$$D_x = 12 \cos 30 = 10.39$$

$$\vec{F} = \vec{A} - \vec{C} + \vec{B} - 2\vec{D}$$

$$F_x = -10 - 0 + 10.61 - 2 \times 10.39 = -20.17$$

$$F_y = 0 - 8 + 10.61 - 2 \times (-6) = 14.61$$

$$\Rightarrow \begin{cases} F = \sqrt{(20.17)^2 + (14.61)^2} = 24.91 \\ \theta = \tan^{-1} \left| \frac{14.61}{-20.17} \right| = 35.9^\circ \text{ above } -x \end{cases}$$

Y-comp.

$$A_y = 0$$

$$B_y = 15 \sin 45 = 10.61$$

$$C_y = 8$$

$$D_y = -12 \sin 30 = -6$$

3

10]

solved in the power point

11]

Final point

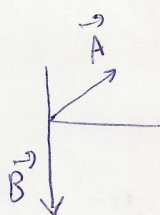
C??

initial point

$$C = \sqrt{(100)^2 + (200)^2} = 223.6$$

$$\theta = \tan^{-1} \frac{100}{200} = 26.6^\circ$$

12]



$$A = 3 \times 2 = 6 \text{ km}$$

$$\Rightarrow A_x = 6 \cos 45^\circ, A_y = 6 \sin 45^\circ$$

$$B = 4 \times 2 = 8 \text{ km}$$

$$\Rightarrow B_x = 0$$

$$B_y = -8$$

$$C_x = A_x + B_x = A \cos 45 = 4.2 \text{ km}$$

$$C_y = A \sin 45 - B = -3.7 \text{ km}$$

$$C = \sqrt{C_x^2 + C_y^2} = 5.66 \text{ km}$$

$$\theta = \tan^{-1} \left| \frac{-3.7}{4.2} \right| = 41.6^\circ \text{ below } +x \text{ axis}$$

13]

X-comp

$$A_x = 6$$

$$B_x = 0$$

$$C_x = -9$$

$$D_x = 6 - 9 = -3$$

$$D = \sqrt{D_x^2 + D_y^2} = \sqrt{(-3)^2 + 8^2} = 8.54$$

$$E_x = 15$$

$$E = \sqrt{15^2 + (-8)^2} = 17$$

Y-comp.

$$A_y = 0$$

$$B_y = 8$$

$$C_y = 0$$

$$D_y = 8$$

$$E_y = -8$$

$$\begin{cases} \vec{D} = \vec{A} + \vec{B} + \vec{C} \\ \vec{E} = \vec{A} - \vec{B} - \vec{C} \end{cases}$$

$$\theta = \tan^{-1} \left| \frac{8}{-3} \right| = 69.4^\circ \text{ above } -x \text{ axis}$$

$$\theta = 28.1^\circ \text{ above } +x \text{ axis}$$

14

x-comp

$$A_x = 10 \cos 40$$

$$B_x = 8 \cos 70$$

$$C_x = -6 \cos 23$$

y-comp.

$$A_y = -10 \sin 40$$

$$B_y = 8 \sin 70$$

$$C_y = 6 \sin 23$$

$$\vec{D} = \vec{A} + \vec{B} + \vec{C}$$

$$D_x = 7.66 + 2.74 - 5.52 = 4.88$$

$$D_y = -6.43 + 7.52 + 2.34 = 3.43$$

$$D = 5.96$$

$$\theta = 35.1^\circ \text{ above } +x \text{ axis}$$

$$\vec{E} = \vec{A} - \vec{B} - \vec{C}$$

$$E_x = 16.44$$

$$E_y = -16.29$$

$$E = 19.35$$

$$\theta = 57.3^\circ \text{ above } +x \text{ axis}$$