A+ Academy – Online Teaching

Topic : physics 6102001

طب تحضيري /جامعة القدس(ابوديس)

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Assignment chapter 3

Motion in Two Dimension

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Q1. Vector $\vec{A}$ has a magnitude of 29 units and points in the positive *y*-direction. When vector $\vec{B}$ is added to $\vec{A}$ the resultant vector $\vec{A}+\vec{B}$ points in the negative *y*-direction with a magnitude of 14 units. Find the magnitude and direction of $\vec{B}$

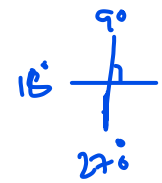
$A = 29\ j$

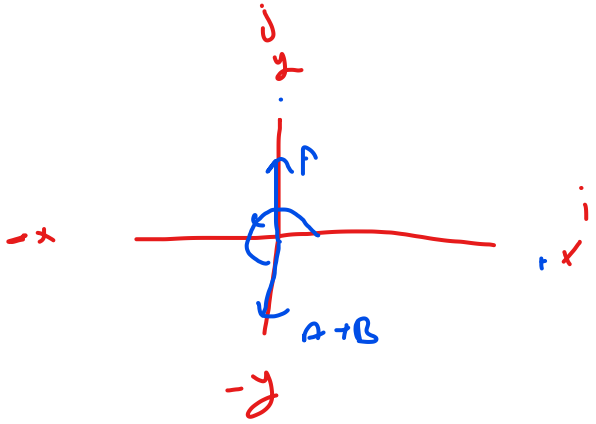
$\vec{A}+\vec{B} = -14\ j$

$29j + \vec{B} = -14\ j$

$\vec{B} = -14j - 29j = -43\ j$

$|B| = \sqrt{(-43)^2} = 43$, $\theta = 270$





Q: 3. Vector $\vec{A}$ is 3.00 units in length and points along the positive x-axis. Vector $\vec{B}$ is 4.00 units in length and points along the negative y-axis. Use graphical methods to find the magnitude and direction of the vectors

a. $\vec{A}+\vec{B}$
b. $\vec{A}-\vec{B}$

(a)

$A = 3i$

$B = -4j$

$\vec{A}+\vec{B} = 3i + (-4j)$

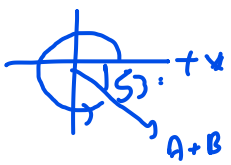
$A+B = 3i - 4j$

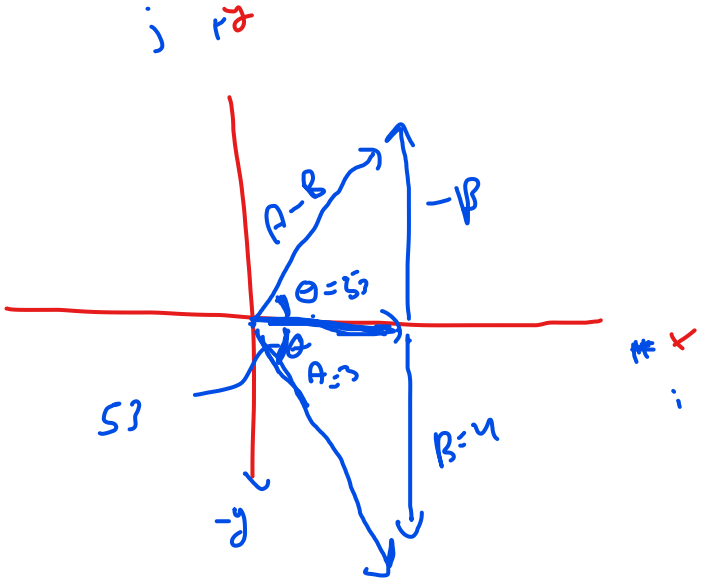
$|A+B| = \sqrt{(3)^2 + (-4)^2} = 5$

$\theta = \tan^{-1}\left(\frac{-4}{3}\right)$

$= -53$

$= 360 - 53$





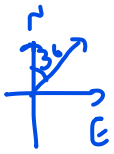
(b)

$A - B = 3i - (-4j)$

$A - B = 3i + 4j$

$|A-B| = \sqrt{3^2 + 4^2} = 5$

$\theta = \tan^{-1}\left(\frac{4}{3}\right) = 53$



Q: 4. Three displacements are $\vec{A}$ = 200 m due south, $\vec{B}$ = 250 m due west, and $\vec{C}$= 150 m at 30.0° east of north.

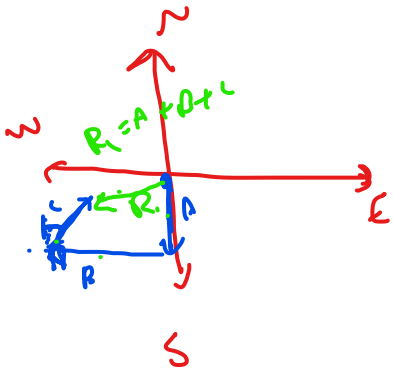
(a) Construct a separate diagram for each of the following possible ways of adding these vectors:

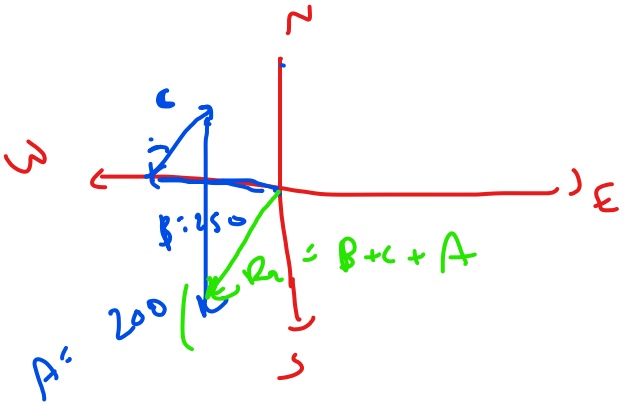
$\boldsymbol{R_1} = \vec{A} + \vec{B} + \vec{C}$

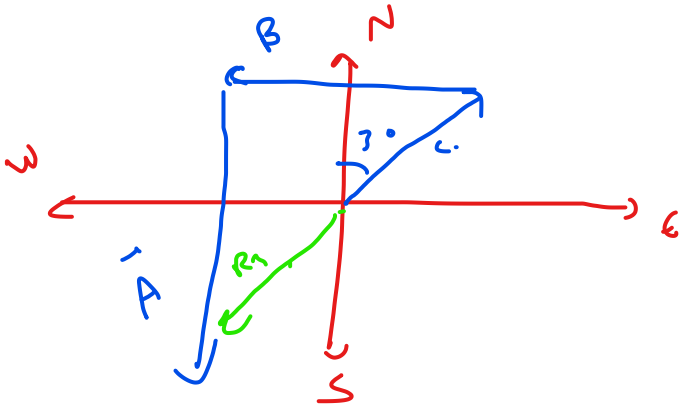
$\boldsymbol{R_2} = \vec{B} + \vec{C} + \vec{A}$

$\boldsymbol{R_3} = \vec{C} + \vec{B} + \vec{A}$

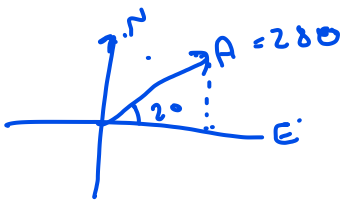
(b) Explain what you can conclude from comparing the diagrams.

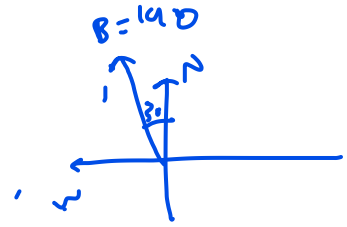


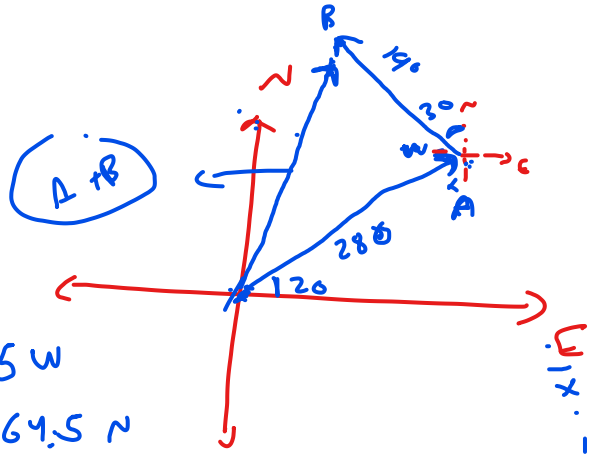




Q:7 A plane flies from base camp to lake A, a distance of 280 km at a direction of 20.0° north of east. After dropping off supplies, the plane flies to lake B, which is 190 km and 30.0° west of north from lake A. Graphically determine the distance and direction from lake B to the base camp







$A_E = 280\cos 20 = 263$ E

$A_N = 280\sin 20 = 95.7$ N

$\vec{A} = 263\,\hat{E} + 95.7\,\hat{N}$

$B_W = 190\sin 30 = 95$ W

$B = 190\cos 30 = 164.5$ N

$\vec{B} = 95\,\hat{W} + 164.5\,\hat{N}$

$\vec{A}+\vec{B} = 168\,\hat{E} + 260\,\hat{N}$, $|A+B| = \sqrt{168^2 + 260^2} = 310$

$\theta = \tan^{-1}\frac{260}{168} = 57°$

Q:11 The magnitude of vector $\vec{A}$ is 35.0 units and points in the direction 325° counterclockwise from the positive *x*-axis. Calculate the *x*- and *y*-components of this vector

$A_x = A\cos 35$

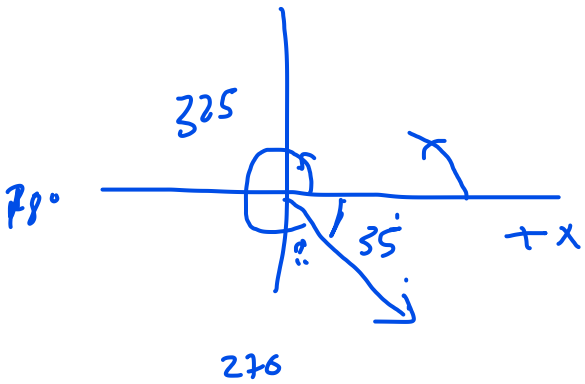
$= 35\cos 35$

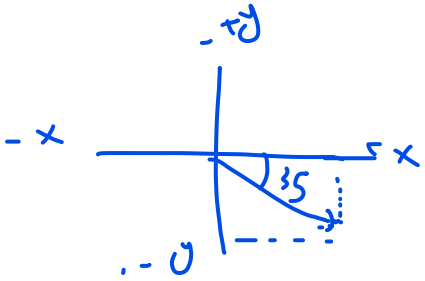
$A_x = 28.7$

$A_y = A\sin\theta$

$= 35\sin 35$

$= 20$





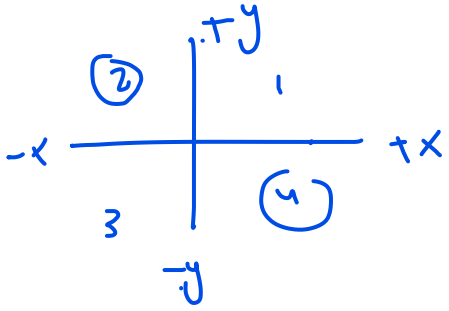
Q:15 A vector has an *x*-component of 225.0 units and a *y*-component of 40.0 units. Find the magnitude and direction of the vector.

$\vec{A} = 225\ i + 40\ j$

$|A| = \sqrt{(225)^2 + (40)^2} = 228.5$

$\theta = \tan^{-1}\left(\frac{40}{225}\right) = 10.08$

$\vec{B} = -25\ i + 40\ j$



$|B| = \sqrt{(-25)^2 + (40)^2}$

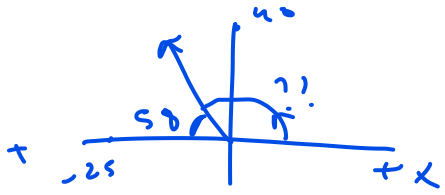
$= 47.16$

X	+	-	-	+
y	+	+	-	-
	1	2	3	4
θ	θ	90+θ	180-θ	360-θ

$\theta = \tan^{-1}\left(\frac{40}{-25}\right) = -58$ (X)

$= \theta = 180 - 58$

$= 122°$



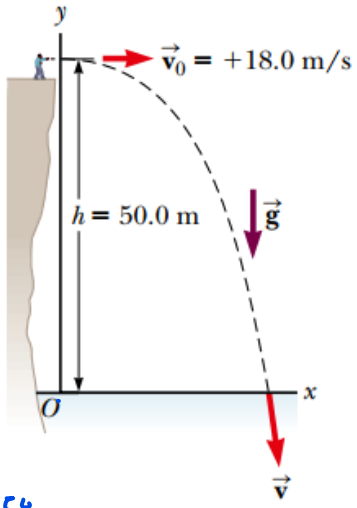
Q:23 A student stands at the edge of a cliff and throws a stone horizontally over the edge with a speed of 18.0 m/s. The cliff is 50.0 m above a flat, horizontal beach as shown in Figure.

(a) What are the coordinates of the initial position of the stone? $x_i = 0,\ y_i = 50\ m$

(b)What are the components of the initial velocity?

$U_{ix} = 18\ m/s$

$U_{iy} = 0$



0,50

c) Write the equations for the *x*- and *y*-components of the velocity of the stone with time.

$U_{fx} = U_{ix} + a_x t = 18\ m/s$

$U_{fy} = U_{iy} + gt = 10t$

d) Write the equations for the position of the stone with time, using the coordinates in Figure.

$\Delta x = U_{ix}t + \frac{1}{2}a_x t^2$

$x_f - x_i = 18t$

$x_f = 18t$

x_0

$\Delta y = U_{iy}t + \frac{1}{2}gt^2$

$y_f - y_i = -5t^2$

$y_f - 50 = 5t^2 \Rightarrow y_f = 5t^2 + 50$

(e) How long after being released does the stone strike the beach below the cliff?

$\Delta y = U_{iy}t + \frac{1}{2}gt^2$

$50 = 5t^2 \Rightarrow t^2 = \sqrt{10} = 3.16$

(f) With what speed and angle of impact does the stone land?

$U_{fy} = U_{iy} + 10t$

$= 18(3.16) = -31.6\ m/s$

$\theta = \tan^{-1}\left(\frac{-31.6}{18}\right)$

18

-31.6

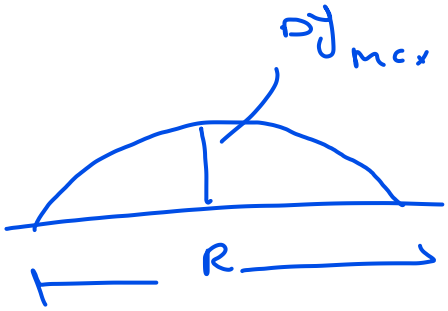
Q:24 rock is thrown upward from the level ground in such a way that the maximum height of its flight is equal to its horizontal range *R*.

(a) At what angle θ is the rock thrown?

(b) In terms of the original range *R*, what is the range R_{max} the rock can attain if it is launched at the same speed but at the optimal angle for maximum range?

(c) Would your answer to part (a) be different if the rock is thrown with the same speed on a different planet?

$$y_{max} = \frac{U_0^2 \sin^2\theta}{2g}$$



$$R = \frac{2U_0^2 \sin\theta\cos\theta}{g}$$

$$y_{max} = R \Rightarrow \frac{U_0^2 \sin^2\theta}{2g} = \frac{2U_0^2 \sin\theta\cos\theta}{g}$$

$$\frac{\sin\theta}{2} = 2\cos\theta \Rightarrow \frac{\sin\theta}{\cos\theta} = 4$$

$$\tan\theta = 4, \quad \theta = \tan^{-1}(4) = 76.0^\circ$$

(b) $\theta = 45^\circ \rightarrow R_{max}$

$$R_{max} = \frac{2U_0^2 \sin 45 \cos 45}{g} = \frac{U_0^2}{g}$$

$$R = \frac{2U_0^2 \sin 76 \cos 76}{g}$$

$$\frac{R_{max}}{R} = \frac{U_0^2/g}{0.47U_0^2/g}$$

$$\frac{R_{max}}{R} = \frac{1}{0.47}$$

$$R_{max} = \frac{R}{0.47} = 2.13R$$