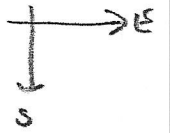
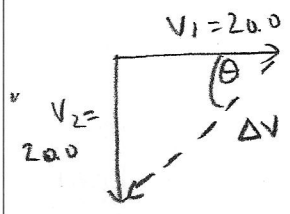
Day 4 HW Acceleration Vectors in 2D p1, 2 pg 34 S4, 8, 10, 11, 12 pg 35

P1. $\vec{V}_1 = 20.0\ m/s\ [E]$

$\vec{V}_2 = 20.0\ m/s\ [S]$





$\Delta V = \sqrt{20.0^2 + 20.0^2} = 28.28\ m/s$

$\theta = 45°$

$\Delta t = 12\ s$

$\Delta \vec{V} = ?$ $\vec{a} = ?$

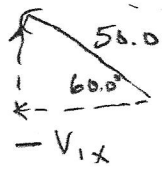
analysis: $\Delta \vec{V} = \vec{V}_2 - \vec{V}_1$

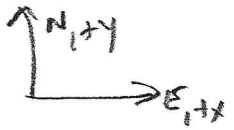
$\therefore \vec{a} = \frac{\Delta \vec{V}}{\Delta t} = \frac{28.28\ m/s\ [SE]}{12\ s} = 2.357\ m/s^2\ [SE]$

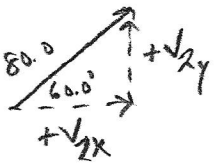
$\therefore$ the average acceleration is $2.4\ m/s^2\ [SE]$.

2] $\vec{V}_1 = 50.0\ km/h\ [W\ 60.0°N]$

$\vec{V}_2 = 80.0\ km/h\ [E\ 60.0°N]$







$\Delta t = \frac{15.0\ min}{60.0\ min/h} = 0.25\ h$

$\Delta \vec{V} = ?$ $\vec{a} = ?$

analysis: $\Delta \vec{V} = \vec{V}_2 - \vec{V}_1$

x dir: $\Delta V_x = V_{2x} - V_{1x}$

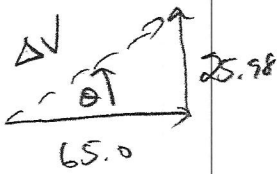
$= 80.0 \cos 60.0° - (-50.0 \cos 60.0°)$

$= 65.0$

y dir: $\Delta V_y = V_{2y} - V_{1y}$

$= 80.0 \sin 60.0° - 50.0 \sin 60.0°$

$= 25.98$



$\Delta V = \sqrt{25.98^2 + 65.0^2} = 70.0$ $\theta = \text{Tan}^{-1}\left(\frac{25.98}{65.0}\right) = 21.8°$

$\therefore \Delta \vec{V} = 70.0\ km\ [E\ 21.8°N]$

$\vec{a} = \frac{\Delta \vec{V}}{\Delta t} = \frac{70.0\ km\ [E\ 21.8°N]}{0.25\ h} = 280.\ km/h^2\ [E\ 21.8°N]$

$\therefore$ the average acceleration was $2.80 \times 10^2\ km/h^2\ [E\ 21.8°N]$.

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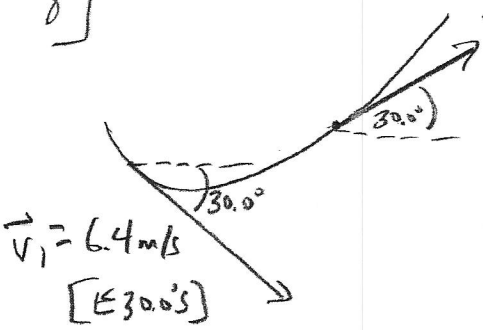
4] Acceleration involves either a change in speed and/or a change of direction, so an object can undergo acceleration while maintaining constant speed if it is turning or changing direction.

8]

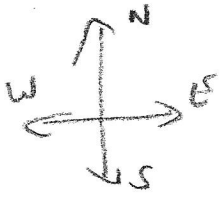


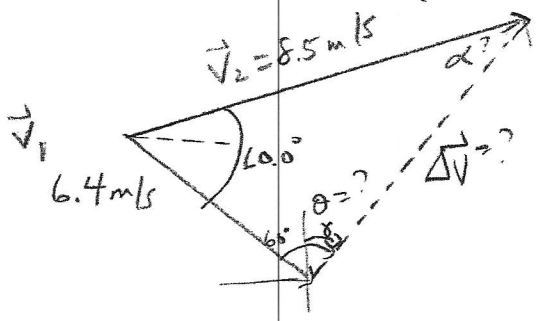
$\Delta t = 3.8s$

$\Delta \vec{V} = ?$

$\vec{a} = ?$

analysis: $\Delta \vec{V} = \vec{V}_2 - \vec{V}_1$





$\Delta V = \sqrt{6.4^2 + 8.5^2 - 2(6.4)(8.5)\cos 60.0°}$

$= 7.669\ m/s$

$\alpha = \sin^{-1}\left(\frac{6.4 \sin 60.0}{7.669}\right) = 46.3°$

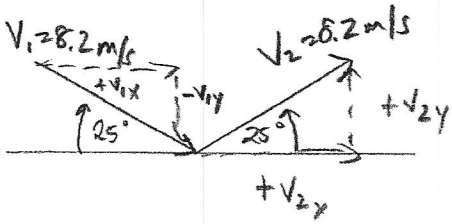
$\therefore \theta = 180 - 60.0° - 46.3° = \underline{73.7°}$

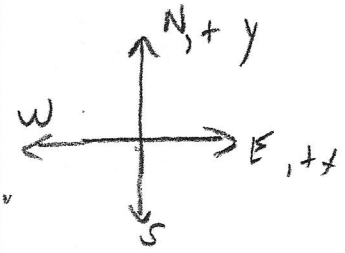
$\therefore \gamma = 73.7° - 60° = 13.7°$

$\Delta \vec{V} = 7.67\ m/s\ [N\ 13.7°E)$

$\vec{a} = \frac{\Delta \vec{V}}{\Delta t} = \frac{7.67\ m/s\ [N13.7°E)}{3.8\ s} = 2.0\ m/s^2\ [N\ 14°E)$

10]





$\Delta\vec{V}$ = ?

Δt = 3.2 ms = 0.0032 s

$\vec{a}$ = ?

analysis: $\Delta\vec{V} = \vec{V_2} - \vec{V_1}$

X dir

$\Delta V_x = V_{2x} - V_{1x}$

$= 8.2\cos 25 - 8.2\cos 25$

$= 0$

Y dir

$\Delta V_y = V_{2y} - V_{1y}$

$= +8.2\sin 25 - (-8.2\sin 25)$

$= 6.93$ m/s

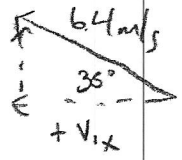
$\therefore \Delta\vec{V} = 6.93$ m/s [N]

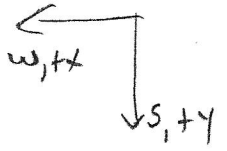
$$\vec{a} = \frac{\Delta\vec{V}}{\Delta t} = \frac{6.93 \text{ m/s [N]}}{0.0032 \text{ s}} = 2165.92 \text{ m/s}^2 \text{ [N]}$$

$\therefore$ the ball's average acceleration was 2.2×10^3 m/s^2 [N]

11]

$\vec{V_1} = 6.4$ m/s [W 35° N]

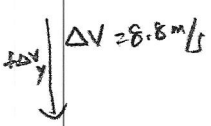




$\vec{a} = 2.2$ m/s^2 [S]

$\Delta t = 4.0$ s

$\Delta\vec{V} = (2.2 \text{ m/s}^2)(4.0 \text{ s}) = 8.8$ m/s [S]



$\vec{V_2}$ = ?

analysis: $\vec{V_2} = \vec{V_1} + \Delta\vec{V}$

X dir: $V_{2x} = V_{1x} + \Delta V_x$

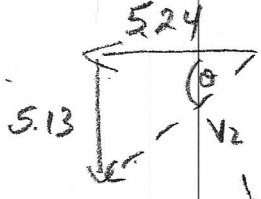
$= 6.4\cos 35 + 0$

$= 5.24$ m/s

Y dir: $V_{2y} = V_{1y} + \Delta V_y$

$= -6.4\sin 35 + 8.8$

$= 5.13$ m/s



$V_2 = 7.33$ m/s

$\theta = \tan^{-1}\left(\frac{5.13}{5.24}\right) = 44.4°$

$\therefore \vec{V_2} = 7.3$ m/s [W 44° S]

12) $\vec{V}_2 = 3.6 \times 10^2 \text{ km/h [N]}$

$\vec{a} = 5.0 \text{ m/s}^2 \text{ [W]}$

$\Delta t = 9.2 \text{ s}$

$\Delta \vec{V} = ?$

$\vec{V}_1 = ?$

analysis: $\vec{V}_1 = \vec{V}_2 - \Delta \vec{V}$

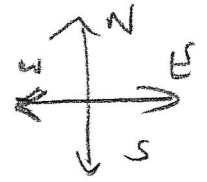
$\Delta \vec{V} = \vec{a} \Delta t$

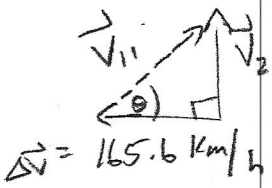
$\Delta \vec{V} = (5.0 \frac{\text{m}}{\text{s}^2} \text{ [W]})(9.2 \text{ s})$

$= 46 \text{ m/s [W]}$

$= \frac{46 \text{ m}}{\text{s}^2} \times \frac{1 \text{ km}}{1000 \text{ m}} \times \frac{(3600 \text{ s})}{(1 \text{ h})}$

$= 165.6 \text{ km/h}^2 \text{ [W]}$





$V_1 = \sqrt{360^2 + 165.6^2} = 396.26$

$\theta = \text{Tan}^{-1}\left(\frac{360}{165.6}\right) = 65.3°$

$\vec{V}_1 = 4.0 \times 10^2 \frac{\text{km}}{\text{h}} \text{ [E 65° N]}$