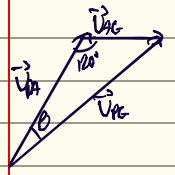
Review

1) 

$|\vec{V}_{PC}|^2 = |\vec{V}_{PA}|^2 + |\vec{V}_{AC}|^2 - 2|\vec{V}_{PA}||\vec{V}_{AC}|\cos 120°$

$= 300^2 + 80^2 - 2(300)(80)\cos(120°)$

$= 120400$

$|\vec{V}_{PC}| = 346.99$ km/h

$\frac{\sin\theta}{|\vec{V}_{AC}|} = \frac{\sin 120°}{|\vec{V}_{PC}|}$

$\sin\theta = (80)\left(\frac{\sin 120}{346.99}\right)$

$= 0.199667$

$\theta = 12°$

$\therefore \vec{V}_{PC} = 346.99$ km/h [N42°E]

2) 

$\frac{\sin\alpha}{|\vec{V}_{BC}|} = \frac{\sin 60}{|\vec{V}_{BW}|}$

$\sin\alpha = |\vec{V}_{BC}|\left(\frac{\sin 60}{|\vec{V}_{BW}|}\right)$

$= 11\left(\frac{\sin 60}{8}\right)$

$= 0.287$

$\alpha = 17°$

$\theta = 180° - 60° - \alpha$

$= 103°$

She must point her boat at [S17W].

$\frac{|\vec{V}_{BC}|}{\sin\theta} = \frac{|\vec{V}_{BW}|}{\sin 60°}$

$|\vec{V}_{BC}| = \sin\theta\left(\frac{|\vec{V}_{BW}|}{\sin 60}\right)$

$= 3.38$ m/s

$\Delta t = \frac{d}{|\vec{V}_{BC}|}$

$= \frac{200}{3.38}$

$= 59.17$s

$\therefore$ She will get to her cottage in 59.17s.

3) $\vec{V}_i = 0$

$\vec{a} = 5$m/s^2 [F]

$\Delta t = 4$s

$\vec{d} = \vec{V}_i\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$= \frac{1}{2}(5)(4)^2$

$= 40$m [F]

4) $\vec{V}_1 = 4$m/s [E]

$\vec{V}_2 = -16$m/s [E]

$\Delta t = 5$s

$\vec{a} = \frac{\vec{V}_2 - \vec{V}_1}{\Delta t}$

$= \frac{-16-4}{5}$

$= -4$m/s^2 [E]

$= 4$m/s^2 [W]

5) $\vec{V}_i = 8$m/s [up]

$\vec{a} = -9.81$ m/s^2 [up]

$\vec{V}_2 = 0$

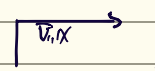
$\vec{d} = \frac{\vec{V}_2^2 - \vec{V}_i^2}{2\vec{a}}$

$\frac{0-8^2}{2(-9.81)}$

$= 3.26$ [up].

$\therefore \vec{d} < 7$m,

$\therefore$ the ball doesn't reach 7m.

6) 

$\vec{V}_{i,y} = 0$

$\vec{a} = 9.81$m/s^2 [down]

$\vec{d}_y = 1.8$m [down]

$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$1.8 = 4.905\Delta t^2$

$\Delta t^2 = 0.367$

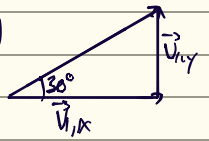
$\Delta t = 0.606$s

$\vec{V}_{i,x} = 10$m/s [F]

$\vec{d}_x = \vec{V}_{i,x}\cdot\Delta t$

$= (10)(0.606)$

$= 6.06$m [F]

7) 

$\vec{V}_{i,y} = 10\sin 30$ m/s [up]

$\vec{a} = -9.81$m/s^2 [up]

$\vec{d}_y = -1.8$m [up]

$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$-1.8 = 10\sin 30\Delta t - 4.905\Delta t^2$

$-4.905\Delta t^2 + 10\sin 30\Delta t + 1.8 = 0$

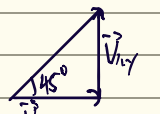
$\Delta t = 1.30$s

$\vec{V}_{i,x} = 10\cos 30°$ m/s [F]

$\vec{d}_x = \vec{V}_{i,x}\Delta t$

$= (10\cos 30°)(1.30)$

$= 11.27$m [F]

8) 

$\vec{V}_{i,x} = 16\cos 45°$ m/s [F]

$\vec{d}_x = 20$m [F]

$\Delta t = \frac{d_x}{\vec{V}_{i,x}}$

$= \frac{20}{16\cos 45}$

$= 1.77$s

$\vec{V}_{i,y} = 16\sin 45°$ m/s [up]

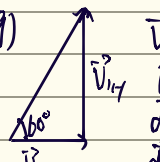
$\vec{a} = -9.81$ m/s^2 [up]

$\Delta t = 1.77$s

$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$= (16\sin 45°)(1.77) + \frac{1}{2}(-9.81)(1.77)^2$

$= 4.66$m [up].

9) 

$\vec{V}_{i,y} = 20\sin 60°$ m/s [up]

$\vec{a} = -9.81$ m/s^2 [up]

$\vec{d}_y = 0$

$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$0 = \Delta t(20\sin 60 - 4.905\Delta t)$

$20\sin 60 - 4.905\Delta t = 0$

$\Delta t = \frac{20\sin 60}{4.905}$

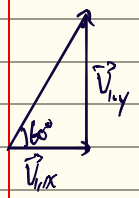
$= 3.53$s

$\vec{V}_{i,x} = 20\cos 60°$ m/s

$\vec{d}_x = \vec{V}_{i,x}\cdot\Delta t$

$= 35.3$m [F]

10)



$\vec{V}_{i,y} = \vec{V}_i \sin 60$ m/s [up]

$\vec{a} = -9.81$ m/s^2 [up]

$\vec{d}_y = 0$

$\Delta t = 3$ s

$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$\vec{V}_{i,y} = -\frac{1}{2}\vec{a}\Delta t$

$= -\frac{1}{2}(-9.81)(3)$

$= 14.715$

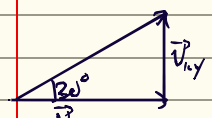
$\vec{V} = \frac{\vec{V}_{i,y}}{\sin 60°}$

$= \frac{14.715}{\sin 60}$

$= 16.99$ m/s [60° above the horizontal]

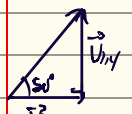
Review

1)



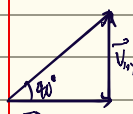
$\vec{V}_{i,y} = 24\sin 30$ m/s [up]
$\vec{a} = -9.81\ m/s^2$ [up]
$\vec{d}_y = -1.5$
$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$-1.5 = 24\sin 30\Delta t - 4.905\Delta t^2$
$-4.905\Delta t^2 + 24\sin 30\Delta t + 1.5 = 0$
$\Delta t = 2.57$s
$\vec{V}_{i,x} = 24\cos 30°$ m/s [F]
$\vec{d}_x = \vec{V}_{i,x}\cdot\Delta t$
$= (24\cos 30)(2.57)$
$= 53.42$ m [F]

2)



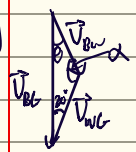
$\vec{V}_{i,x} = 12\cos 50°$ m/s [F]
$\vec{d}_x = 6$m [F]
$\Delta t = \frac{d_x}{\vec{V}_{i,x}}$
$= \frac{6}{12\cos 50°}$
$= 0.778$s
$\vec{V}_{i,y} = 12\sin 50$ m/s [up]
$\vec{a} = -9.81\ m/s^2$ [up]
$\Delta t = 0.778$s
$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$= (12\sin 50)(0.778) + \frac{1}{2}(-9.81)(0.778)^2$
$= 4.18$ m [up]

3)



$\vec{V}_{i,y} = 12\sin 40$ m/s [up]
$\vec{a} = -9.81\ m/s^2$ [up]
$\vec{d}_y = -0.6$m [up]
$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$-0.6 = 12\sin 40\Delta t - 4.905\Delta t^2$
$-4.905\Delta t^2 + 12\sin 40\Delta t + 0.6 = 0$
$\Delta t = 1.635$s
$\vec{V}_{i,x} = 12\cos 40°$ m/s [F]
$\vec{d}_x = \vec{V}_{i,x}\cdot\Delta t$
$= (12\cos 40°)(1.635)$
$= 15.03$ m [F]

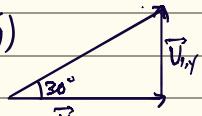
4)



$\alpha = 180° - 20° - \theta$
$= 161°$
$\frac{|\vec{V}_{BG}|}{\sin\alpha} = \frac{|\vec{V}_{BW}|}{\sin 20}$
$|\vec{V}_{BG}| = \sin 161\left(\frac{16}{\sin 20}\right)$
$= 25.1$ m/s

$\frac{\sin\theta}{|\vec{V}_{WG}|} = \frac{\sin 20°}{|\vec{V}_{BW}|}$
$\sin\theta = |\vec{V}_{WG}|\left(\frac{\sin 20°}{|\vec{V}_{BW}|}\right)$
$= 8\left(\frac{\sin 20}{16}\right)$
$\theta = 9° \longrightarrow$ ∴ the boat must steer at [S 9° E]

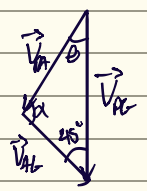
5)



a) $\vec{V}_{i,y} = 12\sin 30°$ m/s [up]
$= 6$ m/s [up]
$\vec{a} = -9.81\ m/s^2$ [up]
$\vec{V}_{2,y} = 0$ m/s
$\vec{d}_y = \frac{\vec{V}_{2,y}^2 - \vec{V}_{i,y}^2}{2\vec{a}}$
$= \frac{-6^2}{2(-9.81)}$
$= 1.83$ m [up]
∴ puck max height is 1.83m + 1.5m, which is 3.33 m above the ice.

b) $\vec{V}_{i,y} = 12\sin 30°$ m/s [up]
$\vec{a} = -9.81\ m/s^2$ [up]
$\vec{d}_y = -1.5$ m [up]
$\vec{d}_y = \vec{V}_{i,y}\Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$-1.5 = 6\Delta t - 4.905\Delta t^2$
$-4.905\Delta t^2 + 6\Delta t + 1.5 = 0$
$\Delta t = 1.436$s
$\vec{V}_{i,x} = 12\cos 30°$ m/s [F]
$\vec{d}_x = \vec{V}_{i,x}\cdot\Delta t$
$= (12\cos 30°)(1.436)$
$= 14.92$ m [F]

6)



a) $\frac{\sin\theta}{|\vec{V}_{AE}|} = \frac{\sin 45}{|\vec{V}_{DA}|}$
$\sin\theta = |\vec{V}_{AE}|\left(\frac{\sin 45}{|\vec{V}_{DA}|}\right)$
$= 90\left(\frac{\sin 45}{500}\right)$
$\theta = 7°$
∴ the pilot must steer at [S 7° W].

b) $\alpha = 180° - 45° - \theta$
$= 180 - 45 - 7$
$= 128°$
$\frac{|\vec{V}_{DE}|}{\sin\alpha} = \frac{|\vec{V}_{DA}|}{\sin 45°}$
$|\vec{V}_{DE}| = \sin\alpha\left(\frac{|\vec{V}_{DA}|}{\sin 45}\right)$
$= 557.21$ km/h
$\Delta t = d/v$
$= 1200/557.21$
$= 2.15$ hr.

7) $v = 15\text{km/h}$

$= 4.167\text{ m/s}$

$d = 45\text{km}$

$= 45000\text{m}$

$\Delta t = d/v$

$= 45000/4.167$

$= 10800\text{s}$

8) $\vec{v}_1 = 5\text{m/s [F]}$

$\vec{v}_2 = 0\text{m/s}$

$\vec{d} = 45\text{m [F]}$

$\vec{a} = \frac{\vec{v}_2^2 - \vec{v}_1^2}{2\vec{d}}$

$= \frac{-(5)^2}{2(45)}$

$= -0.28\text{ m/s}^2\text{ [F]}$

$= 0.28\text{ m/s}^2\text{ [B]}$

9) $\vec{v}_1 = 0$

$\vec{a} = 5\text{m/s}^2\text{ [F]}$

$\vec{d} = 40\text{m [F]}$

$\vec{d} = \vec{v}_1\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$\Delta t^2 = \frac{2\vec{d}}{\vec{a}}$

$\Delta t = \sqrt{\frac{2\vec{d}}{\vec{a}}}$

$= 4\text{s}$