Chapter 1 Review – Self Quiz pg 53

6) $\boxed{d}$

7) $\vec{v}_{pw} = 1.5\ km/h$, $\vec{v}_{wb} = 1.0\ km/h$

$\vec{v}_{pb} = 2.5\ km/h$ $\boxed{d}$

9) T

10) F The addition of two displacement vectors is independent of order of addition.

11) F → average acceleration is not zero if velocity changes only in direction.

12) T

13) F The stones will land at the same time.

14) T

15) F → if $\vec{v}_{AB} = 18.3\ m/s$ [S] then $\vec{v}_{BA} = 18.3\ m/s$ [N] OR $-18.3\ m/s$ [S]

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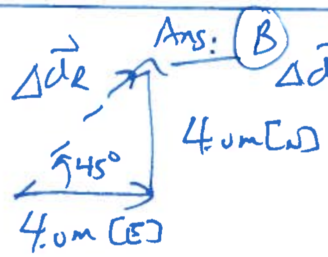
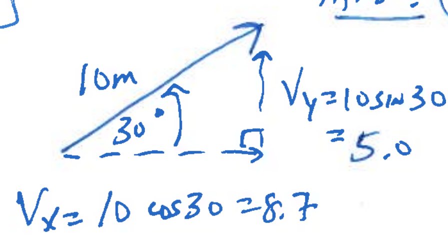
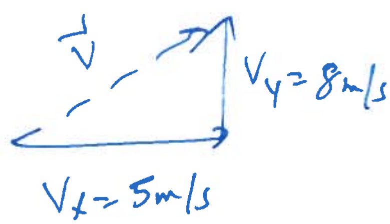
2) Ans: B



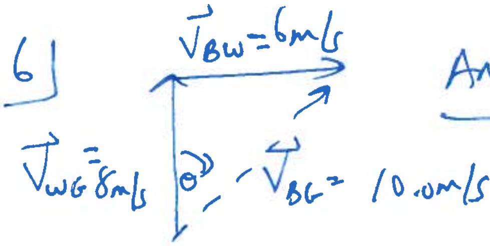
3) Ans: A



5) Ans: C



6) Ans: B



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19) Air resistance will decrease her horizontal velocity significantly so it will reduce her horizontal range. Her vertical velocity will also be reduced so the reduction in both components will reduce her landing speed.

22) If the acceleration is perpendicular to the initial velocity direction then the object will turn but will maintain the same speed. This is the case for centripetal acceleration.

32) If the car is moving horizontally then the time for the ball to fall to the ground will be the same as the time to fall if the car was stationary. This is because the vertical and horizontal motions are independent and the initial vertical velocity conditions have not changed.

34) In order to land directly across from your starting point you will need to steer into the current in addition to heading forward.

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44) a) g_{planet} is less than g_{Earth} so a high jumper would be able to achieve a higher jump as their initial launch speed would not change.

b) (let up = +)

$V_{1y} = 5.0\,m/s$ $\quad a_y = -2.0\,m/s^2$

$\Delta d_{y\,max} = ?$ $\quad V_{2y} = 0.0\,m/s$

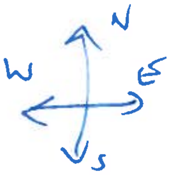
$$\Delta d_y = \frac{V_{2y}^2 - V_{1y}^2}{2a_y} = \frac{0 - (5.0\,m/s)^2}{2(-2.0\,m/s^2)} = 6.2\,m$$

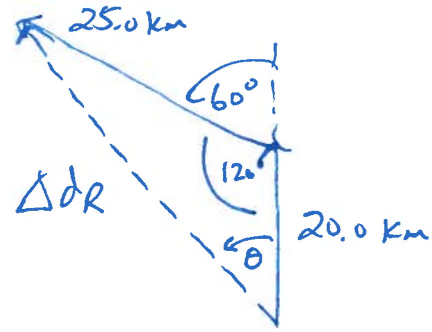
57)

$\vec{\Delta d_1} = 20.0\,km\ [N]$

$\vec{\Delta d_2} = 25.0\,km\ [60.0°\ W\ of\ N]$

$\vec{\Delta d_R} = ?$





<u>analysis</u>: $\vec{\Delta d_R} = \vec{\Delta d_1} + \vec{\Delta d_2}$

$$\Delta d_R = \sqrt{20.0^2 + 25.0^2 - 2(20.0)(25.0)(\cos 120°)} = 39.051\,m$$

$$\frac{\sin\theta}{25.0} = \frac{\sin 120}{39.051} \rightarrow \theta = \sin^{-1}\left(\frac{(25.0)(\sin 120°)}{(39.051)}\right)$$

$$\theta = 33.7°$$

$$\therefore \boxed{\vec{\Delta d_R} = 39.1\,m\ [N\ 33.7°\ W]}$$

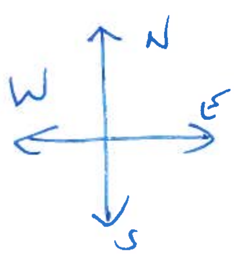
59) $\vec{V_1} = 15\,m/s\ [E]$

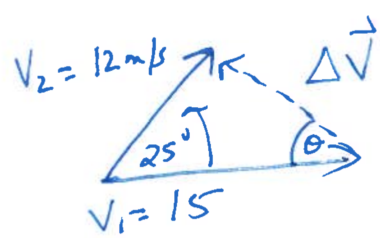
$\Delta t = 5.0\,s$

$\vec{V_2} = 12\,m/s\ [E\ 25°\ N]$

$\Delta\vec{V} = ?$

$\vec{a} = ?$





$$\Delta V = \sqrt{15^2 + 12^2 - 2(12)(15)(\cos 25)} = 6.537\,m/s$$

<u>analysis</u>: $\Delta\vec{V} = \vec{V_2} - \vec{V_1}$

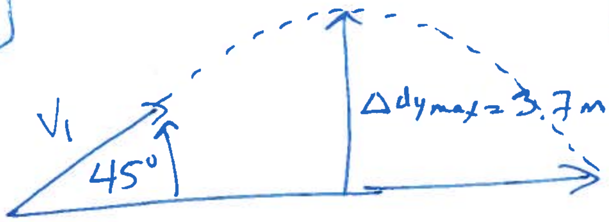
$$\frac{\sin\theta}{12} = \frac{\sin 25°}{6.537} \rightarrow \theta = \sin^{-1}\left(\frac{(12)(\sin 25)}{6.537}\right)$$

$$= 50.88°$$

$$\therefore \Delta\vec{V} = 6.54\,m/s\ [W\ 51°\ N]$$

$$\therefore \vec{a} = \frac{\Delta\vec{V}}{\Delta t} = \frac{6.54\,m/s\ [W\ 51°\ N]}{} = 1.3\,m/s^2\ [W\ 51°\ N]$$

63)

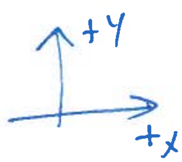


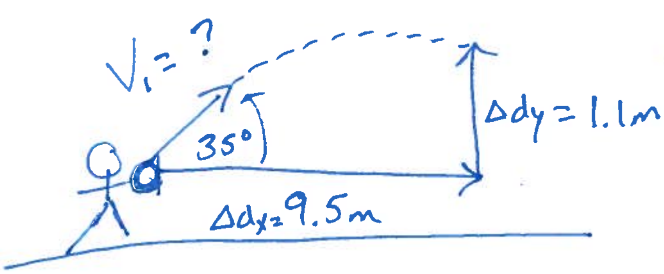
X	Y
$V_{1x} = V_1 \cos 45$	$V_{1y} = V_1 \sin 45$
	$\Delta d_{y\,max} = 3.7\,m$
	$V_{2y} = 0.0$
	$V_1 = ?$
	$a_y = g = -9.80\,m/s^2$

$$\Delta d_y = \frac{\cancel{V_{2y}^2}^{\,0} - V_{1y}^2}{2a_y}$$

$$3.7 = \frac{-(V_1^2 \sin^2 45)}{2(-9.80)} \rightarrow V_1 = \sqrt{\frac{2(3.7)(9.80)}{\sin^2 45}} = 12.0\,m/s$$

66)





x	y
$V_{1x} = V_1 \cos 35$	$V_{1y} = V_1 \sin 35$
$\Delta d_x = 9.5m$	$\Delta d_y = 1.1m$
$\Delta t = ?$	$a_y = 9.80\,m/s^2$ [down]
$V_1 = ?$	

X direction: $\Delta d_x = V_{1x} \Delta t$

$$9.5 = V_1 \cos 35\, \Delta t \quad — ①$$

$$V_1 = \frac{9.5}{\cos 35\, \Delta t}$$

Y direction:

$$\Delta d_y = V_{1y}\Delta t + \frac{1}{2} a_y \Delta t^2$$

$$1.1 = V_1 \sin 35\, \Delta t - 4.90\, \Delta t^2 \quad — ②$$

Solve for Δt by subbing ① into ②:

$$\therefore 1.1 = \left(\frac{9.5}{\cos 35\, \cancel{\Delta t}}\right)(\sin 35)(\cancel{\Delta t}) - 4.90\, \Delta t^2$$

$$\therefore 1.1 = 9.5 \tan 35 - 4.90\, \Delta t^2$$

$$1.1 = 6.652 - 4.90\, \Delta t^2$$

$$-5.552 = -4.90\, \Delta t^2$$

$$\therefore \Delta t = \sqrt{\frac{5.552}{4.90}}$$

$$= \pm 1.064\,s$$

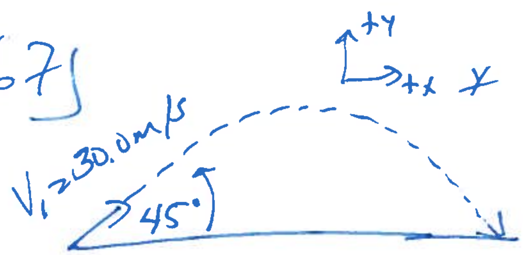
$$\therefore \Delta t = 1.064\,s$$

Solve for V_1 by subbing Δt back into equation ①:

$$V_1 = \frac{9.5}{\cos 35\,\Delta t} = \frac{9.5}{(\cos 35)(1.064s)} = 10.895\,m/s \simeq \underline{11\,m/s}$$

∴ the initial speed of the ball was 11 m/s.

67)



* assume the ball starts and lands on level ground.

$\Delta d_y = 0.0$

$\Delta t = ?$

$V_{1y} = V_1 \sin 45°$

$a_y = g = -9.80\,m/s^2$

$$\Delta d_y = V_{1y}\Delta t + \frac{1}{2}a_y\Delta t^2$$

$$0 = 30.0\sin 45\,\Delta t - 4.90\,\Delta t^2$$

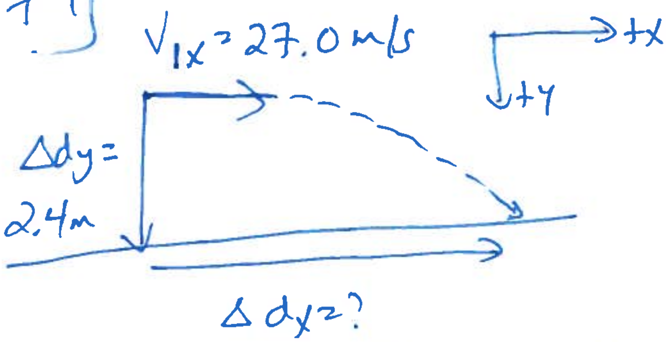
$$0 = \Delta t\,(21.2 - 4.90\,\Delta t)$$

$$\therefore \Delta t = 0 \quad \text{OR} \quad 21.2 - 4.90\,\Delta t = 0$$

$$\Delta t = \frac{-21.2}{-4.90} = 4.33s$$

∴ the ball is in the air for $\underline{4.3s}$.

74)



x	y
$V_x = V_{1x} = 27.0\,m/s$	$V_{1y} = 0.0$
$\Delta d_x = ?$	$\Delta d_y = 2.4m$
	$a_y = 9.80\,m/s^2$ [down]
	$\Delta t = ?$

a) $\Delta d_y = \cancel{V_{1y}\Delta t}^{\,0} + \frac{1}{2}a_y\Delta t^2$

$2.4 = 4.90\,\Delta t^2$

$\Delta t = \pm\sqrt{\frac{2.4}{4.90}} = \pm 0.6998s \simeq \underline{0.70s}$

b) $\Delta d_x = V_x\Delta t = (27.0\,m/s)(0.70s)$

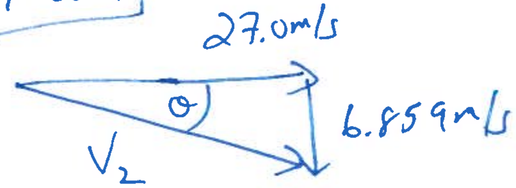
$= 18.896m$

$\simeq 18.9\,m$

c) $V_{2y} = a_y\Delta t$

$= (9.80\,m/s^2)(0.70s) = 6.859\,m/s$

74 cont'

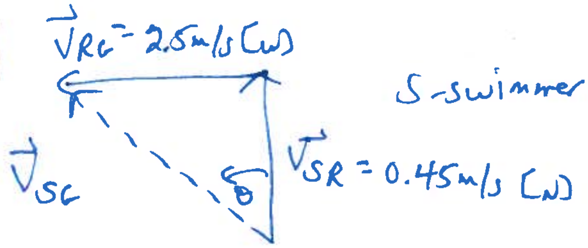


$V_2 = 27.86 \text{ m/s} \simeq 27.9 \text{ m/s}$

$\theta = \tan^{-1}\left(\frac{6.859}{27.0}\right) = 14.3°$

∴ the ball's speed is 28m/s as it hits the ground.

77)



S-swimmer R-river → G-ground.

analysis: $\vec{V}_{SG} = \vec{V}_{SR} + \vec{V}_{RG}$

$\Delta t = 200.0\text{s}$

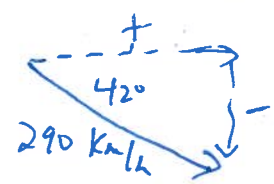
$\Delta d_{North} = ?$

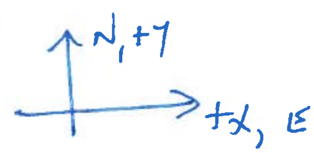
$\Delta \vec{d}_{NORTH} = \vec{V}_{SR} \cdot \Delta t$

$= (0.45 \text{m/s [N]})(200.0\text{s}) = \underline{90.0\text{m}}$

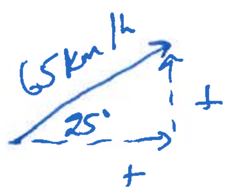
79) Let p = plane, w = wind, G = ground.

$\vec{V}_{pw} = 290$ km/h [E 42°S]





$\vec{V}_{wG} = 65$ km/h [E 25°N]



$\vec{V}_{pG} = ?$

analysis:

$\vec{V}_{pG} = \vec{V}_{pw} + \vec{V}_{wG}$

$V_{pGx} = V_{pwx} + V_{wGx}$

$= 290 \cos 42 + 65 \cos 25$

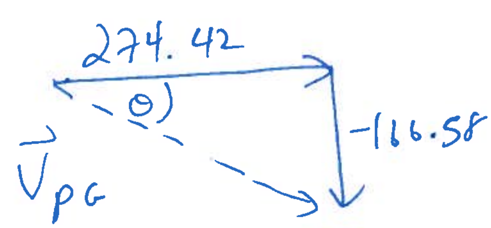
$= 274.42$

$V_{pGy} = V_{pwy} + V_{wGy}$

$= -290 \sin 42 + 65 \sin 25$

$= -166.58$

Combining components



$V_{pG} = \sqrt{274.42^2 + 166.58^2}$

$= 321.02$

$\theta = \tan^{-1}\left(\frac{166.58}{274.42}\right) = 31.3°$

∴ $\boxed{\vec{V}_{pG} = 320 \text{ km/h [E 31°S]}}$

Chapter 3 Review pg 140-141 #16, 21, 22, 23

16) a) $a = \frac{V^2}{r}$ → r constant, double speed $a_c' = 4a_c$

b) V constant, double radius → $a_c' = \frac{V^2}{2r} = \frac{1}{2}a_c$

21) a) $r = 0.13m$

$f = 33.5 \text{ rpm} = \frac{33.5}{60.0s} = 0.558 Hz$

$a_c = 4\pi^2 r f^2$
$= 4\pi^2 (0.13m)(0.558Hz)^2$
$= 1.6 m/s^2$

b) $T = 1.2s$
$r = 4.3m$

$a_c = \frac{4\pi^2 r}{T^2} = \frac{4\pi^2 (4.3m)}{(1.2s)} = 141.46 \, m/s^2 \doteq 1.4 \times 10^2 \, m/s^2$

c) $V = 2.18 \times 10^6 m/s$
$r = \frac{1.06 \times 10^{-10} m}{2} = 0.530 \times 10^{-10} m$

$a_c = \frac{V^2}{r} = \frac{(2.18 \times 10^6 m/s)^2}{(0.530 \times 10^{-10} m)} = 8.97 \times 10^{22} \frac{m}{s^2}$

22) $a_c = 33.8 m/s^2$
$r = 125 m$
$V = ?$

$a_c = \frac{V^2}{r} \rightarrow V = \sqrt{a_c r}$
$= \sqrt{(33.8 m/s^2)(125m)} = 65.0 m/s$

23) $V = \frac{50.0 Km}{h} \times \frac{1h}{3600s} \times \frac{1000m}{Km}$
$= 13.89 m/s$

$r = \frac{33.5m}{2} = 16.75m$

$a_c = ?$

$a_c = \frac{V^2}{r}$
$= \frac{(13.89 m/s)^2}{(16.75m)}$
$= 11.52 m/s^2$

∴ the acceleration is $11.5 m/s^2$.