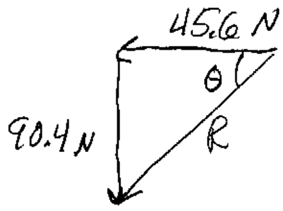
A1>



$R^2 = (45.6)^2 + (90.4)^2$

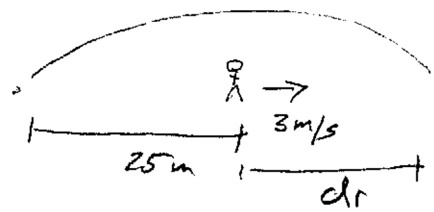
$R = 101.2\ N$

$\tan\theta = \frac{90.4}{45.6}$ $\quad \theta = 63.2°$

$\boxed{101 N @ 63.2° \text{ S of W}}$

A2> The ball is a projectile and for the reciever to catch it they must be at the same place at the same time.

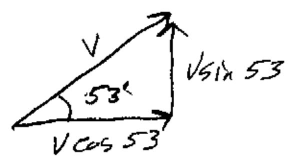
A2>



Reciever

$d = d_o + v_i t + \cancel{\tfrac{1}{2} a t^2}$

$d = 25 + (3)t \quad ①$



football

x) $d = \cancel{d_o} + v_i t + \cancel{\tfrac{1}{2} a t^2}$

$d = V\cos 53\ t \quad ②$

y) $d = \cancel{d_o} + V_i t + \tfrac{1}{2} a t^2$

$0 = V\sin 53\ t + \tfrac{1}{2}(-9.8)t^2$

$0 = V\sin 53 - 4.9t$

$t = \frac{V\sin 53}{4.9}$

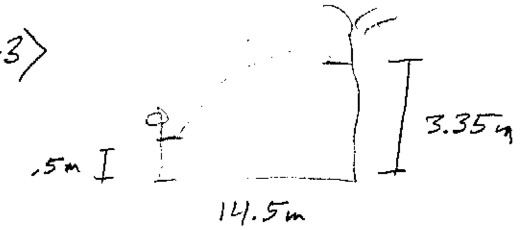
① & ② $\quad 25 + 3t = V\cos 53\ t$

$25 + \frac{3V\sin 53}{4.9} = V\cos 53\left[\frac{V\sin 53}{4.9}\right]$

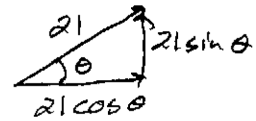
$\boxed{V = 18.6\ m/s}$

A3> the arrow is a projectile.

A3>



$V = 21\ m/s$



x] $d = \cancel{d_0} + V_i t + \cancel{\tfrac{1}{2}at^2}$

$14.5 = 21\cos\theta\ t \Rightarrow t = \frac{21\cos\theta}{14.5}$

y] $d = d_0 + V_i t + \tfrac{1}{2}at^2$

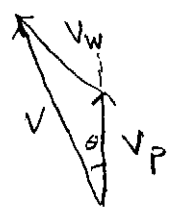
$3.35 = .5 + 21\sin\theta\ t + \tfrac{1}{2}(-9.8)t^2$

$2.85 = 21\sin\theta\left[\frac{21\cos\theta}{14.5}\right] - 4.9\left[\frac{21\cos\theta}{14.5}\right]^2$

$$\boxed{\theta = 24.2^\circ}$$

A4> The wind adds to the Vel of the plane to come to a final Vel.

A4>



$V^2 = V_p^2 + V_w^2 - 2(V_p)(V_w)\cos 135$

$V^2 = (42)^2 + (18)^2 - 2(42)(18)\cos 135$

$\frac{\sin\theta}{V_w} = \frac{\sin 135}{V}$

$V = 56.2\ m/s$

$\sin\theta = \frac{(18)\sin 135}{56.2\ m/s}$

$\theta = 13.1^\circ$

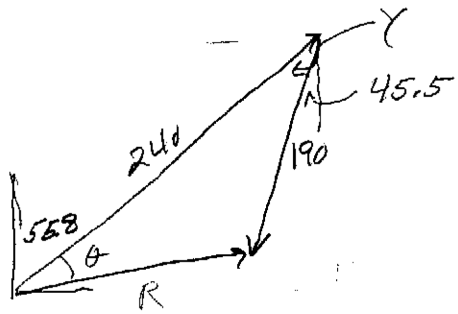
$d = \cancel{d_0} + V_i t + \cancel{\tfrac{1}{2}at^2}$

$d = (56.2)(5)(60)$

$d = 16856\ m$

$$\boxed{16.8\ km\ @\ 13.1^\circ\ W\ of\ N}$$

A5>



$\gamma = 55.8 - 45.5 = 10.3$

$R^2 = (240)^2 + (190)^2 - 2(240)(190)\cos(10.3)$

$R = 63.0054$

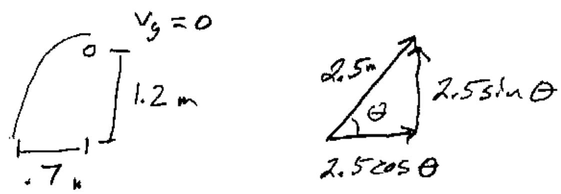
$\dfrac{\sin 10.3}{63.0054} = \dfrac{\sin\theta}{190} \qquad \theta \doteq 32.63^\circ$

$55.8 + 32.63 = 88.43^\circ$

$\boxed{63\ m/s\ @\ 1.57^\circ\ N\ of\ E}$

A6> you are a projectile and hopefully will clear the bar at the top of your path.

A6>



x] $d = \cancel{d_0}^{0} + v_i t + \cancel{\tfrac{1}{2}at^2}^{0}$

$.7 = 2.5\cos\theta\, t \qquad t = \dfrac{.7}{2.5\cos\theta}$

y] $d = \cancel{d_0}^{0} + v_i t + \tfrac{1}{2}at^2$

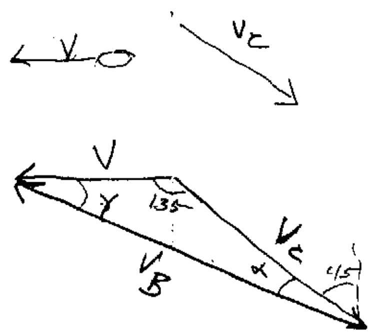
$1.2 = 2.5\sin\theta\ t + \tfrac{1}{2}(-9.8)t^2$

$1.2 = \dfrac{2.5\sin\theta(.7)}{2.5\cos\theta} - 4.9\left[\dfrac{.7}{2.5\cos\theta}\right]^2$

$1.2 = .7\tan\theta - 4.9\left[\dfrac{.7}{2.5\cos\theta}\right]^2$

$\boxed{\theta = 42.3^\circ}$

A7) The velocity of the boat and velocity of the current will combine vectorally to make a new relative velocity



$V_B = 12\ m/s$

$V_C = 3.25\ m/s$

$d - 205m$ West

$$\frac{\sin \gamma}{V_C} = \frac{\sin 135}{V_B}$$

$$\sin \gamma = \frac{(3.25)\sin 135}{12} \qquad \gamma = 11.0408^\circ$$

$$\alpha = 180 - 135 - \gamma \rightarrow \alpha = 33.96^\circ$$

$$\boxed{\text{Steer at } 79.0^\circ \text{ W of N}}$$

$$V^2 = V_B^2 + V_C^2 - 2V_B V_C \cos \alpha$$

$$V^2 = (12)^2 + (3.25)^2 - 2(12)(3.25)\cos(33.96)$$

$$V = 9.47982$$

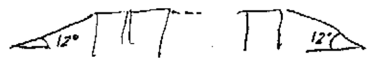
$$d = \cancel{d_0} + v_i t + \cancel{\tfrac{1}{2}a}t^2$$

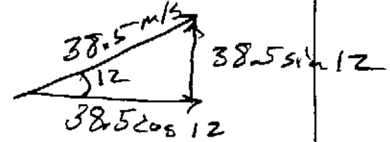
$$205 = (9.47982)\,t$$

$$\boxed{t = 21.6 \text{ sec}}$$

A8> Sophie is a projectile an thus is controled by gravity.

A8>





$L_B = 2.14\,m$

x) $d = \cancel{d_o}^{0} + v_i t + \cancel{\tfrac{1}{2}at^2}^{0}$

$nL_B = 38.5\cos 12\, t \qquad t = \dfrac{n(2.14)}{38.5\cos 12}$

y) $d = d_o + v_i t + \tfrac{1}{2}at^2$

$0 = 38.5\sin 12\, t + \tfrac{1}{2}(-9.8)t^2$

$0 = 38.5\sin 12 - 4.9\,t$

$0 = 38.5\sin 12 - 4.9\left[\dfrac{2.14n}{38.5\cos 12}\right]$

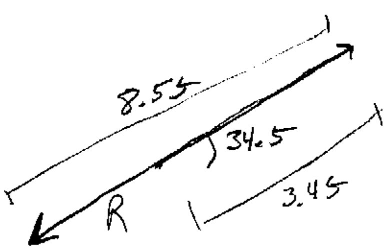
$4.9\left[\dfrac{2.14n}{38.5\cos 12}\right] = 38.5\sin 12$

$2.14n = \dfrac{(38.5)^2\sin 12\cos 12}{4.9}$

$n = 28.747$

$\boxed{28 \text{ busses}}$

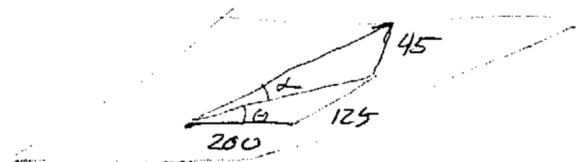
B1>



$\boxed{5.10\,m/s^2 \text{ @ } 55.5° \text{ S of W}}$

B2> The components of a vector combine to be the vector.

B2>



$d^2 = A^2 + B^2 + C^2$

$d^2 = (200)^2 + (125)^2 + (45)^2$

$\boxed{d = 240\text{ m}}$

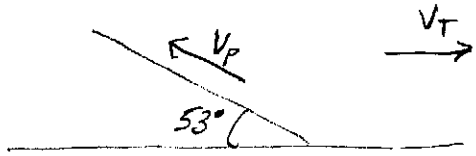
$\tan\theta = \frac{125}{200}$ $\theta = 32.0°$

$\tan\alpha = \frac{45}{\sqrt{200^2 + 125^2}}$ $\alpha = 10.8°$

$\boxed{240\text{m @ } 32.0° \text{ N of E and up } 10.8°}$

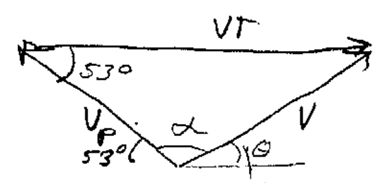
B3> The velocities combine to form a new velocity that is with respect to the ground.

B3>



$V_p = 1.2$ m/s

$V_T = 9.5$ m/s



$V^2 = V_P^2 + V_T^2 - 2V_PV_T\cos 53$

$V^2 = (1.2)^2 + (9.5)^2 - 2(1.2)(9.5)\cos 53$

$V = 8.83$ m/s

$\frac{\sin\alpha}{V_T} = \frac{\sin 53}{V}$ $\sin\alpha = \frac{(9.5)\sin 53}{8.83}$

$\alpha = 59.23°$

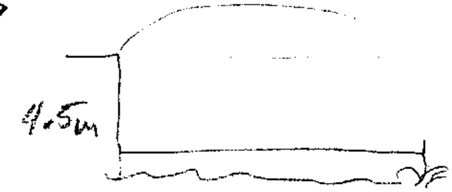
$180 - 53 - \alpha = \theta$

$\theta = 67.8°$

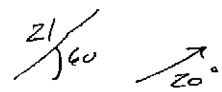
$\boxed{8.83\text{ m/s @ } 67.8 \text{ up}}$

B4> the cannonball is a projectile. It will have a symmetry around 45°.

B4>

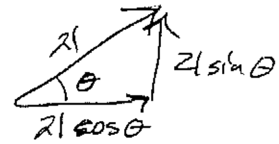


$V = 21$ m/s



x] $d = \cancel{d_0}^0 + v_i t + \cancel{\tfrac{1}{2}at^2}^0$

$d = 21 \cos\theta\, t$



y] $d = d_0 + v_i t + \frac{1}{2}at^2$

$0 = 4.5 + 21\sin\theta\, t + \frac{1}{2}(-9.8)t^2$

$0 = 4.5 + 21\sin\theta\, t - 4.9t^2$

for $\theta = 20°$

$t = 1.93934$ s

$\boxed{d = 38.3 \text{ m}}$

for $\theta = 60°$
$t = 3.944368$ s $\qquad d = 41.4$ m

for $\theta = 45°$

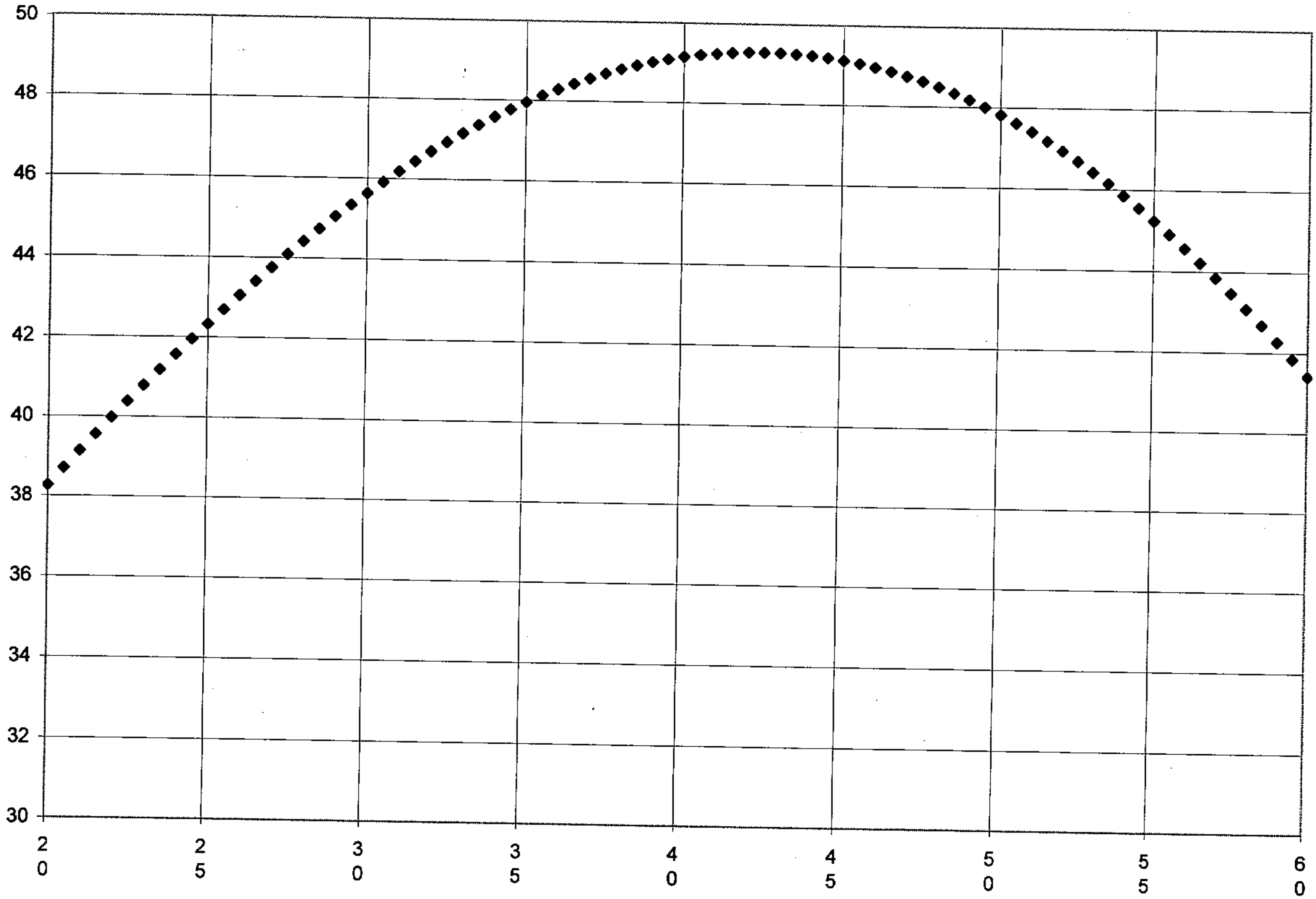
$t = 3.30807$ s $\qquad \boxed{d = 49.12 \text{ m}}$

this involve a little calculus.

actually

$\theta = 42.4°$

$t = 3178774$ $\qquad \boxed{d = 49.3 \text{ m}}$


50
48
46
44
42
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38
36
34
32
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25
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35
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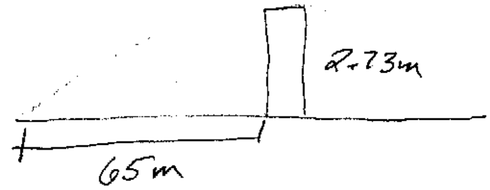
45
50
55
60

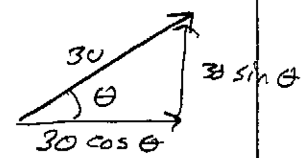
B5)

$$34.5\hat{i} + 23\hat{j} + 52.9\hat{k}$$
$$19.4\hat{i} - 27.9\hat{j} + 12.35\hat{k}$$
$$\boxed{53.9\hat{i} - 4.9\hat{j} + 65.2\hat{k}}$$

B6) The ball is a projectile and must be at the height of the wall when the distance away.

B6)





x] $d = \cancel{d_0}^{0} + v_i t + \cancel{\tfrac{1}{2}at^2}^{0}$

$$65 = 30\cos\theta\, t \qquad t = \frac{65}{30\cos\theta}$$

y] $d = \cancel{d_0}^{0} + v_i t + \tfrac{1}{2}at^2$

$$2.73 = 30\sin\theta\, t + \tfrac{1}{2}(-9.8)t^2$$

$$2.73 = 30\sin\theta\, t - 4.9t^2$$

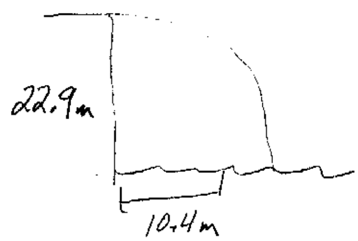
$$2.73 = 30\sin\theta\left[\frac{65}{30\cos\theta}\right] - 4.9\left[\frac{65}{30\cos\theta}\right]^2$$

$$2.73 = 65\tan\theta - 4.9\left[\frac{65}{30\cos\theta}\right]^2$$

$$\boxed{\theta = 25.4^\circ}$$

B7> The bottle is a projectile it only has a set amount of time to move outward as it falls.

B7>



y] $d = d_0 + \cancel{v_i t}^{0} + \frac{1}{2}at^2$

$0 = 22.9 + \frac{1}{2}(-9.8)t^2$

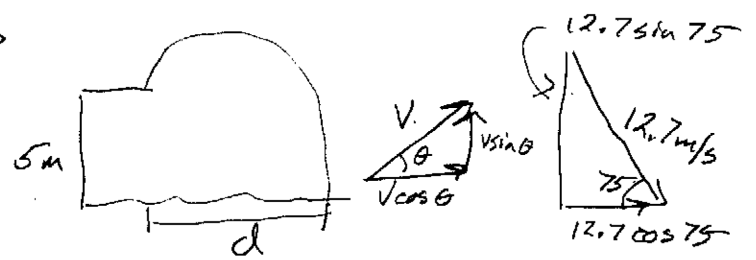
$t = 2.162\ s$

x] $d = \cancel{d_0}^{0} + v_i t + \cancel{\frac{1}{2}a}^{0}t^2$

$10.4 = V(2.162)$ $\boxed{V = 4.81\ m/s}$

B8> the diver is a projectile and so its horizontal vel does not change

B8>



$V\cos\theta = 12.7\cos 75 = 3.287$

y) $V_f^2 = V_i^2 + 2ad$

$(-12.7\sin 75)^2 = (V\sin\theta)^2 + 2(-9.81)(-5)$

$V\sin\theta = 7.2447$

$\frac{V\sin\theta}{V\cos\theta} = \tan\theta = \frac{7.2447}{3.287}$ $\theta = 65.6^\circ$

$V\cos 65.6 = 12.7\cos 75$ $V = 7.96\ m/s$

$d = d_0 + v_i t + \frac{1}{2}at^2$

$0 = 5 + (7.2447)t + \frac{1}{2}(-9.8)t^2$

$t = 1.991\ s$

$d = \cancel{d_0}^{0} + v_i t + \cancel{\frac{1}{2}at^2}^{0}$

$d = (3.287)(1.991)$

$\boxed{d = 6.544\ m}$