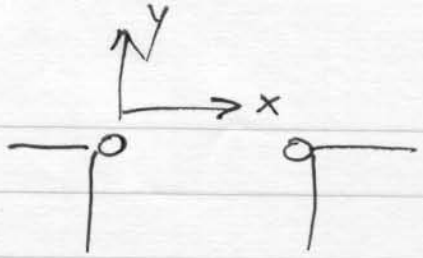
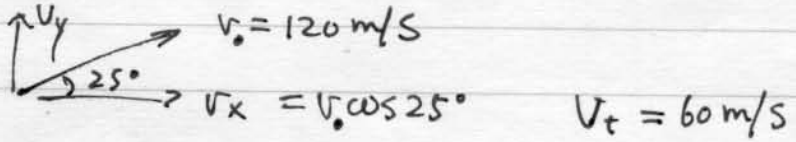



2. Yes. They will hit in the midair.
Because in the y direction, the two balls have same initial velocities & same acceleration. Then they will have the same height at the same time. If the floor is sufficiently far down that they never hit the ground, they'll hit in the midair.

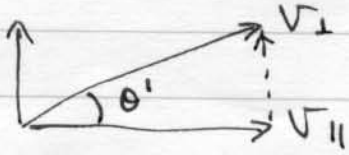
3.




(a) $V_\parallel = V_t + V_x = 60 + 120\cos\theta$ m/s $\quad \theta = 25°$
$\doteq 168.8$ m/s

(b) $V_\perp = V_y = 120\sin\theta$ m/s $\doteq 50.7$ m/s

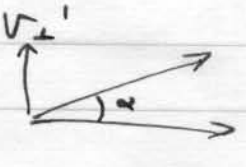
(c) the initial angle depends on $V_\parallel$ and $V_\perp$




$$\tan\theta' = \frac{V_\perp}{V_\parallel} \Rightarrow \theta' = \tan^{-1}\frac{V_\perp}{V_\parallel} \doteq 16.7°$$

(d) If the tank wants to maximize its range,


$$\begin{cases} V_\parallel' = V_t + V_0\cos\theta'' \\ V_\perp' = V_0\sin\theta'' \end{cases}$$




$$\tan\alpha = \frac{V_\perp'}{V_\parallel'} = \frac{V_0\sin\theta''}{V_t + V_0\cos\theta''}$$

$$\alpha = \tan^{-1}\frac{V_0\sin\theta''}{V_t + V_0\cos\theta''} = 45°$$ this angle makes the largest range.

$$\theta'' \doteq 65.7°$$