1. a) We can find the change in velocity by integrating the acceleration:

$$\Delta V = V(t) - \underbrace{V(0s)}_{\substack{\text{zero -} \\ \text{starts at} \\ \text{rest}}} = V(t) = \int_0^t (A - Bt)\,dt = At - \frac{Bt^2}{2}$$

so $V(8s) = A(8s) - \dfrac{B(8s)^2}{2} = 24\ m/s$

b) By definition
$$a_{ave,\,0-8} = \frac{\Delta V}{\Delta t} = \frac{24\ m/s - 0\ m/s}{8s} = 3\ m/s^2$$

c) Integrate $V(t)$ to find ΔX:
$$\Delta X = \int_0^t V(t)\,dt = \int_0^t \left(At - \frac{Bt^2}{2}\right) dt = \frac{At^2}{2} - \frac{Bt^3}{6}$$

$$\Delta X_{0-8s} = \frac{A(8s)^2}{2} - \frac{B(8s)^3}{6} = 224\ m$$

Standard Problems 2. Complex 1D kinematics w/ constant accel. Intervals, Quiz

Name Solution Lab section (circle one): 9am 11am

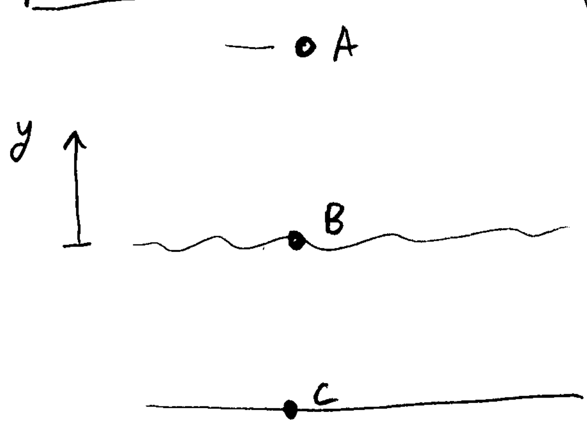
$$v_B = v_A + a_{AB}\Delta t_{AB} \qquad x_B = x_A + v_A\Delta t_{AB} + \frac{a_{AB}}{2}\Delta t_{AB}^{\ 2}$$

$$v_B^2 = v_A^2 + 2a_{AB}\Delta x_{AB} \qquad x_B = x_A + \left(\frac{v_A+v_B}{2}\right)\Delta t_{AB}$$

A lead ball is dropped into a lake from a diving board 5.0 m above the water. After entering the water, it sinks to the bottom with a constant velocity equal to the velocity with which it hit the water. The ball reaches the bottom 3.40 s after it is released.

How deep is the lake?

$\boxed{\text{O and P}}$



$V_A = 0$ m/s $\quad a_{AB} = -g$

$y_A = 5.0$ m $\quad a_{BC} = 0$

$y_B = 0$ m $\quad V_B = V_C = ?$

$y_C = ?$ $\quad \Delta t_{AC} = 3.40$ s.

First let's find the time it takes to hit the water (Δt_{AB}) and V_B using the free fall motion from A to B then, Use this to find the depth.

$\boxed{\text{Solve}}$

$V_B^2 = V_A^2 + 2a_{AB}\Delta y$ (const accel)

$V_B = \sqrt{0 + 2(-9.8\frac{m}{s^2})(-5m)}$

$V_B = -9.9$ m/s. (negative b/c it's moving down)

$V_B = V_A + a_{AB}\Delta t_{AB}$

$\Rightarrow \Delta t_{AB} = \dfrac{V_B - V_A}{a_{AB}} = 1.01$s.

Since $\Delta t_{AC} = \Delta t_{AB} + \Delta t_{BC}$, $\quad \Delta t_{BC} = \Delta t_{AC} - \Delta t_{AB} = 3.40\text{s} - 1.01\text{s}$

$= 2.39$s.

For the constant velocity motion from B to C,

$x_C = x_B + V_B\Delta t_{BC}$

$= 0 + (-9.9\frac{m}{s})(2.39s) = 23.7$ m. A pretty deep lake!