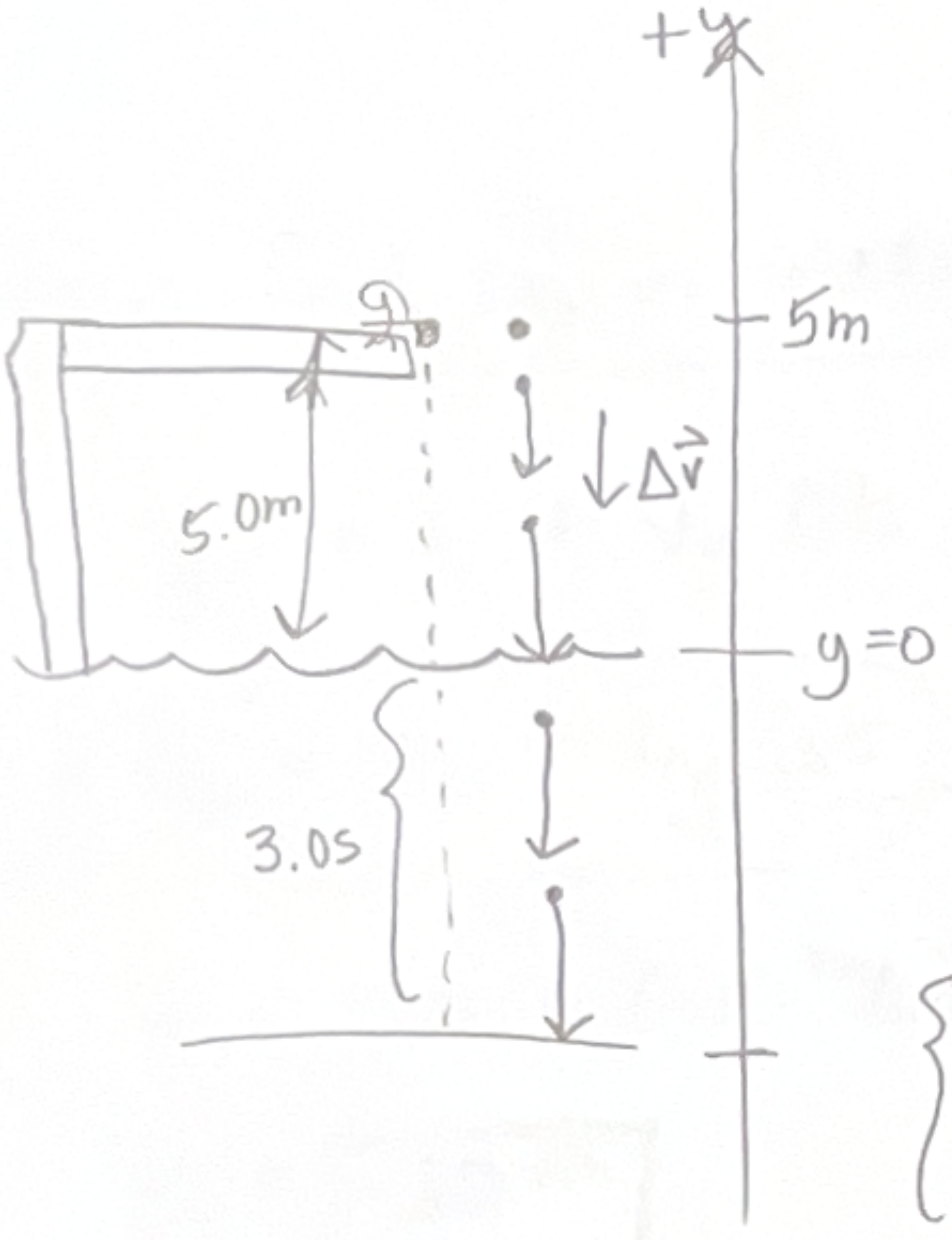
Analyzing Free Fall motion, Activity 6



$t_0 = 0$, $y_0 = 5m$, $V_{0y} = 0$

$t_1 =$, $y_1 = 0m$, $V_{1y} =$

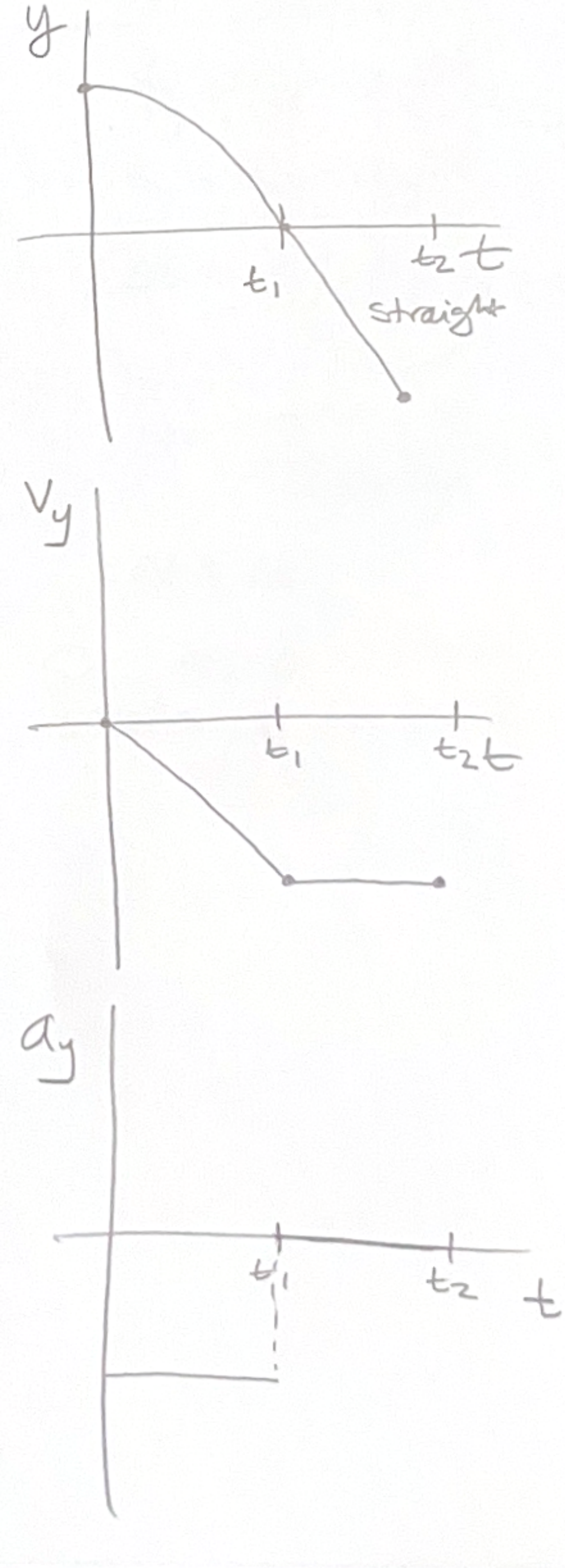
$t_2 = t_0 + 3s$, $y_2 =$, $V_{2y} = V_{1y}$

constant acceleration

$\vec{a} \downarrow \quad a_{0y} = -10\ m/s^2$

constant velocity

$\vec{a} = 0$



For the time in the water, it is constant velocity, but all I know is time, so I can't use $X_f = X_i + V_x \Delta t$ yet.

From t_0 to t_1, find V_{1y}:

$$V_{fy}^2 = V_{iy}^2 + 2a_y \Delta y$$

$$V_{1y}^2 = V_{0y}^2 + 2a_{0y}(y_1 - y_0)$$

$$V_{1y} = \sqrt{V_{0y}^2 + 2a_{0y}(y_1 - y_0)}$$

$$V_{1y} = \sqrt{0 + 2(-10\ m/s^2)(0m - 5m)}$$

$$V_{1y} = \pm 10\ m/s$$

choose neg. velocity, so $V_{1y} = -10\ m/s$

Now find ~~Δy~~ y_f in water using t_1 to t_2:

$y_f = y_i + V_y \Delta t$

$y_2 = y_1 + V_{1y} \Delta t$

$y_2 = 0m + (-10 m/s)(2.0s)$

$y_2 = \boxed{-20 m}$

So the lake is 20 m deep

This is reasonable because it has correct units and a lake could be 20m deep

→ I need Δt in water. So first I have to find Δt in air, and subtract that from the total time of 3.0s.

Find Δt in air using t_0 to t_1:

$V_{fy} = V_{iy} + a_y \Delta t$

$V_{1y} = V_{0y} + a_{0y} \Delta t$

$\Delta t = \frac{V_{1y} - V_{0y}}{a_{0y}}$

$\Delta t = \frac{-10 m/s - 0}{-10 m/s^2}$

$\Delta t = 1s$

So... the Δt in the water is $3.0s - 1.0s = \boxed{2.0s.}$