STAEDTLER® No. 937 811E Engineer's Computation Pad

••61 A drowsy cat spots a flowerpot that sails first up and then down past an open window. The pot is in view for a total of 0.50 s, and the top-to-bottom height of the window is 2.00 m. How high above the window top does the flowerpot go?

$$y = y_0 + v_{0y}t - \frac{1}{2}gt^2$$

$$y\left(t=\tfrac{1}{2}\right) = y_0 + v_{0y}\left(\tfrac{1}{2}\right) - \tfrac{1}{2}(9.80)\left(\tfrac{1}{2}\right)^2 = y_0 + 2$$

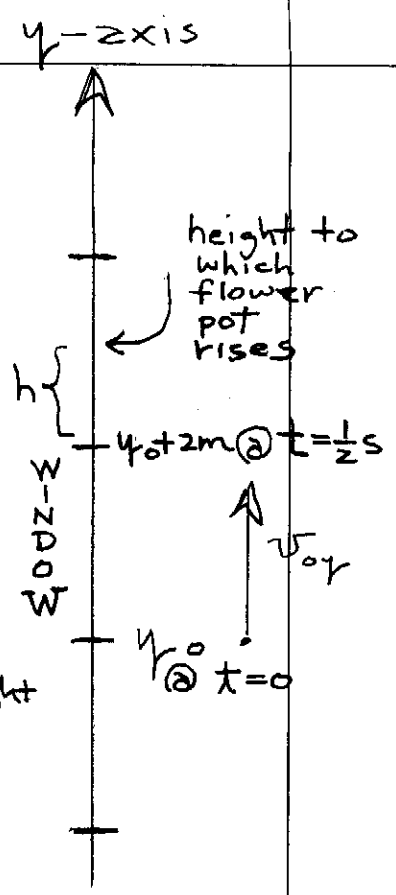
$$\Rightarrow v_{0y} = 2\left\{2 + \frac{9.80}{2^3}\right\} = 6.45\ \frac{m}{s}$$

$$v^2 = v_0^2 + 2(-g)(y - y_0)$$

$$v^2 = v_0^2 - 2(9.80)\underbrace{2.00}_{y - y_0}$$

↑ at top of window ↑ @ bottom of window $= (6.45)^2$ ($y - y_0$ = window height)

$$v = 1.55\ m/s$$



or you could use $v = v_0 + (-g)t$

$$v = 6.45 - 9.80\left(\tfrac{1}{2}\right) = 1.55\ m/s$$

$$v^2_{\substack{top\\traj}} = v^2_{\substack{top\\window}} + 2(-g)\left(y_{\substack{top\\traj}} - y_{\substack{top\\window}}\right)$$

$$0 = (1.55)^2 - 2(9.80)h$$

$$h = 0.123\ m = 12.3\ cm$$

OR YOU COULD DO:

$$v^2_{\substack{top\\traj}} = v^2_{\substack{bot\\window}} + 2(-g)\left(y_{\substack{top\\traj}} - y_{\substack{bot\\wind}}\right)$$

$$0^2 = (6.45)^2 - 2(9.8)(h+2)$$

$$\Rightarrow h + 2 = 2.123$$

$$h = 0.123\ m$$

or you could use $v = v_0 - gt$ (@ top of Trajectory)

$$0 = 6.45 - 9.80t \Rightarrow t = 0.658\ s$$

$$\Rightarrow y(t=0.658) = y_0 + v_0 t - \tfrac{1}{2}gt^2$$

$$= y_0 + 6.45(0.658) - \tfrac{1}{2}(9.80)(0.658)^2$$

$$= y_0 + 2.123$$

$$= y_0 + 2.00 + 0.123$$

$\Rightarrow$ 0.123 m above top of window

Why does the book have 2.34 m?

BECAUSE THE PROBLEM AUTHOR MEANT THE TIME IT PASSES UP + THE TIME IT PASSES DOWN = 1/2 SEC. SINCE THE MOTION IS SYMMETRIC IN TIME ABOUT THE POINT IN TIME CORRESPONDING TO THE TOP OF THE TRAJECTORY THE TIME TO PASS THE WINDOW ON ITS WAY UP = THAT ON WAY DOWN $= \frac{1}{4}$ SEC $\Rightarrow$ WORK PROBLEM WITH $\frac{1}{4}$ SEC & GET 2.34 m!