63. The object, once it is dropped ($v_0 = 0$) is in free-fall ($a = -g = -9.8$ m/s^2 if we take *down* as the $-y$ direction), and we use Eq. 2-15 repeatedly.

(a) The (positive) distance D from the lower dot to the mark corresponding to a certain reaction time t is given by $\Delta y = -D = -\frac{1}{2}gt^2$, or $D = gt^2/2$. Thus for $t_1 = 50.0\,\text{ms}$

$$D_1 = \frac{(9.8\,\text{m/s}^2)(50.0 \times 10^{-3}\,\text{s})^2}{2} = 0.0123\,\text{m} = 1.23\,\text{cm}\ .$$

(b) For $t_2 = 100\,\text{ms}$

$$D_2 = \frac{(9.8\,\text{m/s}^2)(100 \times 10^{-3}\,\text{s})^2}{2} = 0.049\,\text{m} = 4D_1\ ;$$

for $t_3 = 150\,\text{ms}$

$$D_3 = \frac{(9.8\,\text{m/s}^2)(150 \times 10^{-3}\,\text{s})^2}{2} = 0.11\,\text{m} = 9D_1\ ;$$

for $t_4 = 200\,\text{ms}$

$$D_4 = \frac{(9.8\,\text{m/s}^2)(200 \times 10^{-3}\,\text{s})^2}{2} = 0.196\,\text{m} = 16D_1\ ;$$

and for $t_4 = 250\,\text{ms}$

$$D_5 = \frac{(9.8\,\text{m/s}^2)(250 \times 10^{-3}\,\text{s})^2}{2} = 0.306\,\text{m} = 25D_1\ .$$