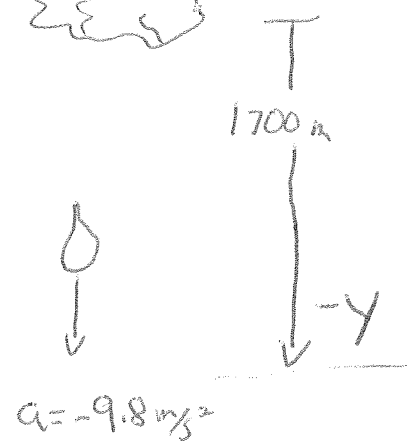
2-46 Rain falls 1700 m from a cloud.



Say they start at rest ($v_0 = 0$ m/s) and that we don't have to worry about air resistance. Falling things are accelerated down at ~9.8 m/s² (constant accelleration)

We know: $(x - x_0) = 1700$ m. $a = -9.8$ m/s² $v_0 = 0$

we'd like:

a) how fast is it going? v

Table 2-1 has solved out the algebra of the equations of constant motion for us, looks like eq. 2-16 is what we need;

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$v^2 = 0^2 + 2(9.8\,m/s^2)(1700\,m) = 33{,}320\ m^2/s^2$$

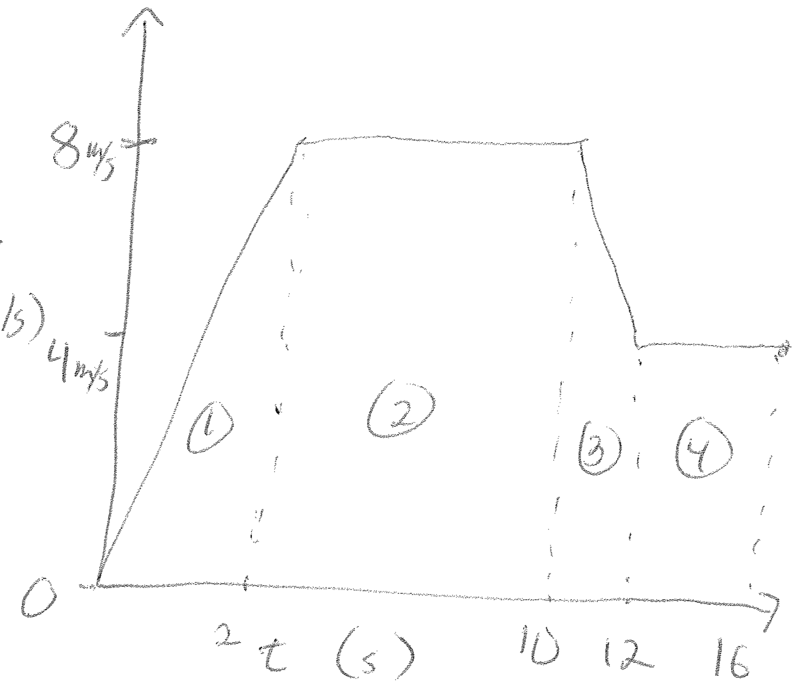
$$v = \sqrt{33{,}320\ m^2/s^2} = \pm 183\ m/s$$

which way? negative = down, so $v = -183$ m/s.

b) Would it hurt?

2-69 The runner has a v-vs.-t graph as shown

How far does he go?



Let's break the problem up into 4 parts, ① → ④, find Δx in each part, and then add them up.

① Constant $a = \frac{8\,m/s - 0\,m/s}{2s - 0s} = 4\,m/s^2$

from $t = 0 \rightarrow 2$ seconds.

use 2-15, $x - x_0 = v_0 t + \frac{1}{2} a t^2 = 0 \cdot (2s) + \frac{1}{2}(4\,m/s^2)\cdot(2s)^2 = 8\,m$

② constant $v = 8\,m/s$ for $(10s - 2s) = 8s$, $\Delta x = (8\,m/s)(8s) = 64\,m$

③ Like ①, constant a, but a is negative: $a = \frac{4\,m/s - 8\,m/s}{2s} = -2\,m/s^2$

so again the 2-15, $\Delta x = (8\,m/s)(2s) + \frac{1}{2}(-2\,m/s^2)(2s)^2 = 16m - 4m = 12m$

④ Like ②, but $v = 4\,m/s$, $t = 4s$, so $\Delta x = 16\,m$

add up the 4 parts,

Total $\Delta x = 8m + 64m + 12m + 16\,m$

$= 100\,m$