Physics H/w

(1) (a) $v^2 = u^2 - 2gy = (10\,m/s^2) - 2(9.80\,m/s^2)(-50m)$

$= 1.08 \times 10^3\,m^2/s^2$

So, $v = \sqrt{1.08 \times 10^3\,m^2/s^2} = \pm 32.9\,m/s$ or $-32.9\,m/s$

(b) $t = \dfrac{10\,m/s - (-32.9\,m/s)}{9.8\,m/s^2}$

$= \dfrac{42.9\,m/s}{9.8\,m/s^2} = 4.38\,s$

(2) (a) Distance travelled = height of bridge = 4m

$s = ut + \frac{1}{2} \times a t^2$

$= 0 \times t + \frac{1}{2} \times 9.8 \times 5 \times 5$

$= 122.5\,m$

(b) Distance travelled in 4s

$= \frac{1}{2} \times 9.8 \times 4 \times 4$

$= 16 \times 4.9$

$= 78.4\,m$

Distance travelled in 1 last second =
= distance travelled in 5 sec - distance travelled in 4 sec = 122.5 - 78.4 = 44.1m

Case-1

③ Initial $v = 22\ m/s$
Final $v = 0\ m/s$
$a = -9.8\ m/s^2$

$t_1 = ?$

$v = u + at$

$\Rightarrow 0 = 22 + 9.8 \times t$

$\Rightarrow -22 = 9.8\ t$

$\Rightarrow \frac{-22}{-9.8} = t$

$\Rightarrow 2.24 = t_1$

The ball takes 2.24 s to reach the required velocity of 22 m/s before it starts retarding at a velocity of -15 m/s.

Case-2

$u = 0\ m/s$
$v = 15\ m/s$
$a = -g = -9.8\ m/s^2$
$t_2 = ?$

$\Rightarrow t_2 = \frac{-15}{-9.8} = 1.53\ s$

So, the ball takes extra 1.53 s to start retarding at 15 m/s before it hits the ground. So total time
$= t_1 + t_2$
$= (2.24 + 1.53)\ s$
$= 3.77\ s$