(ii) $u = 12$
$a = -1$
$s = s$
$t = t$

$s = ut + \frac{1}{2}at^2$

$s = 12t - \frac{1}{2}t^2$

$\frac{ds}{dt} = 12 - t$

$= 0$ (Since s is a minimum)

$t = 12$

At $t = 12$, $s = 12(12) - \frac{1}{2}(12)^2 = 72$ m

This means that they have travelled a distance of 72 m towards each other, and so the distance between then will be $120 - 72 = 48$ m.

Exercise 2D

Q. 1. (i) $s = 35t - 4.9t^2 = 0$
$\therefore t(35 - 4.9\,t) = 0$
$\therefore t = 0$ **OR** $t = \frac{350}{49} = \frac{50}{7}$ s

(ii) $v = 0$
$35 - 9.8t = 0$

$\therefore t = \frac{350}{98} = \frac{50}{14} = \frac{25}{7}$

$s = 35\left(\frac{25}{7}\right) - 4.9\left(\frac{25}{7}\right)^2$

$= 125 - 62.5 = 62.5$ m

Q. 2. (i) $u(1) - 4.9(1)^2 = 16.1$
$\therefore u - 4.9 = 16.1$
$\therefore u = 21$ m/s

(ii) $v = 0$
$21 - 9.8t = 0$

$t = \frac{21}{9.8} = \frac{210}{98} = \frac{15}{7}$

at $t = \frac{15}{7}$,

$s_y = 21\left(\frac{15}{7}\right) - 4.9\left(\frac{15}{7}\right)^2$

$= 45 - 22.5 = 22.5$ m

(iii) $s_y = 0$
$21t - 4.9t^2 = 0$

$\therefore t = 0$ **OR** $t = \frac{21}{4.9}$

$= \frac{210}{49} = \frac{30}{7}$ s

Q. 3. (i) $s_1 = s_2$
$\therefore 0(t) + 4.9t^2$
$= 14.7\,(t - 1) + 4.9\,(t - 1)^2$

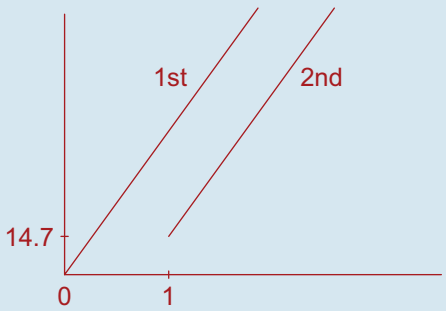
$\therefore t^2 = 3(t - 1) + (t - 1)^2$

$\therefore t^2 = 3t - 3 + t^2 - 2t + 1$

$\therefore t = 2$

(ii) $4.9(2)^2 = 19.6$ m

(iii)



Q. 4. (i) Let t = time Q is in motion.
$\therefore t + 2$ = time P is in motion.

$s_P = s_Q$
$47(t + 2) - 4.9(t + 2)^2 = 64.6t - 4.9t^2$
$47t + 94 - 4.9t^2 - 19.6t - 19.6$
$= 64.6t - 4.9t^2$

$74.4 = 37.2t$

$\therefore t = 2$ s

(ii) $64.6(2) - 4.9(2)^2 = 109.6$ m

Q. 5. First t seconds

$u = u$, $s = 70$, $a = -9.8$, $t = t$

$\therefore 70 = ut - 4.9t^2$ … **Equation 1**

First $2t$ seconds

$u = u$, $s = 70 + 50 = 120$,
$a = -9.8$, $t = 2t$

$120 = 2ut - 4.9\,(2t)^2$

$\therefore 120 = 2ut - 19.6t^2$ … **Equation 2**

Eq 2: $120 = 2ut - 19.6t^2$

$-2 \times$ **Eq. 1:** $\underline{-140 = -2ut + 9.8t^2}$

$-20 = -9.8t^2$

$200 = 98t^2$

$\therefore t^2 = \frac{100}{49}$

$\therefore t = \frac{10}{7}$ s