

$$a = \frac{40}{60} = \frac{2}{3} \text{ m/s}^2$$

$$\text{Since } 60a = 40 = 3az$$

$$\therefore z = \frac{60a}{3a} = \frac{60}{3} = 20 \text{ s}$$

$$\text{Area} = 8,800$$

$$\therefore \frac{1}{2}(60)(40) + 40y + \frac{1}{2}(20)(40) = 8,800$$

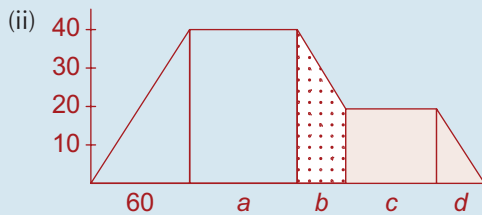
$$\therefore 1,200 + 40y + 400 = 8,800$$

$$\therefore 40y = 7,200$$

$$\therefore y = 180$$

\therefore Distances are 1,200, 7,200, 400 metres

$$\text{Total time} = 60 + 180 + 20 = 260 \text{ s}$$



$$\text{Shaded region} = 1 \text{ km} = 1,000 \text{ m}$$

$$\begin{aligned} \text{The deceleration} &= 3a = 3\left(\frac{2}{3}\right) \\ &= 2 \text{ m/s}^2 \quad (\text{from (i)}) \end{aligned}$$

$$\therefore d = \frac{20}{2} = 10 \text{ s}$$

$$\text{Shaded region} = 1,000$$

$$\therefore 20c + \frac{1}{2}(d)(20) = 1,000$$

$$\therefore 20c + \frac{1}{2}(10)(20) = 1,000$$

$$\therefore 20c + 100 = 1,000$$

$$\therefore 20c = 900$$

$$\therefore c = 45$$

Dotted region: $u = 40, v = 20,$
 $a = -2, t = b$

$$v = u + at$$

$$\therefore 20 = 40 - 2b$$

$$\therefore b = 10$$

$$\text{Area} = 10(20) + \frac{1}{2}(10)(20) = 300 \text{ m}$$

$$\text{Total area} = 8,800$$

$$\begin{aligned} \therefore \frac{1}{2}(60)(40) + 40a + 300 + 900 + 100 \\ = 8,800 \end{aligned}$$

$$\therefore 40a = 6,300$$

$$\therefore a = 157.5$$

$$\begin{aligned} \text{Total time} &= 60 + 157.5 + 10 + 45 + 10 \\ &= 282.5 \end{aligned}$$

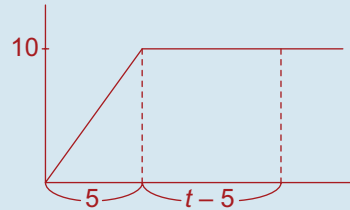
$$\text{Extra time} = 282.5 - 260$$

$$= 22.5 \text{ seconds more than the first time}$$

QED

Exercise 2C

Q. 1.



$$v = u + at$$

$$10 = 0 + 2t$$

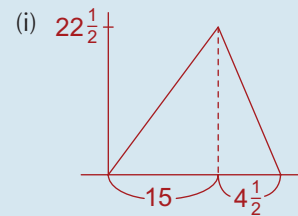
$$t = 5 \text{ s}$$

$$\text{Area under the curve} = 100$$

$$\frac{1}{2}(5)(10) + (t - 5)(10) = 100$$

$$t = 12.5 \text{ s}$$

Q. 2.



$$v = u + at$$

$$v = 0 + \left(1\frac{1}{2}\right)(15) = 22\frac{1}{2} \text{ m/s}$$

$$v = u + at$$

$$0 = 22\frac{1}{2} + (-5)t$$

$$t = 4\frac{1}{2} \text{ s}$$

(ii) Distance = Area under the curve

$$= \frac{1}{2}\left(19\frac{1}{2}\right)\left(22\frac{1}{2}\right) = 219\frac{3}{8} \text{ m}$$

Q. 3.

(i) $v = u + at$

$$24 = 0 + 2t$$

$$t = 12 \text{ s}$$

$$s = \left(\frac{u+v}{2}\right)t$$

$$48 = \left(\frac{24+0}{2}\right)t$$

$$t = 4 \text{ s}$$