

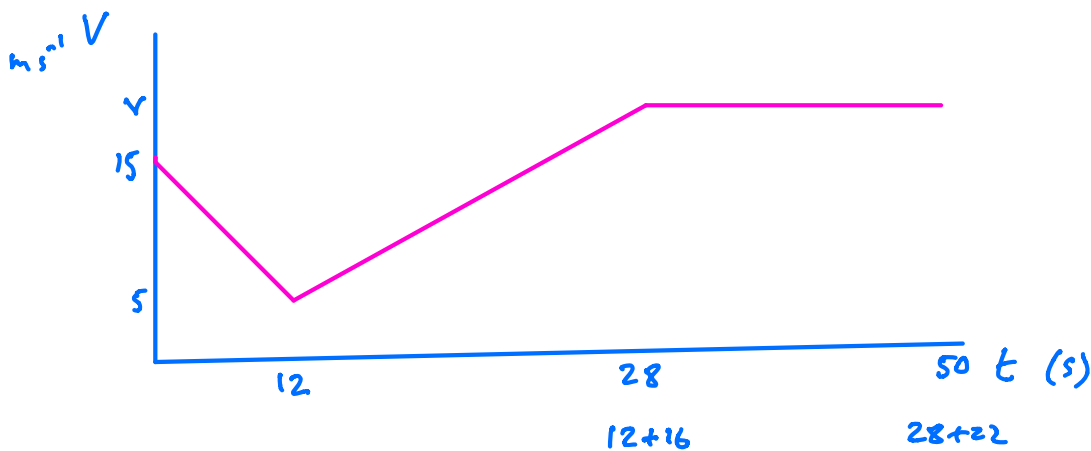
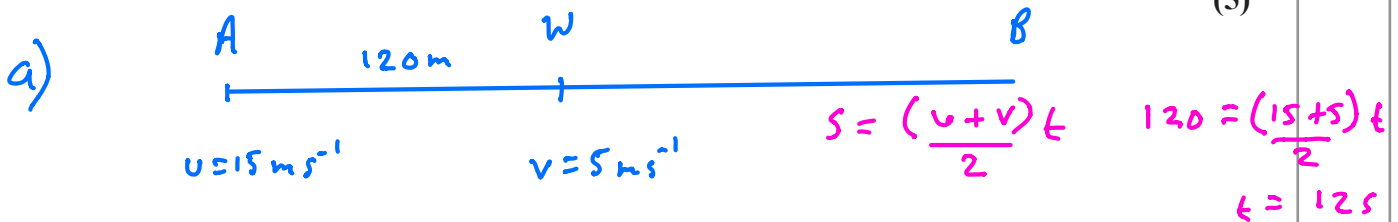
3. A car moves along a horizontal straight road, passing two points  $A$  and  $B$ . At  $A$  the speed of the car is  $15 \text{ m s}^{-1}$ . When the driver passes  $A$ , he sees a warning sign  $W$  ahead of him,  $120 \text{ m}$  away. He immediately applies the brakes and the car decelerates with uniform deceleration, reaching  $W$  with speed  $5 \text{ m s}^{-1}$ . At  $W$ , the driver sees that the road is clear. He then immediately accelerates the car with uniform acceleration for  $16 \text{ s}$  to reach a speed of  $V \text{ m s}^{-1}$  ( $V > 15$ ). He then maintains the car at a constant speed of  $V \text{ m s}^{-1}$ . Moving at this constant speed, the car passes  $B$  after a further  $22 \text{ s}$ .

- (a) Sketch, in the space below, a speed-time graph to illustrate the motion of the car as it moves from  $A$  to  $B$ . (3)

- (b) Find the time taken for the car to move from  $A$  to  $B$ . (3)

The distance from  $A$  to  $B$  is  $1 \text{ km}$ .

- (c) Find the value of  $V$ . (5)



b)  $= 12 + 16 + 22 = 50 \text{ s}$

c) Area under graph =  $1000 \text{ m}$

$$12 \frac{(15+5)}{2} + 16 \frac{(5+V)}{2} + 22V = 1000$$

$$120 + 40 + 8V + 22V = 1000$$

$$30V = 840$$

$$V = \frac{840}{30} = 28 \text{ m s}^{-1}$$



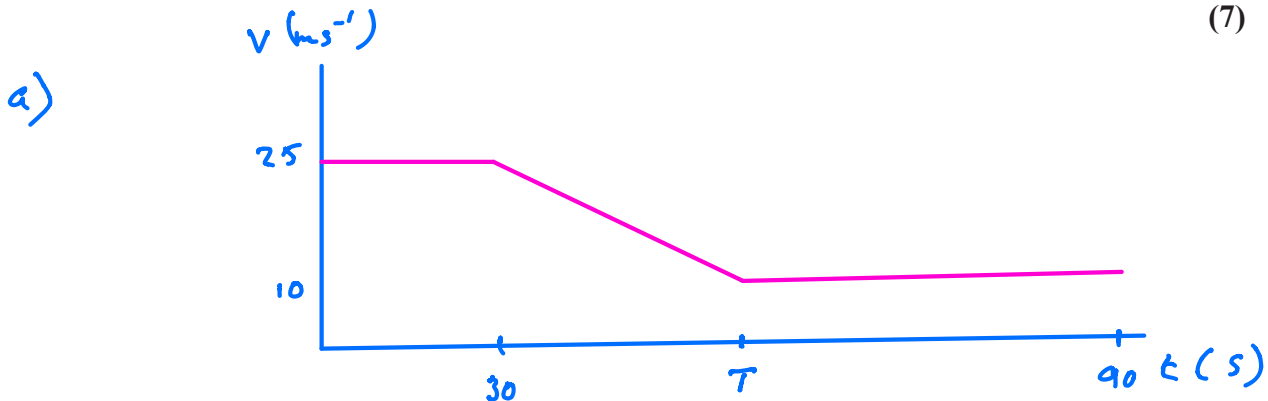
4. A car is moving along a straight horizontal road. The speed of the car as it passes the point  $A$  is  $25 \text{ m s}^{-1}$  and the car maintains this speed for  $30 \text{ s}$ . The car then decelerates uniformly to a speed of  $10 \text{ m s}^{-1}$ . The speed of  $10 \text{ m s}^{-1}$  is then maintained until the car passes the point  $B$ . The time taken to travel from  $A$  to  $B$  is  $90 \text{ s}$  and  $AB = 1410 \text{ m}$ .

(a) Sketch, in the space below, a speed-time graph to show the motion of the car from  $A$  to  $B$ .

(2)

(b) Calculate the deceleration of the car as it decelerates from  $25 \text{ m s}^{-1}$  to  $10 \text{ m s}^{-1}$ .

(7)



$$b) \quad 1410 = 30 \times 25 + \frac{(25+10)(T-30)}{2} + (90-T) \times 10$$

$$1410 = 750 + \frac{35}{2}T - 525 + 900 - 10T$$

$$1410 = 1125 + \frac{15}{2}T$$

$$285 = \frac{15}{2}T$$

$$38 = T$$

$$T = 38 \text{ s}$$

$$a = \frac{v-u}{t} = \frac{10-25}{38-30} = \frac{-15}{8}$$

Decelerates at  $1.875 \text{ ms}^{-2}$



1. Three posts  $P$ ,  $Q$  and  $R$ , are fixed in that order at the side of a straight horizontal road. The distance from  $P$  to  $Q$  is 45 m and the distance from  $Q$  to  $R$  is 120 m. A car is moving along the road with constant acceleration  $a \text{ m s}^{-2}$ . The speed of the car, as it passes  $P$ , is  $u \text{ m s}^{-1}$ . The car passes  $Q$  two seconds after passing  $P$ , and the car passes  $R$  four seconds after passing  $Q$ . Find

(i) the value of  $u$ ,

(ii) the value of  $a$ .

i)



$u$

$t=0$

$t=2$

$t=6$

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

PQ  $45 = 2u + \frac{1}{2}a \times 2^2$

$$45 = 2u + 2a \quad (1)$$

PR  $165 = 6u + \frac{1}{2}a \times 6^2$

$$165 = 6u + 18a \quad (2)$$

Solve (1) and (2) by calc

i)  $u = 20 \text{ m s}^{-1}$

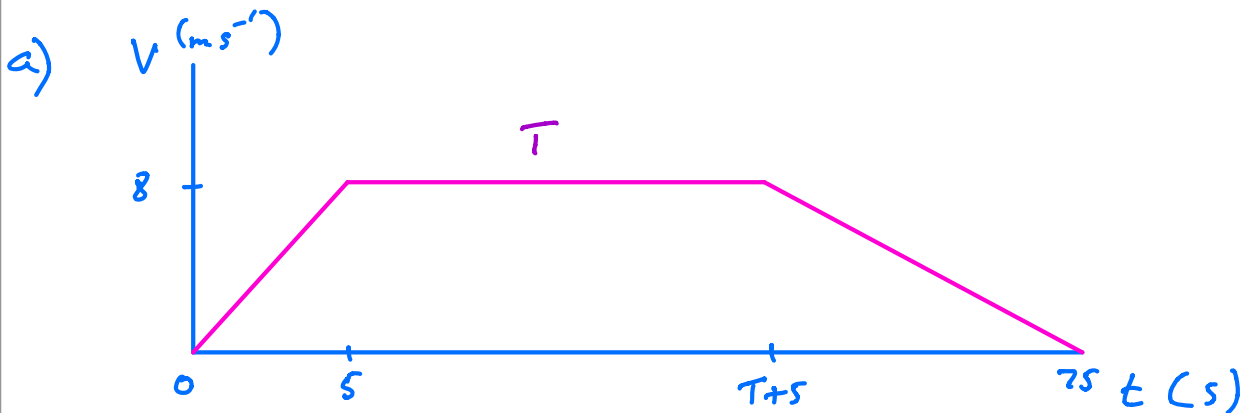
ii)  $a = 2.5 \text{ m s}^{-2}$



2. An athlete runs along a straight road. She starts from rest and moves with constant acceleration for 5 seconds, reaching a speed of  $8 \text{ m s}^{-1}$ . This speed is then maintained for  $T$  seconds. She then decelerates at a constant rate until she stops. She has run a total of 500 m in 75 s.

(a) In the space below, sketch a speed-time graph to illustrate the motion of the athlete. (3)

(b) Calculate the value of  $T$ . (5)



b)

$$500 = \frac{1}{2}(T + 75) \times 8 \quad (\text{Area of trapezium})$$

$$1000 = (T + 75) \times 8$$

$$125 = T + 75$$

$$125 - 75 = T$$

$$50 = T$$

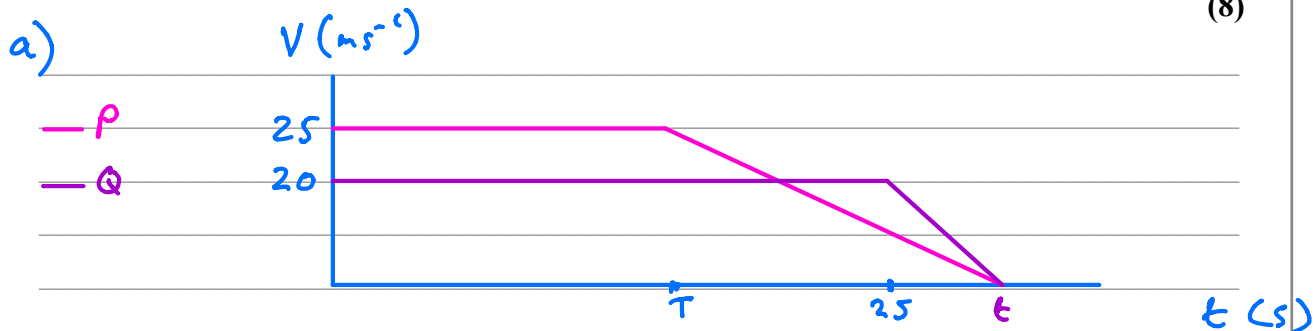
$$\underline{\underline{T = 50 \text{ s}}}$$



5. Two cars  $P$  and  $Q$  are moving in the same direction along the same straight horizontal road. Car  $P$  is moving with constant speed  $25 \text{ m s}^{-1}$ . At time  $t = 0$ ,  $P$  overtakes  $Q$  which is moving with constant speed  $20 \text{ m s}^{-1}$ . From  $t = T$  seconds,  $P$  decelerates uniformly, coming to rest at a point  $X$  which is  $800 \text{ m}$  from the point where  $P$  overtook  $Q$ . From  $t = 25 \text{ s}$ ,  $Q$  decelerates uniformly, coming to rest at the same point  $X$  at the same instant as  $P$ .

- (a) Sketch, on the same axes, the speed-time graphs of the two cars for the period from  $t = 0$  to the time when they both come to rest at the point  $X$ . (4)

- (b) Find the value of  $T$ . (8)



Distance  $800 \text{ m}$  so  $\frac{(25+t) \times 20}{2} = 800$

$$250 + 10t = 800$$

$$10t = 550$$

$$t = 55 \text{ s}$$

Distance  $800 \text{ m}$  so  $\frac{(t+T) \times 25}{2} = 800$

$$(55+T) \times 25 = 1600$$

$$55+T = 64$$

$$T = 64 - 55$$

$$T = 9 \text{ s}$$

