Leave blank

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

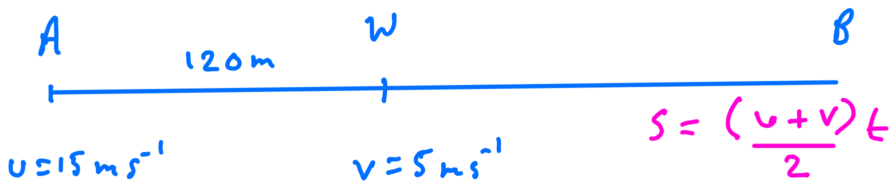
(a) Sketch, in the space below, a speed-time graph to illustrate the motion of the car as it moves from *A* to *B*.
(3)

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

The distance from *A* to *B* is 1 km.

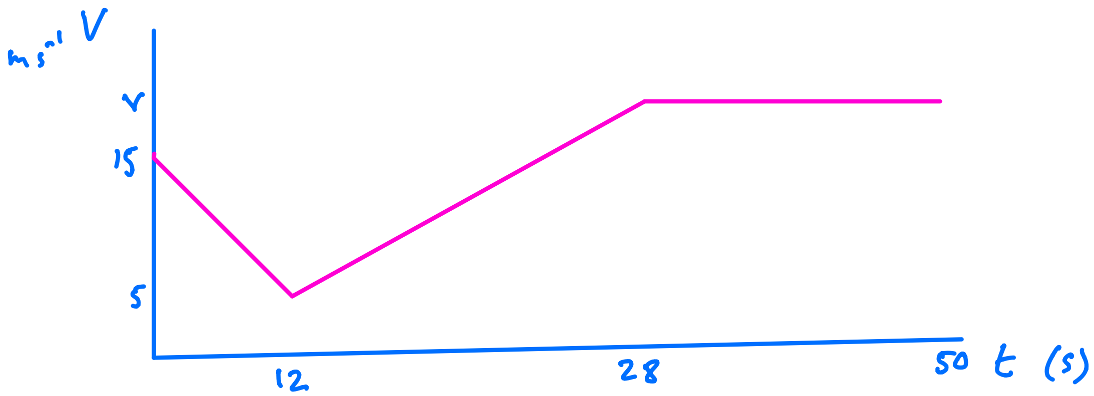
(c) Find the value of *V*.
(5)

a)



$s = \left(\frac{u+v}{2}\right)t$ $\quad 120 = \left(\frac{15+5}{2}\right)t$

$t = 12s$



12+16 $\quad$ 28+22

b) $= 12 + 16 + 22 = 50s$

c) Area under graph $= 1000m$

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

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

$$30v = 840$$

$$v = \frac{840}{30} = 28 \text{ ms}^{-1}$$

M 2 6 3 3 1 A 0 6 2 8

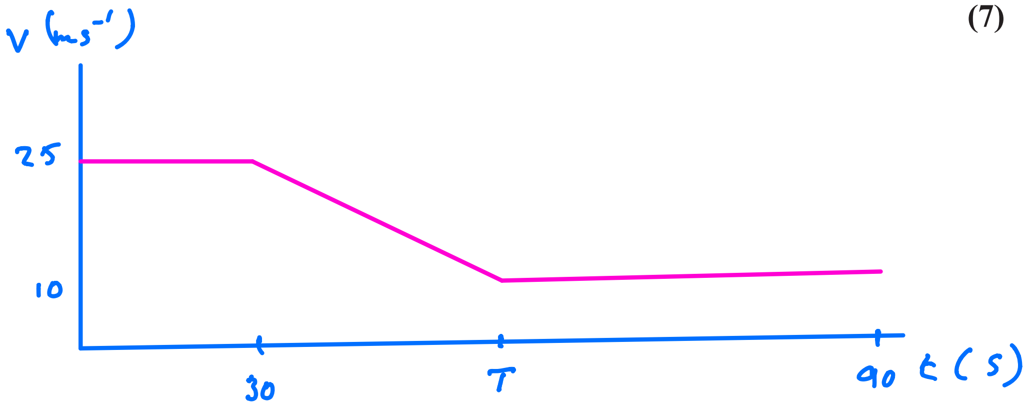
Leave blank

4. A car is moving along a straight horizontal road. The speed of the car as it passes the point A is 25 m s^{-1} and the car maintains this speed for 30 s. The car then decelerates uniformly to a speed of 10 m s^{-1}. The speed of 10 m s^{-1} is then maintained until the car passes the point B. The time taken to travel from A to B is 90 s and AB = 1410 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 m s^{-1} to 10 m s^{-1}.
(7)

a)



b)

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

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

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

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

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

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

Decelerates at 1.875 ms^{-2}

H 2 9 4 9 2 A 0 8 2 4

Leave blank

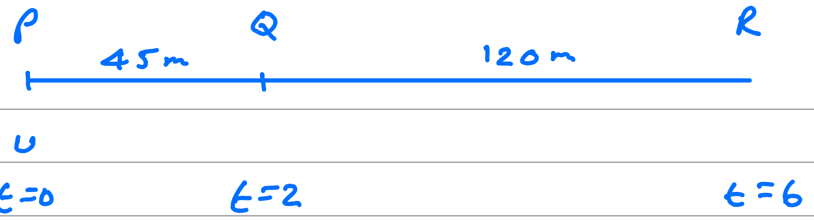
1. Three posts P, Q and R, are fixed in that order at the side of a straight horizontal road. The distance from P to Q is 45 m and the distance from Q to R is 120 m. A car is moving along the road with constant acceleration a m s^{-2}. The speed of the car, as it passes P, is u m s^{-1}. The car passes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

(7)

i)



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

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

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

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

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

Solve (1) and (2) by calc

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

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

N 3 4 2 7 5 A 0 2 2 4

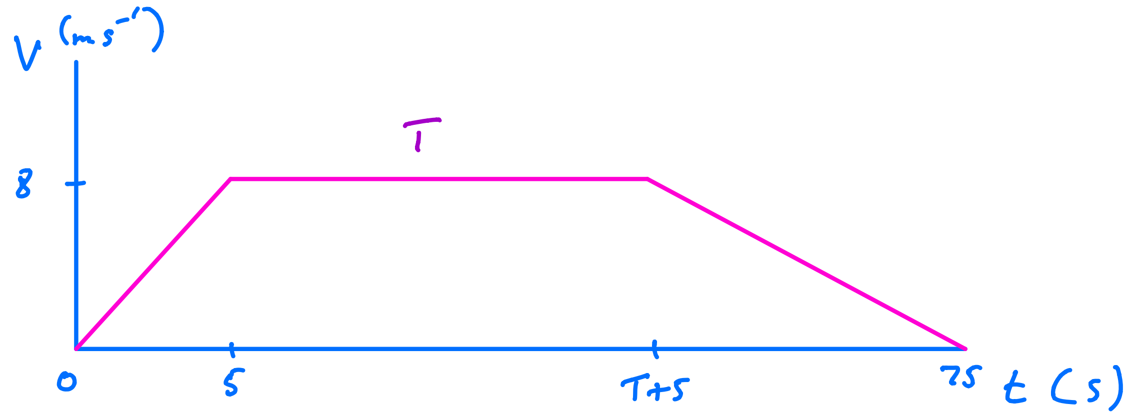
Leave blank

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)

a)



b)

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

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

$125 = T + 75$

$125 - 75 = T$

$50 = T$

$T = 50\text{ s}$

Leave blank

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 m s^{-1}. At time $t = 0$, P overtakes Q which is moving with constant speed 20 m s^{-1}. From $t = T$ seconds, P decelerates uniformly, coming to rest at a point X which is 800 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.

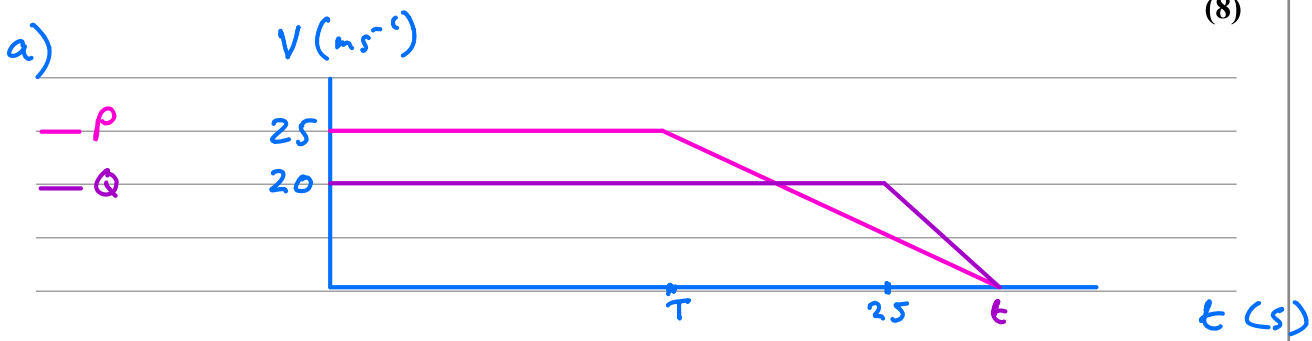
(a) Sketch, on the same axes, the speed-time graphs of the two cars for the period from $t = 0$ to the time when they both come to rest at the point X.

(4)

(b) Find the value of T.

(8)

a)



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

$250 + 10t = 800$

$10t = 550$

$t = 55\text{ s}$

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

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

$55 + T = 64$

$T = 64 - 55$

$T = 9\text{ s}$

N 3 5 3 9 0 A 0 1 2 2 8