

## Homework 2

- 1) A ball is projected vertically from ground level. The ball attains a maximum height of 49 metres before returning to the ground.

Assuming only the action of gravity, calculate the time of flight of the ball.

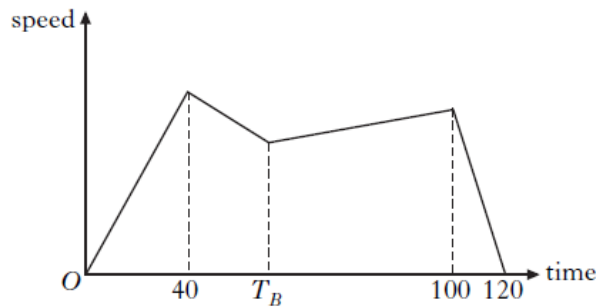
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- 2) An athlete runs a 200 metre race, along a straight horizontal track, in 30 seconds. She accelerates uniformly from rest for 4 seconds, reaching a maximum speed of  $V \text{ m s}^{-1}$ . She runs at this speed for 24 seconds before decelerating uniformly for the final 2 seconds, finishing the race with speed  $(V - 6) \text{ m s}^{-1}$ .

Sketch the speed-time graph for the race and calculate the value of  $V$ .

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- 3) The speed-time graph of the motion of a car as it travels along a straight road is shown below. The car accelerates from  $O$  and passes markers on the road at  $A$ ,  $B$ ,  $C$  before stopping at  $D$  after 120 seconds. The car passes  $A$  after 40 seconds,  $B$  after  $T_B$  seconds, and  $C$  after 100 seconds.



The speed of the car between  $A$  and  $B$  is given by  $v_1(t) = -\frac{1}{2}t + 45$  ( $40 \leq t \leq T_B$ ) and between  $B$  and  $C$  by  $v_2(t) = \frac{1}{8}t + \frac{15}{2}$  ( $T_B \leq t \leq 100$ ), where the speed is measured in metres per second and time  $t$  is measured in seconds from the beginning of the motion.

- (a) Calculate the speed of the car at  $B$ .

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- (b) Calculate the distance between  $B$  and  $D$ .

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- 4)** . A sprinter competes in a 100 metre race along a straight track.  
He starts from rest and for the first 4 seconds he has speed  $\left(\frac{13}{2}t - t^2\right) \text{ m s}^{-1}$ . For the next 6 seconds he maintains a constant speed of  $10 \text{ m s}^{-1}$  before decelerating at  $0.4 \text{ m s}^{-2}$  for the remainder of the race.  
Calculate the total time taken by the sprinter to complete the race. **6**

- 5)** An aircraft is flying from airport A to airport B, which is 500 kilometres from A on a bearing of  $100^\circ$ . A wind, with speed 70 kilometres per hour, is blowing from the south throughout the flight. The speed of the aircraft in still air is 350 kilometres per hour.

a) Calculate the bearing on which the aircraft should fly to reach B **3**

b) Calculate the time of the flight to the nearest minute. **3**