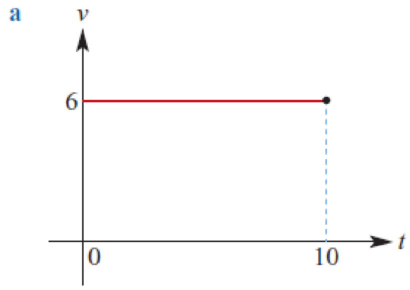
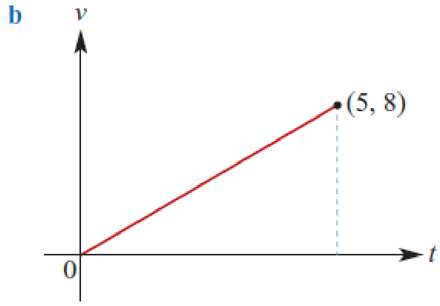
Each of the following graphs describes the motion of a particle. For each of them:
i describe the motion **ii** find the distance travelled (d) **iii** displacement (s)
Velocity is measured in m/s and time in seconds.

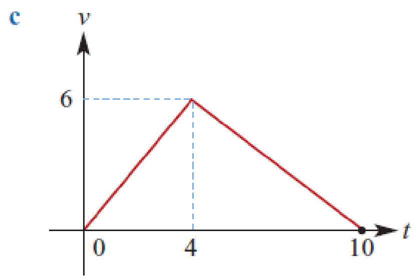


The particle travels with constant velocity of 6 m/s for 10 seconds.
Distance = displacement = area under curve = 6x10 = 60 m



The particle accelerates uniformly for 5 seconds by which time it has reached 8 m/s.

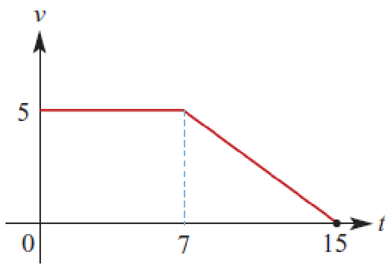
$$d = s = \frac{1}{2} \times 5 \times 8 = 20\ m$$



The particle accelerates uniformly for 4 seconds by which time it has reached 6 m/s. It then decelerates uniformly until it comes to rest after 10 seconds.

$$d = s = \frac{1}{2} \times 10 \times 6 = 30\ m$$

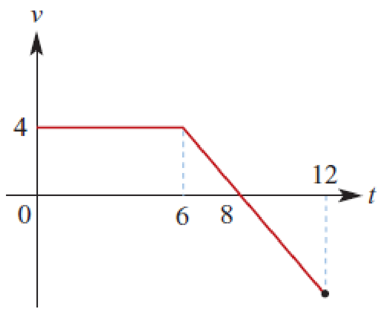
d



The particle travels with constant velocity of 5 m/s for 7 seconds. It then decelerates uniformly until it comes to rest after 15 seconds.

$$d = s = \frac{7 + 15}{2} \times 5 = 55\, m$$

e



The particle travels with constant velocity of 4 m/s for 6 seconds. It then decelerates uniformly until it comes to rest after 8 seconds before changing direction and continuing to accelerate uniformly in the negative direction for a further 4 seconds.

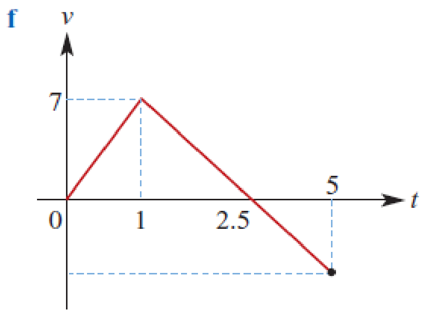
$In\ first\ 8\ seconds\ d = \frac{6 + 8}{2} \times 4 = 28\, m.$

$To\ find\ area\ of\ the\ triangle\ we\ first\ need\ find\ acceleration.$

$a = \frac{0 - 4}{2} = -2\, m\, s^{-2}. Then\ final\ velocity\ v = 0 - 2 \times 4 = -8\, m\, s^{-1}.$

$So\ area\ of\ the\ triangle = \frac{1}{2} \times 4 \times 8 = 16\, m. So\ d = 28 + 16 = 44\, m,$

$s = 28 - 16 = 8\, m$



The particle accelerates uniformly for 1 second by which time it has reached 7 m/s. It then decelerates uniformly until it comes to rest after 2.5 seconds before changing direction and continuing to accelerate uniformly in the negative direction for a further 2.5 seconds.

$In\ first\ 2.5\ seconds\ d = \frac{1}{2} \times 2.5 \times 7 = 8.75\ m.$

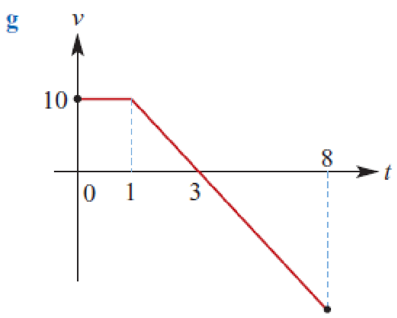
$To\ find\ area\ of\ the\ second\ triangle\ we\ first\ need\ find\ acceleration.$

$a = \frac{0-7}{1.5} = -4.7\ m\,s^{-2}. Final\ velocity\ v = 0 - 4.7 \times 2.5 = -11.75\ m\,s^{-1}.$

$So\ area\ of\ the\ triangle = \frac{1}{2} \times 2.5 \times 11.75 = 14.69\ m.$

$So\ d = 8.75 + 14.69 = 23.44\ m,$

$s = 8.75 - 14.69 = -5.94\ m$



The particle travels with constant velocity of 10 m/s for 1 second. It then decelerates uniformly until it comes to rest after 3 seconds before changing direction and continuing to accelerate uniformly in the negative direction for a further 5 seconds.

$In\ first\ 3\ seconds\ d = \frac{1+3}{2} \times 10 = 20\ m.$

$To\ find\ area\ of\ the\ triangle\ we\ first\ need\ find\ acceleration.$

$a = \frac{0-10}{2} = -5\ m\,s^{-2}.$

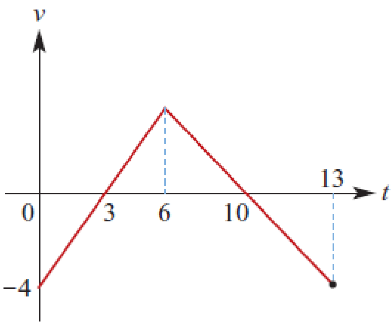
$Final\ velocity\ v = 0 - 5 \times 5 = -25\ m\,s^{-1}.$

$So\ area\ of\ the\ triangle = \frac{1}{2} \times 5 \times 25 = 62.5\ m.$

$So\ d = 20 + 62.5 = 82.5\ m,$

$s = 20 - 62.5 = -42.5\ m$

h



An object starting at –4 m/s slows down uniformly until it comes to rest after 3 seconds before changing direction and continuing to accelerate uniformly for a further 3 seconds. The particle then decelerates uniformly until it comes to rest after further 4 seconds before changing direction and continuing to accelerate uniformly in the negative direction for a further 3 seconds.

$In\ first\ 3\ seconds\ d = \frac{1}{2} \times 3 \times 4 = 6\ m$

$To\ find\ area\ of\ the\ second\ triangle\ we\ first\ need\ find\ acceleration.$

$a = \frac{0-(-4)}{3} = \frac{4}{3}\ m\ s^{-2}.$

$Velocity\ at\ 6\ seconds\ v = 0 + \frac{4}{3} \times 3 = 4\ m\ s^{-1}.$

$Area\ of\ the\ second\ triangle = \frac{1}{2} \times 7 \times 4 = 14\ m.$

$To\ find\ area\ of\ the\ third\ triangle\ we\ first\ need\ find\ acceleration.$

$a = \frac{0-4}{4} = -1\ m\ s^{-2}.$

$Final\ velocity\ v = 0 - 1 \times 3 = -3\ m\ s^{-1}.$

$Area\ of\ the\ third\ triangle = \frac{1}{2} \times 3 \times 3 = 4.5\ m.$

$So\ d = 6 + 14 + 4.5 = 24.5\ m,$

$s = -6 + 14 - 4.5 = 3.5\ m$