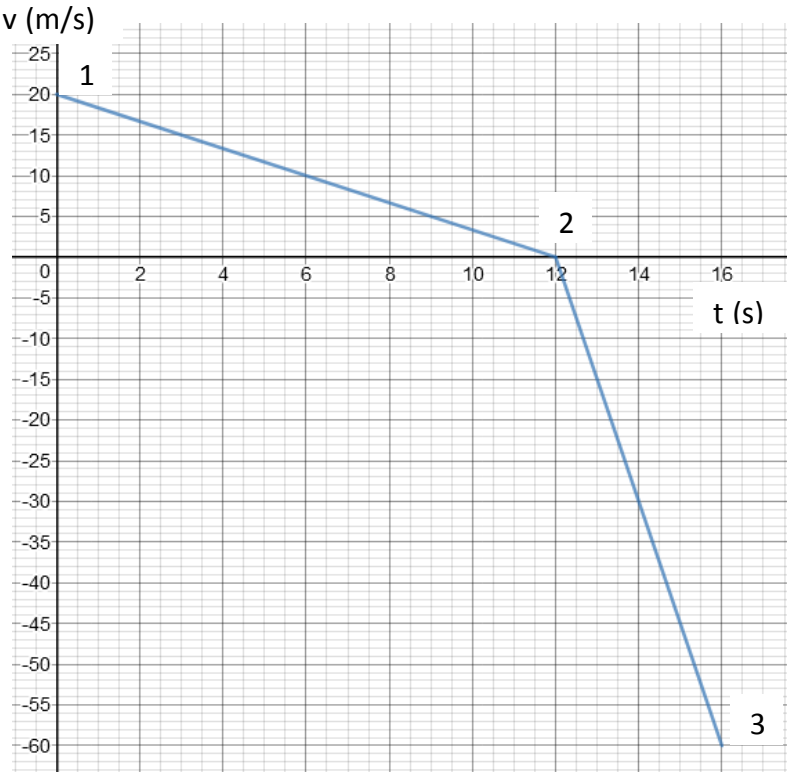
Answer on Question 72732, Physics / Mechanics | Relativity

Question

A car decelerates uniformly from 20ms to rest in 12seconds, then reverses with uniform acceleration to its original starting point also in 4seconds.

a.Draw a v-t graph

Solution.



At initial time, $t = 0\ \text{s}$, the velocity is $v = 12\ \text{m/s}$. Put the point 1 on the graph that corresponds to these values. In $t = 12\ \text{s}$ the velocity is $v = 0\ \text{m/s}$. Put the point 2 on the graph that corresponds to these values. Since a car decelerates uniformly draw a line 1-2. The area between the line and the time axis on a velocity-time graph, between two times is the displacement change Δx during that time interval. We find that

$$\Delta x = \frac{1}{2} \cdot 20\ \text{m/s} \cdot 12\ \text{s} = 120\ \text{m}$$

After stopping the car moves in opposite direction to the same distance in 4 seconds with uniform acceleration to its original starting point. So we can find the velocity at its original starting point from the equation

$$\Delta x = \frac{1}{2} \cdot v\ \text{m/s} \cdot 4\ \text{s} = -120\ \text{m}$$

The minus sign means that the displacement occurs in the opposite direction. Solving this equation we get $v = -60\ \text{m/s}$. Put the point 3 on the graph that corresponds to $t = 12 + 4 = 16\ \text{s}$ and $v = -60\ \text{m/s}$. Then draw a line 2-3.