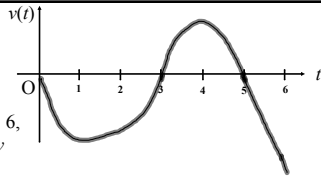


AP Test Question  
2008  
No Calculator Allowed

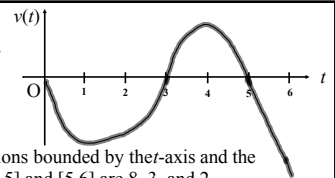


4) A particle moves along the  $x$ -axis so that its velocity at time  $t$ , for  $0 \leq t \leq 6$ , is given by a differentiable function whose graph is shown above. The velocity is 0 at  $t = 0$ ,  $t = 3$ , and  $t = 5$ , and the graph has horizontal tangents at  $t = 1$  and  $t = 4$ . The areas of the regions bounded by the  $t$ -axis and the graph of  $v$  on the intervals  $[0,3]$ ,  $[3,5]$  and  $[5,6]$  are 8, 3, and 2, respectively. At time  $t = 0$ , the particle is at  $x = -2$ .

a) For  $0 \leq t \leq 6$ , find both the time and the position of the particle when the particle is farthest to the left. Justify your answer.

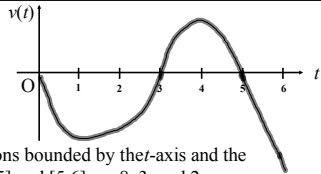
**At  $t = 3$  sec, the particle is farthest to the left at position  $x = -10$ .**

A particle moves along the  $x$ -axis so that its velocity at time  $t$ , for  $0 \leq t \leq 6$ , is given by a differentiable function whose graph is shown above. The velocity is 0 at  $t = 0$ ,  $t = 3$ , and  $t = 5$ , and the graph has horizontal tangents at  $t = 1$  and  $t = 4$ . The areas of the regions bounded by the  $t$ -axis and the graph of  $v$  on the intervals  $[0,3]$ ,  $[3,5]$  and  $[5,6]$  are 8, 3, and 2, respectively. At time  $t = 0$ , the particle is at  $x = -2$ .



b) For how many values of  $t$ , where  $0 \leq t \leq 6$ , is the particle at  $x = -8$ ? Explain your reasoning. **3**

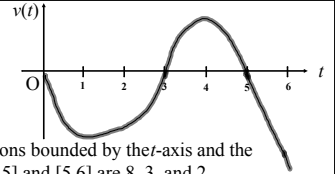
A particle moves along the  $x$ -axis so that its velocity at time  $t$ , for  $0 \leq t \leq 6$ , is given by a differentiable function whose graph is shown above. The velocity is 0 at  $t = 0$ ,  $t = 3$ , and  $t = 5$ , and the graph has horizontal tangents at  $t = 1$  and  $t = 4$ . The areas of the regions bounded by the  $t$ -axis and the graph of  $v$  on the intervals  $[0,3]$ ,  $[3,5]$  and  $[5,6]$  are 8, 3, and 2, respectively. At time  $t = 0$ , the particle is at  $x = -2$ .



c) On the interval  $2 < t < 3$ , is the speed of the particle increasing or decreasing? Give a reason for your answer.

**The speed is decreasing because  $\lim_{t \rightarrow 3} |v(t)| = 0$**

A particle moves along the  $x$ -axis so that its velocity at time  $t$ , for  $0 \leq t \leq 6$ , is given by a differentiable function whose graph is shown above. The velocity is 0 at  $t = 0$ ,  $t = 3$ , and  $t = 5$ , and the graph has horizontal tangents at  $t = 1$  and  $t = 4$ . The areas of the regions bounded by the  $t$ -axis and the graph of  $v$  on the intervals  $[0,3]$ ,  $[3,5]$  and  $[5,6]$  are 8, 3, and 2, respectively. At time  $t = 0$ , the particle is at  $x = -2$ .



d) During what time intervals, if any, is the acceleration of the particle negative? Justify your answer.

**$a(t) = v'(t)$   
 $a(t) < 0$  for  $t \in (0,1)$  and  $t \in (4,6)$  since the slope of the tangent is negative.**