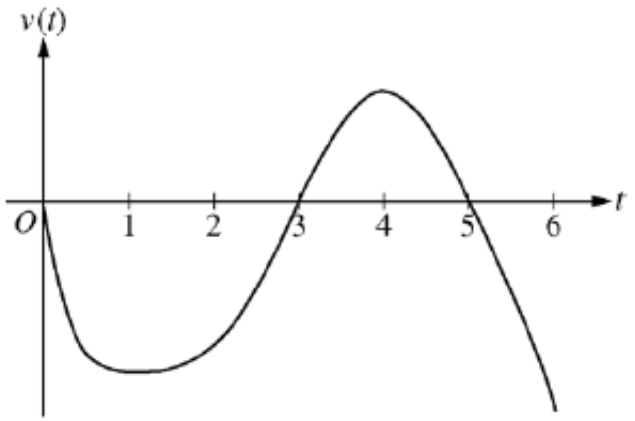
AP Calculus: Motion on a Line

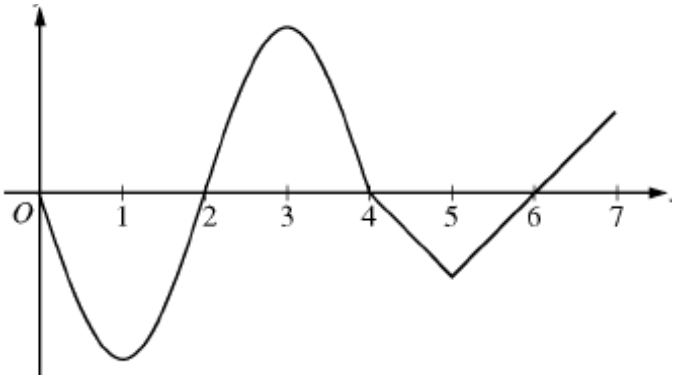
A particle moves along the x-axis so that its velocity at time t for [0, 6] is given by v(t) whose graph is shown below. Justify each answer.



Graph of v

1) State the value(s) of t where the particle is at rest.
2) State the value(s) of t where the particle is changing direction.
3) State the interval(s) where the particle is moving to the right.
4) State the interval(s) where the particle is moving to the left.
5) State the interval(s) where the particle is slowing down.
6) State the interval(s) where the particle is speeding up.
7) State the interval(s) where the **velocity** is increasing.
8) State the interval(s) where the **velocity** is decreasing.

A particle moves along the x-axis so that its velocity at time t for [0, 7] is given by v(t) whose graph is shown below. Justify each answer.



Graph of v(t)

9) State the value(s) of t where the particle is at rest.
10) State the value(s) of t where the particle is changing direction.
11) State the interval(s) where the particle is moving to the right.
12) State the interval(s) where the particle is moving to the left.
13) State the interval(s) where the particle is slowing down.
14) State the interval(s) where the particle is speeding up.
15) State the interval(s) where the **velocity** is increasing.
16) State the interval(s) where the **velocity** is decreasing.

Answers

1 $t = 0, 3, 5$; $v(t) = 0$ at these times
2 $t = 3, 5$; $v(t) = 0$ at these times and $v(t)$ changes signs at these times
3 $(3, 5)$; $v(t) > 0$ on this interval
4 $(0, 3)$ and $(5, 6)$; $v(t) < 0$ on these intervals
5 $(1, 3)$ and $(4, 5)$; $v(t)$ and the slope of $v(t)$ have opposite signs
6 $(0, 1)$ and $(3, 4)$ and $(5, 6)$; $v(t)$ and the slope of $v(t)$ have the same signs
7 $(1, 4)$; the slope of $v(t)$ is positive
8 $(0, 1)$ and $(4, 6)$; the slope of $v(t)$ is negative

9 $t = 0, 2, 4, 6$; $v(t) = 0$ at these times
10 $t = 2, 4, 6$; $v(t) = 0$ at these times and $v(t)$ changes signs at these times
11 $(2, 4)$ and $(6, 7)$ $v(t) > 0$ on this interval
12 $(0, 2)$ and $(4, 6)$; $v(t) < 0$ on these intervals
13 $(1, 2)$ and $(3, 4)$ and $(5, 6)$; $v(t)$ and the slope of $v(t)$ have opposite signs
14 $(0, 1)$ and $(2, 3)$ and $(4, 5)$ and $(6, 7)$; $v(t)$ and the slope of $v(t)$ have the same signs
15 $(1, 3)$ and $(5, 7)$; the slope of $v(t)$ is positive
16 $(0, 1)$ and $(3, 5)$; the slope of $v(t)$ is negative