

- 1) A particle travels along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = t^3 - 9t^2 + 24t + 2$. For what value(s) of t is the velocity equal to zero?
 A) $t = 4$, only
 B) $t = 2$, only
 C) $t = 0$ and $t = 3$
 D) $t = 3$, only
 E) $t = 2$ and $t = 4$

Find when $v(t) = 0$.
 $v(t) = 3t^2 - 18t + 24 = 0$

$$3(t^2 - 6t + 8) = 0$$

$$3(t-4)(t-2) = 0$$

$$t = 2, 4$$

- 2) A particle moves on the x-axis so that its position is given by $x(t) = t^4 - 6t^2 + 8$ for $t \geq 0$. For what times t is the velocity of the particle increasing?
 A) $t > 0$
 B) $0 < t < \sqrt{3}$
 C) $t > \sqrt{3}$
 D) $0 < t < 1$
 E) $1 < t < \sqrt{3}$

when is slope of $v(t)$ positive?
 when is $a(t) > 0$?

$$v(t) = 4t^3 - 12t$$

$$a(t) = 12t^2 - 12 = 0$$

$$t = 1$$

Best Answer



- 3) The position of a particle moving on a horizontal axis for time t , where $t \geq 0$, is $S(t) = 3t^3 - 4t$. What is the average velocity of the particle for $0 \leq t \leq 2$?

- A) 2
 B) 6
 C) 8
 D) 10
 E) 14

Average velocity is the average rate of change of $s(t)$.

Average rate of change of $s(t)$ is

$$\frac{s(2) - s(0)}{2 - 0}$$

$$= \frac{16 - 0}{2 - 0} = 8$$

- 4) What is the maximum acceleration of a particle on the interval $0 \leq t \leq 3$ if its position is given by

$$s(t) = t^4 - 4t^3$$

$$v(t) = 4t^3 - 12t^2$$

$$a(t) = 12t^2 - 24t$$

$$a'(t) = 24t - 24 = 0$$

$$t = 1$$

t	a(t)
0	0
1	-12
3	-18

- 5) The table below shows the position of a particle, S , at various times, t , as it moves along a straight line.

t (sec)	1.0	1.4	1.8	2.2	2.6
s (ft)	6.0	7.0	10.0	15.0	21.0

What is an estimated value of the velocity of the particle at time $t = 2$? what is estimated slope of $s(t)$ at $t = 2$?

- A) 15 ft/sec
 B) 12.5 ft/sec
 C) 20 ft/sec
 D) 10 ft/sec
 E) 5 ft/sec

$$\frac{s(2.2) - s(1.8)}{2.2 - 1.8} = \frac{15 - 10}{2.2 - 1.8}$$

$$= \frac{5}{.4} = 12.5$$

- 6) If the position of a particle moving on the x-axis at any time t is given by $x(t) = 2t^3 - 3t^2$, what is the average acceleration of the particle for $0 \leq t \leq 3$?

- A) 15
 B) 18
 C) 8
 D) 9
 E) 12

Similar to #4.

Average acceleration is the average rate of change of $v(t)$.

Average rate of change of $v(t)$ is

$$\frac{v(3) - v(0)}{3 - 0} = 12$$

- 7) A particle moves along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = 3t^4 + 3t^2 - 8$. What is the acceleration of the particle at time $t = 1$? Find $a(1)$.

- A) 10
 B) 36
 C) 40
 D) 42
 E) 50

$$v(t) = 12t^3 + 6t$$

$$a(t) = 36t^2 + 6$$

$$a(1) = 42$$

Note: Maximum position occurs when $v(t)$ changes signs or at an endpoint.
 Maximum velocity occurs when $a(t)$ changes signs or at an endpoint.
 Maximum acceleration occurs when $a'(t)$ changes signs or at an endpoint.