

AP Calculus AB

ws 85 - Particle Motion

1) $s(t) = -t^3 + 7t^2 - 14t + 8$

a) $v(t) = -3t^2 + 14t - 14$

b) $v(4) = -6 \text{ m/sec}$

At $t=4$, the particle is moving to the left.

c) $\frac{s(12) - s(0)}{12 - 0} = \frac{-880 - (8)}{12} = -74 \text{ m/sec}$

d) At rest, $v(t) = 0$

$-3t^2 + 14t - 14 > 0$

$3t^2 - 14t + 14 < 0$

$$t = \frac{14 \pm \sqrt{(-14)^2 - 4(3)(14)}}{6}$$

$t = 3.215 \text{ sec}$

$t = 1.451 \text{ sec}$

3) $s(t) = t^2 - 5t - 8$

displacement $\rightarrow \Delta$ in position

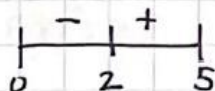
$s(7) - s(1) = 6 - (-12) = 18$

At $t=7$, the particle is 18 units to the right of where it was at $t=1$.

6) $v(t) = t^2 - 4$ on $[0, 5]$

$t^2 - 4 = 0$

$t = 2$



Since $v(t)$ Δ s signs at $t=2$, the particle Δ s directions

2) $h(t) = 3 + 135t - 16t^2$

speed up or slow down?

check sign of $v(t)$ & $a(t)$.

$v(t) = 135 - 32t$

$v(3) = 135 - 32(3) = 39 > 0$

$a(t) = -35 < 0$

Since $v(3)$ & $a(3)$ have opposite signs, the object is slowing down at $t=3$.

4) $v(2.3) = s'(2.3)$

From a table:

$$\begin{aligned} v(2.3) &\approx \frac{s(2.5) - s(2.0)}{2.5 - 2.0} \\ &= \frac{-4 - (-8.5)}{0.5} \frac{\text{ft}}{\text{sec}} \\ &= 4.5/0.5 = 9 \text{ ft/sec} \end{aligned}$$

7) $v(t) = 2t^3 - 9t^2 + 12t - 5$

Find $|v(t)|$ when $\underline{a(t) = 0}$

$a(t) = 6t^2 - 18t + 12 = 0$

$t^2 - 3t + 2 = 0$

$(t-1)(t-2) = 0$

$t=1 \quad t=2$

$|v(1)| = |2 - 9 + 12 - 5| = 0 \text{ m/sec}$

$|v(2)| = |16 - 24 + 24 - 5| = 11 \text{ m/sec}$

8) $s(t) = t^3 + 3t$

v is decreasing when $a(t) < 0$

$$v(t) = 3t^2 + 3$$

$$a(t) = 6t = 0$$

$$t = 0$$

$\xleftarrow{-} \overset{+}{\xrightarrow{}}$
 $a(t)$
 0

The velocity of the particle is decreasing on $(-\infty, 0)$ b/c $a(t) < 0$

9)

a) decreasing

b) negative

c) decreasing

d) negative

e) decreasing

f) positive