AP Calculus AB

Friday, October 19, 2012

Fill in this chart (it's on page 76 in your packet) to describe a particle's motion in each situation.

	$a(t) > 0$	$a(t) < 0$	$a(t) = 0$
$v(t) > 0$	RT / ACCL.	RT / slowing down	RT / constant spd.
$v(t) < 0$	left / slowing down	left / spd up	left @ const. spd.
$v(t) = 0$	stopped (changing directions)	stopped	stopped

4. $s(t) = t + \frac{9}{t+1} + 1$

$v(t) = 1 + \frac{(t+1)(0) - 9(1)}{(t+1)^2} + 0$

$v(t) = 1 + \frac{-9}{(t+1)^2}$

$\frac{-9}{(t+1)^2} = -9(t+1)^{-2}$

$a(t) = 0 + 18(t+1)^{-3} \cdot 1$

$a(t) = \frac{18}{(t+1)^3}$

Determine when v(t) = 0 and where v(t) is positive & negative.

$v(t) = 1 + \frac{-9}{(t+1)^2}$

$1 + \frac{-9}{(t+1)^2} = 0$

$\frac{9}{(t+1)^2} = 1$

$(t+1)^2 = 9$

$t+1 = 3$ $\quad t+1 = -3$

$t = 2$ $\quad t = -4$ ignore bc $t > 0$

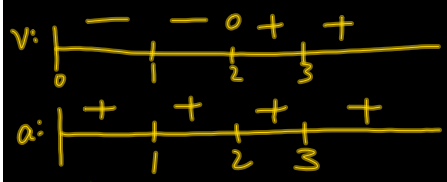
$t = -1$ → ignore bc $t > 0$ makes denom. 0 ∴ $v(t)$ undef.

analyze $a(t)$

$a(t) = \frac{18}{(t+1)^3}$

$\frac{18}{(t+1)^3} = 0$

For $t > 0$, $a(t)$ never $= 0$. $a(t) > 0$.



$0 < t < 2$: $v(t) < 0$ ∴ particle is moving to left

$a(t) > 0$ and $v(t) < 0$ particle is slowing down

At $t = 2$, the $v(t) = 0$.

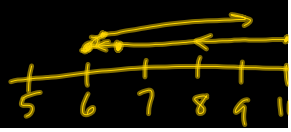
On $t > 2$, $v(t) > 0$ & $a(t) > 0$ ∴ particle is moving to right & speeding up

$s(t) = t + \frac{9}{t+1} + 1$

$s(0) = 0 + 9 + 1 = 10$

$s(1) = 1 + \frac{9}{2} + 1 = \frac{13}{2}$

$s(2) = 2 + 3 + 1 = 6$



Example 3) A particle is moving along a horizontal line with position function $s(t) = t^3 - 9t^2 + 24t + 4$. Do an analysis of the particle's direction, acceleration, motion (speeding up or slowing down), and position

$v(t) = 3t^2 - 18t + 24$

$3t^2 - 18t + 24 = 0$

$t^2 - 6t + 8 = 0$

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

@ $t=4$ & $t=2$ the velocity is zero.

$a(t) = 6t - 18$

$6t - 18 = 0$

$t = 3$

When $t=3$, $a(3) = 0$.

$a(t) = 6t - 18$

$v(t) = 3t^2 - 18t + 24$

$v(1) = 3 - 18 + 24$

$v(3) = 27 - 54 + 24$

$v(5) = 25 - 90 + 24$

From $0 < t < 2$, $v(t) > 0$ and $a(t) < 0$. ∴ the particle is moving to the right & slowing down.

From $2 < t < 3$, $v(t) < 0$ and $a(t) < 0$. ∴ the particle is moving left & speeding up.

From $3 < t < 4$, $v(t) < 0$ and $a(t) > 0$ ∴ the particle is moving left & slowing down.

On $t > 4$, $v(t) > 0$ & $a(t) > 0$ ∴ the particle is speeding up & moving to the right.

Make a position graph

$s(t) = t^3 - 9t^2 + 24t + 4$

$s(0) = 4$

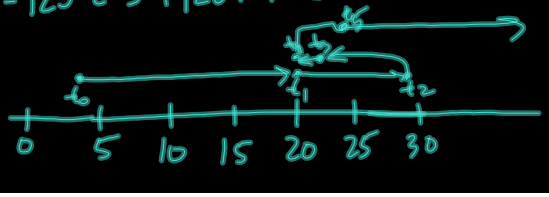
$s(1) = 1 - 9 + 24 + 4 = 20$

$s(2) = 8 - 36 + 48 + 4 = 28$

$s(3) = 27 - 81 + 72 + 4 = 22$

$s(4) = 64 - 144 + 96 + 4 = 20$

$s(5) = 125 - 225 + 120 + 4 = 24$



$$s(t) = -16t^2 + v_0 t + s_0,$$

$$d(t) = -9.8t^2 + v_0 t + s_0$$

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