

# Position, Velocity, Acceleration -

An object moves along a line according to the function  $x(t)$  or  $s(t) = 3t^4 - 16t^3 + 30t^2 - 24t + 1$   
 $t \geq 0$ .

1. Where is object at  $t = 0, 1, 2, 3, 4$ ?

Make Table - copy answers

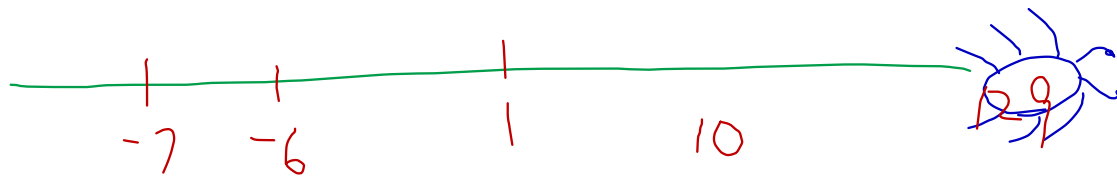
$$x(0) = 1$$

$$x(1) = -6$$

$$x(2) = -7$$

$$x(3) = 10$$

$$x(4) = 129$$



2. Write velocity function

$$v(t) = x'(t) = 12t^3 - 48t^2 + 60t - 24$$

Velocity is derivative of position function,  $x(t)$  or  $s(t)$ .

3. When is object at rest (stopped)?

Find when  $v(t) = 0$ .

Use calc, graph  $v(t)$ , find hor axis intercepts.

$$v(t) = 0 \text{ if } t = 1, 2$$

4. When is object moving left/right? Justify!



Left  $\Rightarrow v(t) < 0$

Moves left  $[0, 1), (1, 2)$  b/c  $v(t) < 0$ .

Right  $\Rightarrow v(t) > 0$

Moves right  $(2, \infty)$  b/c  $v(t) > 0$

5. What is  $v(.5)$ ?

$v(.5) = -4.5$  from calc.

6. What is "speed" at  $t = .5$ ?

Speed =  $|v(t)|$

Speed =  $|-4.5| = 4.5$

7. Write formula for acceleration

$$a(t) = x''(t) = v'(t)$$

$$a(t) = 36t^2 - 96t + 60$$

8. Find  $a(.5)$

$$a(.5) = 21 \text{ from calc.}$$

9. At  $t = .5$  is object slowing down or speeding up?

Same sign for  $v(t)$  and  $a(t) \Rightarrow$  speed up.

Opposite signs for  $v(t)$  and  $a(t)$  slowing down.

Slowing down b/c opp signs for  $v(t)$  and  $a(t)$

10. How far did object travel between  $t=0$  and  $t=4$ ?

Add abs values of left and right distances.

$$\begin{array}{l} \text{start} \\ \rightarrow \end{array} \left. \begin{array}{l} x(0) = 1 \\ x(1) = -6 \\ x(2) = -7 \\ x(4) = 129 \end{array} \right\} \begin{array}{l} |1 - (-6)| = |7| = 7 \\ |-6 - (-7)| = |-6 + 7| = |1| = 1 \\ |-7 - 129| = |-136| = 136 \end{array}$$

---

144  
Total distance

Tues 11/10/09

Hand in

$$\text{Let } x(t) = t^3 - 6t^2 + 9t - 4, \quad t \geq 0$$

Respond to all 10 things from  
the example problem.