Place your name in this position → Key

AP Calculus AB: 5.3 Position, Velocity, Acceleration

1. A particle's position is given by the formula $s(t) = t^4 - 8t^2 + 9$ where $s(t)$ is measured in meters and t is measured in seconds for the interval $0 \le t \le 5$

a) Find the average velocity for the interval $1 \le t \le 2$

$\frac{s(2)-s(1)}{2-1} = \frac{-7-2}{1} =$ **$-9 \frac{\text{meters}}{\text{sec}}$**

b) Find the average acceleration from t=0 to t=2

$v(t) = 4t^3 - 16t$ $\quad \frac{v(2)-v(0)}{2-0} = \frac{0-0}{2} =$ **$0\ m/s^2$**

c) Find the instantaneous acceleration of the particle at t=3

$a(t) = 12t^2 - 16$ $\quad a(3) = 12(3)^2 - 16 =$ **$92\ m/s^2$**

d) Find when the velocity is equal to zero.

$4t^3 - 16t = 0$

$t(4t^2 - 16) = 0$

$t = 0 \quad 4t^2 - 16 = 0$

$4t^2 - 16 = 0$

$4t^2 = 16$

$t^2 = 4$

$t = \pm 2$

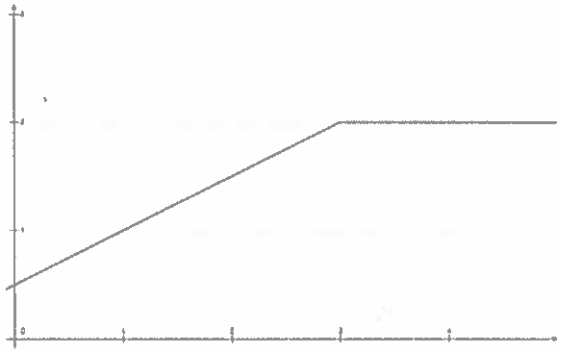
$t = 0, 2$ No negative 2

2. A particle's position is given by the function $x(t) = \ln(t^2) \cdot f(t)$, the graph to the right is a graph of $f(t)$. Where $x(t)$ is measured in meters and t is measured in seconds.

a) Find the average velocity for $1 \le t \le 4$

$\frac{x(4)-x(1)}{4-1} = \frac{\ln(16)(2) - \ln(1)(1)}{3}$

$\frac{2\ln(16)}{3}\ m/s$



b) Find the instantaneous velocity at t=1

$v(t) = f(t) \cdot \frac{2t}{t^2} + \ln(t^2) \cdot f'(t)$

$v(1) = (1)\frac{2(1)}{(1)^2} + \ln(1^2) \cdot (\frac{1}{2}) =$ **$2\ m/s$**

3. The table below gives a particle's velocity at given times. The function $v(t)$ is continuous and differentiable at all times.

t (sec)	0	2	5	6	9
v(t) (m/s)	3	7	8	5	10

a) How many times, if any, must $a(t)=0$? Justify.

$v'(t) = 0$ twice because of MVT and $v(t)$ is continuous and differentiable between $[5,6]$ and $[6,9]$

b) How many times, if any, must $v(t)=8$? Justify.

$v(t) = 8$ twice at $t=5$ and between $[6,9]$ because of IVT.