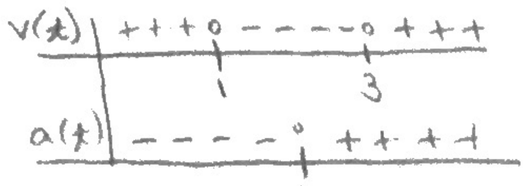
8) A particle moves along the x-axis so that is position at any time t is given by $x(t) = t^3 - 6t^2 + 9t + 12$. During what times is the speed of the particle increasing? when is particle speeding up?

A) $t < 1$ or $2 < t < 3$
(B) $1 < t < 2$ or $t > 3$
C) $t < 2$ or $t > 3$
D) $1 < t < 3$
E) $t < 1$ or $t > 3$

Find when $v(t)$ and $a(t)$ have the same signs.

$v(t) = 3t^2 - 12t + 9 = 0$
$3(t^2 - 4t + 3) = 0$
$3(t-3)(t-1) = 0$
$t = 1, 3$
$a(t) = 6t - 12 = 0$
$t = 2$



9) A particle moves along a coordinate line so that its position is given by $S(t) = (3x+4)^3$ for $0 \le t \le 10$. What is the acceleration of the particle at $t = 2$? Find $a(2)$.

(A) 540
B) 360
C) 54
D) -10
E) -50

$v(t) = 3(3x+4)^2(3) = 9(3x+4)^2$
$a(t) = 18(3x+4)(3) = 54(3x+4)$
$a(2) = 54(10) = 540$

10) A particle moves along the x-axis in such a way that its position at any time t is given by $x(t) = t^4 - 8t^3 + 18t^2 + 2$ for $t > 0$. At what time is acceleration of the particle equal to 36?

A) 3
(B) 4
C) 12
D) 6
E) 2

Find when $a(t) = 36$

$v(t) = 4t^3 - 24t^2 + 36t$
$a(t) = 12t^2 - 48t + 36 = 36$
$12t^2 - 48t = 0$
$12t(t-4) = 0$
$t = 0, 4$

11) A particle moves on the x-axis such that its position at any time $t > 0$ is given by $x(t) = t^3 - 9t^2 + 24t$. What is the velocity of the particle when its acceleration is zero?

A) 105
B) 24
(C) -3
D) 3
E) 0

Find time acceleration $= 0$.

$v(t) = 3t^2 - 18t + 24$
$a(t) = 6t - 18 = 0$
$t = 3$

$a(t) = 0$ when $t = 3$
so
$v(3) = -3$

12) A particle moves along a horizontal axis so that its position is defined by $S(t) = \frac{1}{12}t^4 - t^3 + 4t^2$ for $t \ge$
What is the velocity of the particle at the time its acceleration is first equal to zero?

A) -10
B) $\frac{1}{3}$
C) 0
(D) $\frac{20}{3}$
E) 7

Find time acceleration $= 0$.

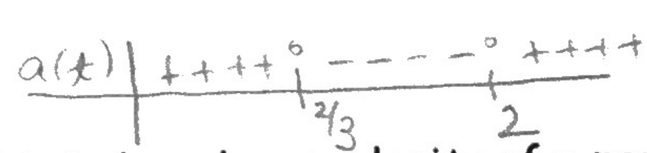
$v(t) = \frac{1}{3}t^3 - 3t^2 + 8t$
$a(t) = t^2 - 6t + 8 = 0$
$= (t-2)(t-4) = 0$ at $t = 2, 4$
$a(t) = 0$ first when $t = 2$.
Find $v(2)$
$v(2) = \frac{1}{3}(2)^3 - 3(2)^2 + 8(2) = \frac{20}{3}$

13) A particle moves along a horizontal coordinate line so that its position at time t, $0 \le t \le 4$ is given by $S(t) = t^4 - \frac{16}{3}t^3 + 8t^2 + 1$. For what times t is the velocity of the particle decreasing?

(A) $\frac{2}{3} < t < 2$
B) $t > \frac{2}{3}$
C) $0 < t < 2$
D) $0 < t < 4$
E) $2 < t < 4$

velocity of particle is decreasing when has a negative slope → when $a(t) <$

$v(t) = 4t^3 - 16t^2 + 16t$
$a(t) = 12t^2 - 32t + 16 = 0$
$4(3t^2 - 8t + 4) = 0$
$4(3t-2)(t-2) = 0$



14) The table below shows velocity of a particle at various times t of a particle that moves along a horizontal line.

t (sec)	0.5	1.0	1.5	2.0	2.5
v (m/sec)	8.3	9.2	9.8	10.6	11.0

What is an approximate value of the acceleration of the particle at time $t = 2$?

(A) 1.2 ft/sec^2
B) -0.8 ft/sec^2
C) 1.6 ft/sec^2
D) -1.6 ft/sec^2
E) 1.8 ft/sec^2

what is the approximate slope of $v(t)$ at $t =$

$\frac{\Delta v}{\Delta t} = \frac{v(2.5) - v(1.5)}{2.5 - 1.5} = 1.$