* $C(t)$ is a parabola, $v(t)$ is linear

The change in $n(t)$ is given by its derivative,

$$\frac{dn}{dt} = n'(t) = \frac{d}{dt}(c(t)v(t))$$

$$= c(t)\cdot\frac{dv}{dt} + v(t)\cdot\frac{dc}{dt} \qquad (c(t)v'(t) + v(t)c'(t))$$

$$= (4-t^2)(3) + (1+3t)(-2t)$$

$$\frac{d}{dt}(1+3t) = 3 \qquad \frac{d}{dt}(4-t^2) = -2t$$

So $n'(t) = 12 - 3t^2 - 2t - 6t^2$

$$= -9t^2 - 2t + 12$$

1) Since initially means $t=0$, $n'(0) = -9(0) - 2(0) + 12 > 0$

so <u>initially</u>, $n(t)$ is increasing.

2) A change in behavior can happen at a critical point, where $n'(t) = 0$. We have to solve

$-9t^2 - 2t + 12 = 0$ by the quadratic formula

$$t = \frac{2 \pm \sqrt{4 - 4(9)(12)}}{-18} = -\frac{1}{9} \pm \frac{\sqrt{109}}{9} \approx -1.27,\ +1.049$$

this one makes since since it is positive

the critical point is $t \approx 1.05$ sec