

7N #2 Instantaneous Rate
of change (The Derivative)

$$(a) V(0) = 4000 \text{ L}$$

$$V(20) = 4000 \left(1 - \frac{20}{60}\right)^2 = 1778 \text{ L}$$

$$(b) \frac{V(20) - V(0)}{20 - 0} = \frac{1778 - 4000}{20 - 0} = -111 \text{ L/min}$$

$$*(c) \frac{dV}{dt} = 8000 \left(1 - \frac{t}{60}\right) \left(-\frac{1}{60}\right)$$

\uparrow
 $-\frac{1}{60}t$

$$\left. \frac{dV}{dt} \right|_{t=20} = 8000 \left(1 - \frac{20}{60}\right) \left(-\frac{1}{60}\right) = -\underline{\underline{88.9}} \text{ L/min}$$

$$\left. \frac{dV}{dt} \right|_{t=0} = 8000 \left(1 - \frac{0}{60}\right) \left(-\frac{1}{60}\right) = -133 \text{ L/min}$$

$$(d) \frac{dv}{dt} = 8000 \left(1 - \frac{t}{60}\right) \left(-\frac{1}{60}\right) = 0$$

$$t = 60 \text{ min}$$



Ex. A ball is thrown upward so that its height is given by

$$h(t) = -16t^2 + \underline{60t} + 5$$

h in feet, t in seconds

initial height is $h(0) = 5$ ft.

(a) Find the initial velocity

$$\frac{dh}{dt} = v(t) = -32t + 60$$

$$v(0) = 60 \text{ ft/sec}$$

(b) Find the initial acceleration.

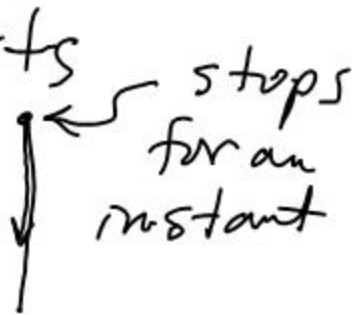
$$a(t) = \frac{dv}{dt} = -32 \frac{\text{ft}/\text{sec}}{\text{sec}}$$

(c) When does the ball reach its maximum height?

$$v(t) = -32t + 60 = 0$$

$$-32t = -60$$

$$t = \frac{60}{32} = \frac{15}{8} \text{ sec}$$



Ex. A particle is moving along the x-axis so that its displacement from the origin is given by

$$s(t) = t^3 - t^2 - t - 2$$

(a) Find the position at time $t=0$.

(b) Find the initial velocity

(c) When is the particle at rest? (if ever)

(d) Find the initial acceleration.

(a) $s'(0) = -2$

(b) $\frac{ds}{dt} = v(t) = 3t^2 - 2t - 1$

$v(0) = -1$ (moving left)

(c) $v(t) = 3t^2 - 2t - 1 = 0$

$$t = \frac{2 \pm \sqrt{4 + 12}}{6}$$

$$= \frac{2 \pm 4}{6} = 1 \text{ or } -\frac{1}{3}$$

(d) $a(t) = \frac{dv}{dt} = 6t - 2$

$a(0) = -2$ (force pulling to the left)

HW 7N # 3, 4; 7O # 2; 7P # 1, 2