

#2 (Cheetah Problem)

a) $x(t)$ = cheetah's position

$$\frac{dx}{dt} = kt + 2$$

b/c $\frac{dx}{dt} = 2$ @ $t = 0$ seconds

b) if speed = 100 km/hr, $\frac{dx}{dt} = 100$

we need to solve for "k" using information given

$$\frac{dx}{dt} = 42 \text{ at } t = \frac{1}{120}$$

$$42 = k\left(\frac{1}{120}\right) + 2$$

$$40 = \frac{k}{120} \Rightarrow k = 4800$$

$$\therefore \frac{dx}{dt} = 4800t + 2 = 100$$

$$100 = 4800t + 2$$

$$98 = 4800t$$

$$\boxed{0.02 \text{ hr} = t}$$

c) velocity = $\frac{dx}{dt} = 4800t + 2$

we ACTUALLY want position function $x(t)$
What function has derivative = $4800t + 2$?

$$\boxed{x(t) = 2400t^2 + 2t + C}$$

d) $x(0) = 0$

$t = 0.02$ hr when $\frac{dx}{dt} = 100$ km/hr

$$x(0.02) = 2400(0.02)^2 + 2(0.02) \\ = 1 \text{ km}$$

$$\text{distance travelled} = 1 \text{ km} - 0 = \boxed{1 \text{ km}}$$