

① a) At P, $y=0$

$$\therefore t(t+3)=0$$

$$\therefore t=0 \text{ or } t=-3$$

~~When~~ if $t=0$, $x=4$

if $t=-3$, $x=-5$

clearly $x > 0$ at P so $P(4,0)$

At Q, $x=0$

$$\therefore t-t^2=0$$

$$\therefore t = \pm 2$$

but $t \geq 0$ so $t=2$

$$\therefore y = 2(2+3) = 10$$

$$\therefore Q(0,10)$$

b)

$$A = \int y \, dx$$

← standard formula
you must learn this

$$= \int_2^0 t(t+3) \, dx$$

$$= \int_2^0 t(t+3) \frac{dx}{dt} \, dt$$

$$= \int_2^0 t(t+3)(-2t) \, dt$$

$$= - \int_2^0 (2t^3 + 6t^2) \, dt$$

$$= \int_0^2 (2t^3 + 6t^2) \, dt$$

$$c) = \left[\frac{1}{2}t^4 + 2t^3 \right]_0^2 = 8 + 16 = 24$$

$t=2$ at Q
 $t=0$ at P

$$x = t - t^2$$

$$\frac{dx}{dt} = -2t$$