1) a) $P(2) = 61$

$P'(2) = A(2) - L(2)$

$= -0.401 \rightarrow M$

$P(2.5) \approx 6 + M(2.5-2)$

$= 6.201$

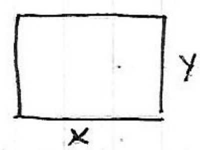
b) $P''(5) = A'(5) - L'(5)$

$= -0.679$

The rate of change of the number of people in the venue is decreasing at a rate of 0.679 hundreds of people per hour per hour.

c) If $P'(t)$ changes from neg to positive, then $A(t)-L(t)$ changes from neg. to pos.
This occurs at $t = 6.548$

d)



$x = 16 \quad \frac{dx}{dt} = 6$

$y = 10 \quad \frac{dy}{dt} = -3$

$A = xy \quad \frac{dA}{dt} = x\frac{dy}{dt} + y\frac{dx}{dt}$

$= -48 + 60$

$= 12 \text{ ft}^2/\text{sec}$

2) a) $w'(t) = \frac{1}{3}(t-4)$

$w'(7) = 1 \text{ ft/hour}$

At $t = 7$, the depth of water in the zoo aquarium is increasing at a rate of 1 ft/hour

b) $w(2) = \frac{32}{5}$

$w'(t) = -\frac{\pi}{10}\sin\left(\frac{\pi t}{4}\right)$

$w'(2) = -\frac{\pi}{10}$

$L(t) = \frac{32}{5} - \frac{\pi}{10}(t-2)$

$w(2.5) \approx \frac{32}{5} - \frac{\pi}{20} \geq 6$

c) $\lim_{t \to 2} \frac{w(t) - t^2 - \frac{12}{5}}{t-2} \rightarrow \frac{\frac{32}{5} - 4 - \frac{12}{5}}{0} \rightarrow \frac{0}{0}$

$\underline{\text{L'H}}$

$\lim_{t \to 2} \frac{w'(t) - 2t}{1} = w'(2) - 2t$

$= \boxed{-\frac{\pi}{10} - 4}$

3) a) $x_p(t) = \dfrac{e^{2-t} - 2t}{e^{2-t} + 3t}$

$$V_P(t) = \frac{(e^{2-t}+3t)(-e^{2-t}-2) - (e^{2-t}-2t)(-e^{2-t}+3)}{(e^{2-t}+3t)^2}$$

$$= \frac{-e^{4-2t} - 2e^{2-t} - 3te^{2-t} - 6t + e^{4-2t} - 3e^{2-t} - 2te^{2-t} + 6t}{(e^{2-t}+3t)^2}$$

$$= \frac{-5e^{2-t} - 5te^{2-t}}{(e^{2-t}+3t)^2}$$

b) $X_Q(2) = 5$ $\quad$ $x_p(2) = -\frac{2}{3} < x_Q(2)$

$V_P(2) = \dfrac{-5-10}{36} = -\dfrac{15}{36} < 0$ moving left

Particle P is moving away from Particle Q.

c) $V_Q(t) = 3t^2 - 6t$

$a_Q(t) = 6t - 6$

$a_Q(2) = 6$

d) $\lim\limits_{t\to\infty} x_p(t) = -\frac{2}{3}$ $\quad$ $\lim\limits_{t\to\infty} X_Q(t) = \infty$

Particle P will approach position $x = -\frac{2}{3}$

Particle Q's position is unbounded