1) Verify the integral

$$\int t^2 e^{-t/5}\,dt = \int f'(t)\,dt = f(t) =$$
$$= -5\left(t^2e^{-t/5} + 10te^{-t/5} + 50e^{-t/5}\right)$$

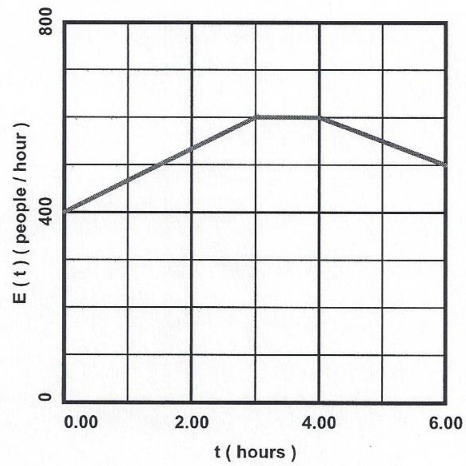
by differentiation.

$$f'(t) = -5\left[2te^{-t/5} + t^2 \cdot -\tfrac{1}{5}e^{-t/5} + 10\left(e^{-t/5} + t \cdot -\tfrac{1}{5}e^{-t/5}\right) + 50 \cdot -\tfrac{1}{5}e^{-t/5}\right] =$$

$$= -5\left[\cancel{2te^{-t/5}} - \tfrac{1}{5}t^2e^{-t/5} + \cancel{10e^{-t/5}} - \cancel{2te^{-t/5}} - \cancel{10e^{-t/5}}\right] =$$

$$= -5\left[-\tfrac{1}{5}t^2e^{-t/5}\right] = t^2e^{-t/5}$$

2) The graph of $E = E(t)$ shown



gives the number of people per hour that enter an amusement park from noon ($t = 0$) until 6:00pm ($t = 6$). During that same time period, the number of people leaving the park $L = L(t)$, in people per hour, is given by

$$L = 50\left(2 + t^2e^{-t/5}\right).$$

If at noon there were 3000 people in the park, how many are in the park at 6:00pm? You will need to use the integral from problem 1.

$P = P(t) \equiv$ number of people in the park.

$$P(6) = P(0) + \int_0^6 E(t)\,dt - \int_0^6 L(t)\,dt.$$

Use trapezoids and a rectangle...

$$\int_0^6 E(t)\,dt = \tfrac{1}{2}(400+600)(3) + (1)(600) + \tfrac{1}{2}(600+500)(2) = 1500 + 600 + 1100 = 3200$$

$$\int_0^6 L(t)\,dt = \left[100t - 250(t^2+10t+50)e^{-t/5}\right]_0^6 = 2106,41 = 2106.$$

$$P(6) = 3000 + 3200 - 2106 = 4094 \text{ people}$$