**Problem 1.23** The plot in Fig. P1.23 displays the cumulative amount of charge $q(t)$ that has exited a certain device up to time $t$. What is the current at:

(a) $t = 2$ s
(b) $t = 6$ s
(c) $t = 12$ s

![Graph showing cumulative charge $q(t)$ over time $t$.]

**Solution:**

(a) $i = 0 @ t = 2$ s (slope = 0 of first segment).
(b) $i = \frac{4 - 2}{8 - 4} = \frac{2}{4} = 0.5$ A (slope of second segment).
(c) $i = \frac{dq}{dt} = \frac{d}{dt} (4e^{-0.2(t-8)}) = 4e^{1.6} \frac{d}{dt} e^{-0.2t} = -4 \times 0.2e^{1.6}e^{-0.2t}$

$= -0.36$ A @ $t = 12$ s.
Problem 1.33  The voltage across a device and the current through it are shown graphically in Fig. P1.33. Sketch the corresponding power delivered to the device and calculate the energy absorbed by it.

Solution: For $0 \leq t \leq 1$ s,

$$p = vi = 5t \times 10 = 50t$$

For $1 \leq t \leq 2$ s,

$$p = vi = (10 - 5t) \times 5 = 50 - 25t.$$  

$$W = \int_0^2 p \, dt = \int_0^1 50t \, dt + \int_1^2 (50 - 25t) \, dt$$  

$$= \left. \frac{50t^2}{2} \right|_0^1 + \left. \left(50t - \frac{25t^2}{2}\right) \right|_1^2$$  

$$= 37.5 \text{ (J)}.$$