

Ex: Compute the power as a function of time consumed by a battery-powered device that draws the following current from a 1.5 volt battery.

- a) Compute the power as a function of time consumed by a battery-powered device that draws the following current from a 1.5 volt battery.

$$i(t) = 1 \text{ mA} + 2 \cos(2\pi t + 30^\circ) \text{ mA}$$

- b) Find the energy consumed by the device described in (a) in the first minute.
Note: Convert the 30° to radians before integrating.

SOL'N: a) Power is the product of voltage and current.

$$p(t) = i(t) \cdot 1.5V = 1.5 \text{ mW} + 3 \cos(2\pi t + 30^\circ) \text{ mW}$$

- b) Energy is the integral of power with respect to time. The product of power and time is energy (or work). The units for energy are Joules.

$$w(t = 60s) = \int_0^{60} p(t) dt = 90 \text{ mJ} + \frac{3 \sin(2\pi t + 30^\circ)}{2\pi} \Big|_0^{60} \text{ mJ} = 90 \text{ mJ}$$

NOTE: The integral of the $\cos()$ term is zero since the $\sin()$ function is evaluated at times where the total angles differ by an integer multiple of 2π and are, therefore, the same.