**Problem 7.2** Express the current waveform

\[ i(t) = -0.2 \cos(6\pi \times 10^9 t + 60^\circ) \text{ mA} \]

in standard cosine form and then determine the following:

(a) Its amplitude, frequency, and phase angle.
(b) \( i(t) \) at \( t = 0.1 \text{ ns} \).

**Solution:**

\[ i(t) = -0.2 \cos(6\pi \times 10^9 t + 60^\circ) \text{ (mA)} \]
\[ = 0.2 \cos(6\pi \times 10^9 t + 60^\circ - 180^\circ) \text{ (mA)} \]
\[ = 0.2 \cos(6\pi \times 10^9 t - 120^\circ) \text{ (mA)}. \]

(a) amplitude = 0.2 mA; \( f = 3 \times 10^9 \text{ Hz} = 3 \text{ GHz}; \phi = -120^\circ \).

(b) \[ i(0.1 \text{ ns}) = 0.2 \cos(6\pi \times 10^9 \times 0.1 \times 10^{-9} - 120^\circ) \text{ (mA)} \]
\[ = 0.2 \cos(0.6\pi - 120^\circ) \text{ (mA)} \]
\[ = 0.2 \cos(108^\circ - 120^\circ) \text{ (mA)} \]
\[ = 0.196 \text{ mA}. \]