1.5.5 Repeat Problem 1.5.4 with $v(t) = 10\cos(120\pi t + 45°)$.

From **1.5.4**, we know that

$$Z = 10 + j\left(12\pi - \frac{1}{0.12\pi}\right)$$

Now we rewrite the input signal in phasor notation, compute the current phasor, and then convert that phasor back to a signal in the time domain.

$$\begin{aligned} V(\chi) &= 10e^{j\frac{\pi}{4}} \\ &= 10\cos\frac{\pi}{4} + j10\sin\pi 4 \\ &= 10\frac{\sqrt{2}}{2} + j10\frac{\sqrt{2}}{2} \\ &= 10\frac{\sqrt{2}}{2}(1+j) \end{aligned}$$

$$\begin{aligned} I(\chi) &= \frac{V(\chi)}{Z} \\ &= \frac{10\frac{\sqrt{2}}{2}(1+j)}{10 + j\left(12\pi - \frac{1}{0.12\pi}\right)} \\ &\approx 0.240 - j0.133 \end{aligned}$$

$$\begin{aligned} i(t) &= \sqrt{(0.240)^2 + (-0.133)^2}\cos\left(120\pi t + \tan^{-1}\left(\frac{-0.133}{0.240}\right)\right) \\ &= 0.274\cos\left(120\pi t - 0.506\right) \\ &= 0.274\cos\left(120\pi t - 29°\right)\text{A} \end{aligned}$$

This is practically the same result as **1.5.4**, except that the signal is shifted forward by about 45°, as expected.