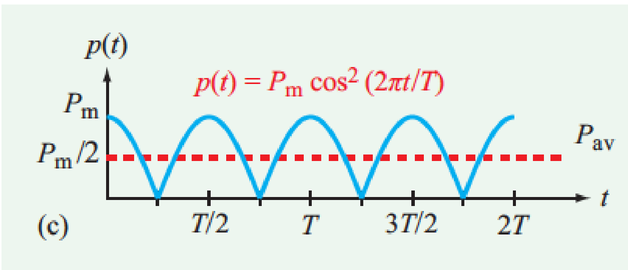
Concept Question 8-2: Why is Eq. (8.10) true, irrespective of the values of ϕ_1 and ϕ_2? Explain in terms of a diagram.

$$\frac{1}{T}\int_0^T \cos^2\left(\frac{2\pi nt}{T}+\phi_1\right)\, dt = \frac{1}{2},$$

and

$$\frac{1}{T}\int_0^T \sin^2\left(\frac{2\pi nt}{T}+\phi_2\right)\, dt = \frac{1}{2},$$

for any values of ϕ_1 and ϕ_2.



A constant value of ϕ_1 or ϕ_2 simply shifts the waveforms along the t axis. Since the integrations are over a full period, the integrated area is always the same.