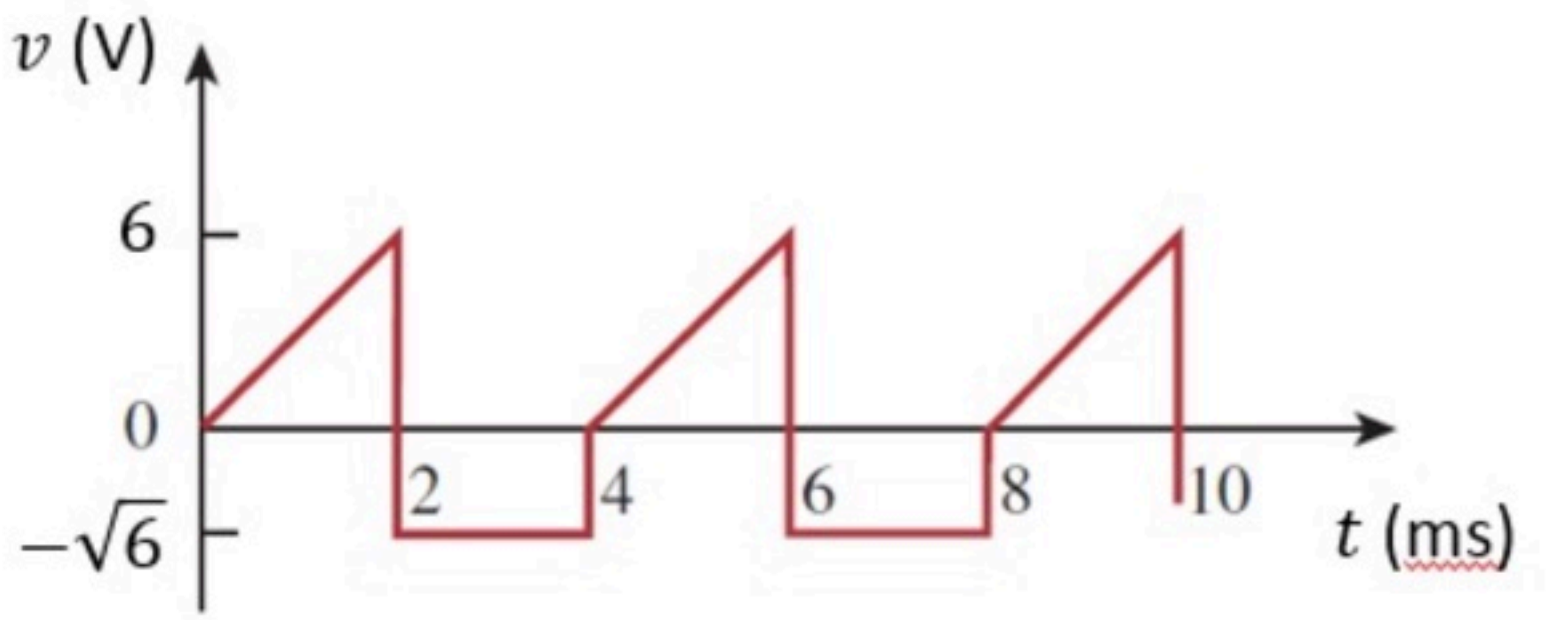
PP AC power 004

Unlimited Attempts.

Find V_{rms} for this waveform.



Given Variables:

. : . .

Calculate the following:

Vrms (V) :

3

Hint: Write the equation of the waveform in parts.

OPTION 1 t EXPRESSED IN SECONDS

$$f(t) = 3 \cdot 10^3 \cdot t \quad , \quad 0 \le t < 2 \cdot 10^{-3}$$
$$= -\sqrt{6} \quad , \quad 2 \cdot 10^{-3} \le t < 4 \cdot 10^{-3}$$

$$\frac{1}{T}\int_0^T f^2(t)\,dt = \frac{1}{4 \cdot 10^{-3}}\left[\int_0^{2 \cdot 10^{-3}} (3 \cdot 10^3\, t)^2\,dt + \int_{2 \cdot 10^{-3}}^{4 \cdot 10^{-3}} (-\sqrt{6})^2\,dt\right]$$

$$= \frac{1}{4 \cdot 10^{-3}}\left[9 \cdot 10^6 \cdot \frac{t^3}{3}\Big|_0^{2 \cdot 10^{-3}} + 6 \cdot 2 \cdot 10^{-3}\right]$$

$$= \frac{1}{4 \cdot 10^{-3}}\left[\frac{9 \cdot 8}{3} \cdot 10^{-3} + 12 \cdot 10^{-3}\right]$$

$$= \frac{24 + 12}{4} = \frac{36}{4} = 9$$

$$\sqrt{\frac{1}{T}\int_0^T f^2(t)\,dt} = \boxed{V_{RMS} = 3V}$$

OPTION 2 t EXPRESSED IN ms

$$f(t) = 3 \cdot t \quad , \quad 0 \le t < 2$$
$$= -\sqrt{6} \quad , \quad 2 \le t < 4$$

$$\frac{1}{T}\int_0^T f^2(t)\,dt = \frac{1}{4}\left[\int_0^2 (3t)^2\,dt + \int_2^4 (-\sqrt{6})^2\,dt\right] = \frac{1}{4}\left[9\,\frac{t^3}{3}\Big|_0^2 + 6 \cdot 2\right]$$

$$= \frac{1}{4}\left[\frac{9 \cdot 8}{3} + 12\right] = \frac{36}{4} = 9$$

$$\boxed{V_{RMS} = 3\,V}$$