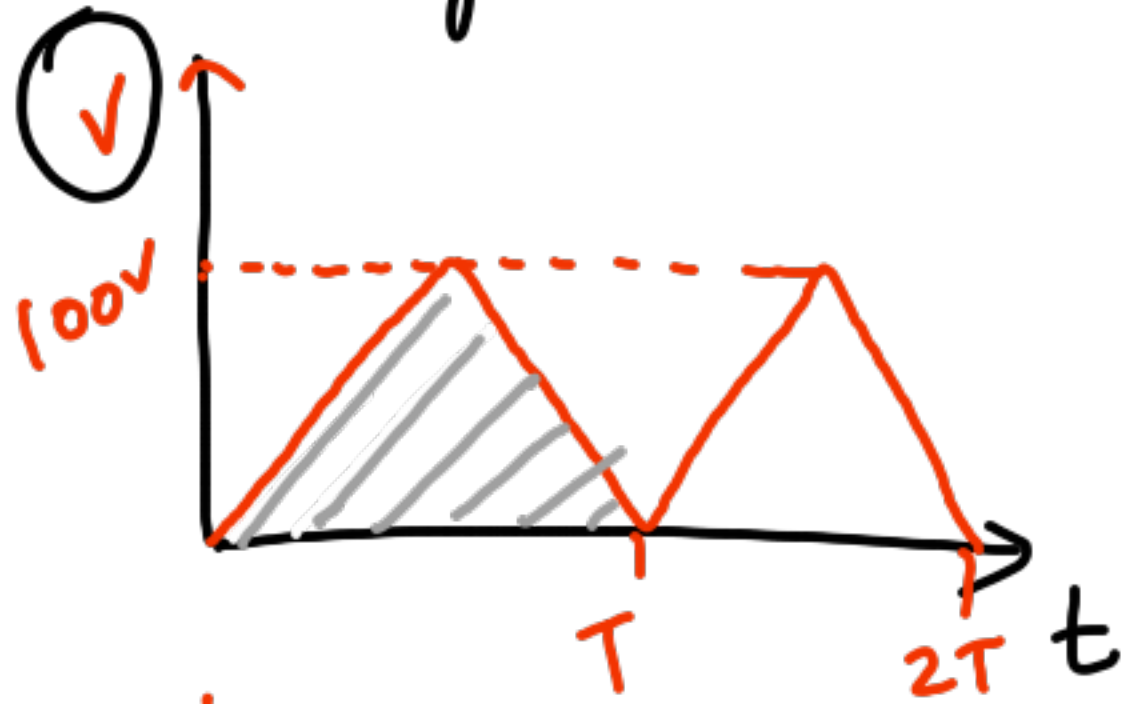


1) Find the average value of the triangle wave



Soln

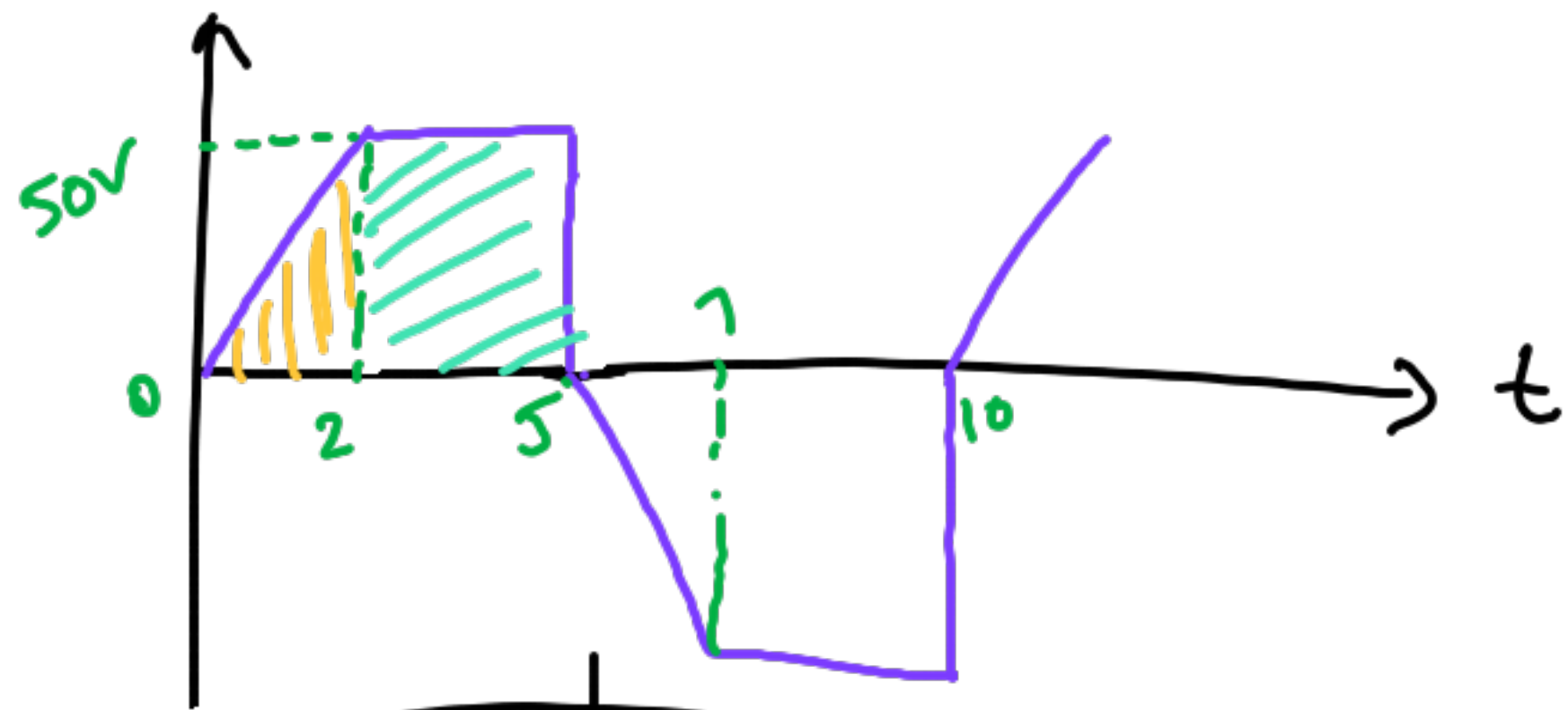
Asymmetrical waveform.

Average value = $\frac{\text{Area Under the Curve Over one complete cycle}}{\text{Time period.}}$

$$\Delta = \frac{1}{2}bh$$

$$= \frac{\frac{1}{2} \times T \times 100}{T} = 50V$$

2) Find the average Value of the Voltage waveform.



Soln Symmetrical waveform.

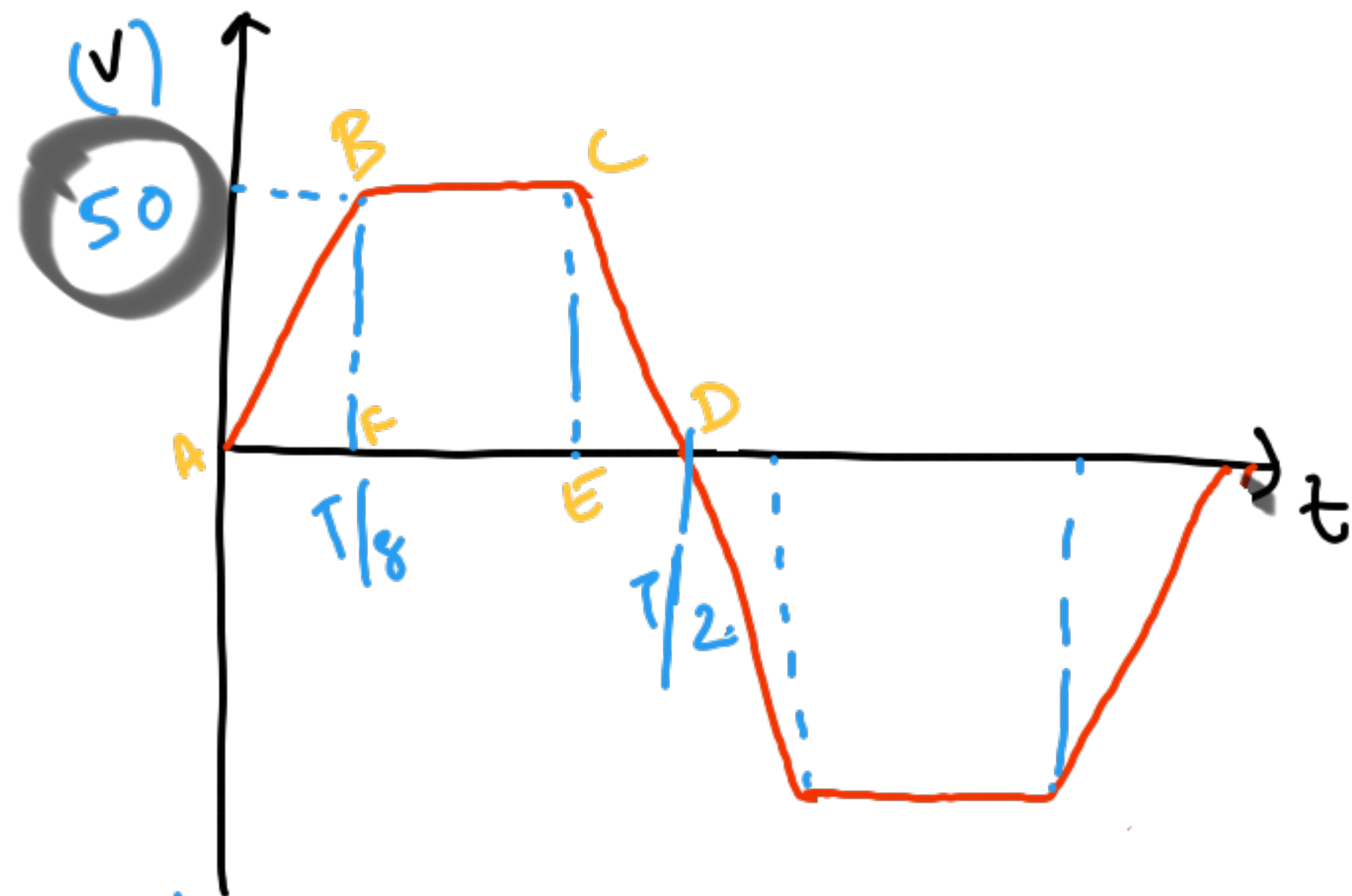
$$\text{Average Value} = \frac{\text{Area under half the cycle}}{\text{half the period.}}$$

$$= \frac{\text{Area of } \Delta + \text{Area of Rectangle}}{\text{half the time period.}}$$

$$= \frac{\frac{1}{2} \times 50 \times 2 + 50 \times 3}{5}$$

$$= 40 \text{ V}$$

3) Find the form factor and Peak factor for the voltage waveform shown in the figure. The RMS Value $V_{RMS} = 40V$



Soln

$$\text{Form factor} = \frac{\text{RMS Value}}{\text{Average Value}}$$

Symmetric waveform.

$$\text{Average Value} = \frac{\text{Area under half the cycle}}{\text{Time period.}}$$

$$= \frac{\text{Area of } \triangle ABF + \text{Area of Rectangl. } BCEF + \text{Area of } \triangle CED}{T/2}$$

$$= \frac{\frac{1}{2} \times \frac{T}{8} \times 50 + \frac{T}{4} \times 50 + \frac{1}{2} \times \frac{T}{8} \times 50}{T/2}$$

$$\text{Avg. Value} = 37.5V$$

$$\text{Form factor} = \frac{\text{RMS Value}}{\text{Avg. Value}} = \frac{40}{37.5} = 1.067$$

$$\text{Peak factor} = \frac{\text{Max Value}}{\text{RMS Value}} = \frac{50}{40} = 1.25$$

6) The alternating current is given by $i = 40 \sin 314t$. Determine the following

i) Maximum Value of current ($\hat{I}_m$)

ii) RMS Value of current

iii) Frequency

Sol
Ans. $i = 40 \sin 314t$ — (1)

We know that

$$i = \hat{I}_m \sin \omega t \text{ — (2)}$$

Compare eq (1) & (2)

$$\hat{I}_m = 40 \text{ A}$$

i) RMS Value of Current

$$I_{rms} = \frac{I_m}{\sqrt{2}} = \frac{40}{\sqrt{2}} = 28.28 \text{ A}$$

ii) Frequency.

Compare eq ① & ②

$$\omega = 314$$

We know that $\omega = 2\pi f$

$$f = \frac{\omega}{2\pi} = \frac{314}{2\pi} = 50 \text{ Hz}$$

$$\begin{aligned}\omega &= 2\pi f \\ f &= \frac{1}{T}\end{aligned}$$

7) An Alternating Voltage is given by $V = 75 \sin(\underline{200\pi t} - 0.25)$ Volts.

Find (a) the amplitude

(b) the peak to peak Voltage

(c) the R.M.S Value

(d) the periodic time

(e) the frequency

(f) the phase angle in degree.

Soln

a) Amplitude.

We know that

$$V = V_m \sin \omega t$$

(or)

$$V = V_m \sin(\omega t + \phi)$$

$$V_m = 75$$

$$\text{Amplitude} = 75 \text{ V}$$

b) Peak to peak Voltage

$$\begin{aligned} \text{Peak to peak Voltage} &= 2 \times \text{Amplitude} \\ &= 2 \times 75 \\ &= 150 \text{ V} \end{aligned}$$

c) RMS Value

$$V_{RMS} = \frac{V_m}{\sqrt{2}} = \frac{75}{\sqrt{2}} = 53.03V$$

d) Periodic time

$$T = \frac{1}{f}$$

we know that

$$\omega = 2\pi f$$

$$\text{we know } \omega = 200\pi$$

$$\cancel{2\pi}f = \cancel{200\pi}$$

$$f = \frac{200}{2} = 100\text{Hz}$$

$$T = \frac{1}{100} = 0.01 = 10\text{ms}$$

$$\hat{I} = \hat{I}_m \sin \omega t - \phi$$

e) frequency

$$\text{Frequency} = 100\text{Hz}$$

f) Phase angle in degree.

$$\text{Given, } \phi = 0.25 \text{ in radians}$$

$$0.25 \text{ in degree} = 0.25 \times \frac{360}{2\pi}$$

$$= 14.32^\circ \text{ (lagging)}$$

→ in phase
→ lagging
→ leading

8) A transformer has a rated output of 200 kVA at a power factor of 0.8. Determine the rated power output and the corresponding reactive power.

Soln

$$\text{Power factor} = 0.8 = \cos \phi$$

$$\text{Apparent power} = 200 \text{ kVA} = VI$$

Rated power $P = ?$

Reactive power $= ?$

$$\begin{aligned} \text{Rated power output} &= VI \cos \phi \\ &= 200 \times 10^3 \times 0.8 \\ &= 160 \text{ kW} \end{aligned}$$

$$\text{Reactive power} = VI \sin \phi$$

We know that

$$\cos \phi = 0.8$$

$$\phi = \cos^{-1}(0.8)$$

$$\phi = 36.87^\circ$$

$$\begin{aligned}\text{Reactive power} &= 200 \times 10^3 \sin(36.87^\circ) \\ &= 120 \text{ KVAR}\end{aligned}$$