

1) An alternating Voltage is given by $v = 75 \sin(200\pi t - 0.25)$ Volt.
Calculate,

- the amplitude
- Peak to peak Voltage
- RMS Value
- time period
- frequency
- Phase angle in degrees.

Soln:

given, $V = 75 \sin(200\pi t - 0.25)$

we know that

$$V = V_m \sin \theta$$

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

$$V_m = 75, \quad \omega = 200\pi$$

$$\phi = 0.25$$

a) Amplitude, $V_m = 75\text{ V}$

b) Peak to peak voltage, $V_{pp} = 2 \times V_m$
 $V_{pp} = 2 \times 75 = 150\text{ V}$

c) RMS value.

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

d) time period,

$$\omega = 2\pi f$$

$$200\pi = 2\pi f$$

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

$$T = \frac{1}{f} = \frac{1}{100}$$

$$T = 0.01\text{ s}$$

e) frequency

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

f) phase angle.

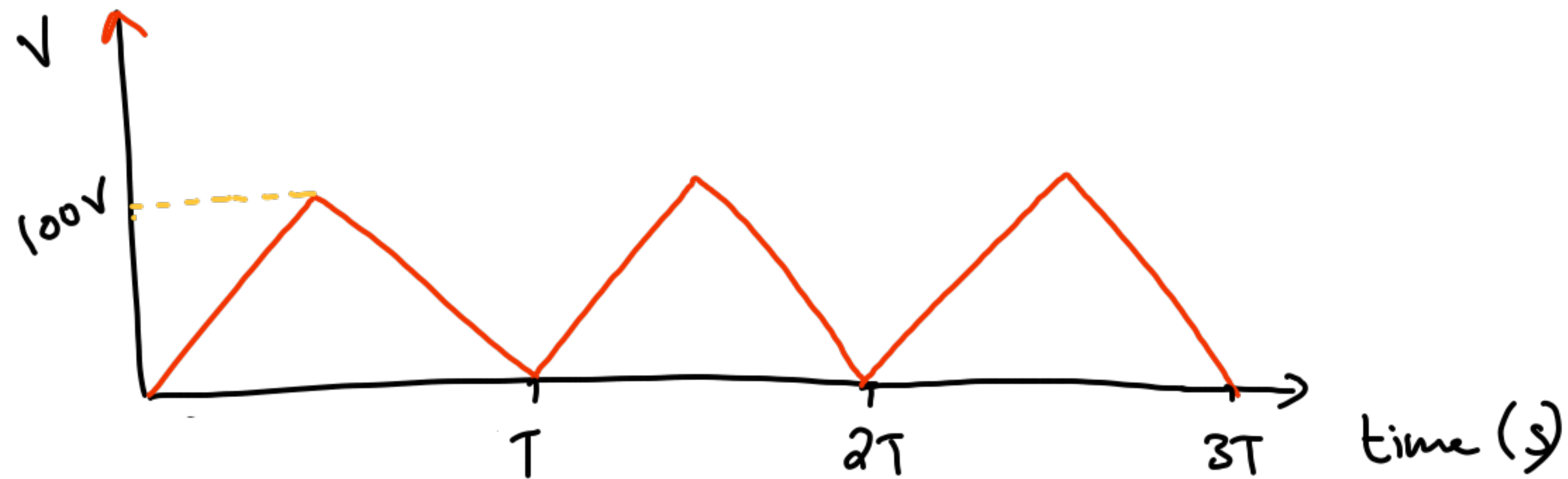
$$\phi = 0.25\text{ rad.}$$

$$\phi^\circ = \phi \times \frac{360}{2\pi}$$

$$\phi^\circ = 0.25 \times \frac{360}{2\pi}$$

$$\phi = 14^\circ 32'$$

2) Calculate the average Value of the waveform shown below.



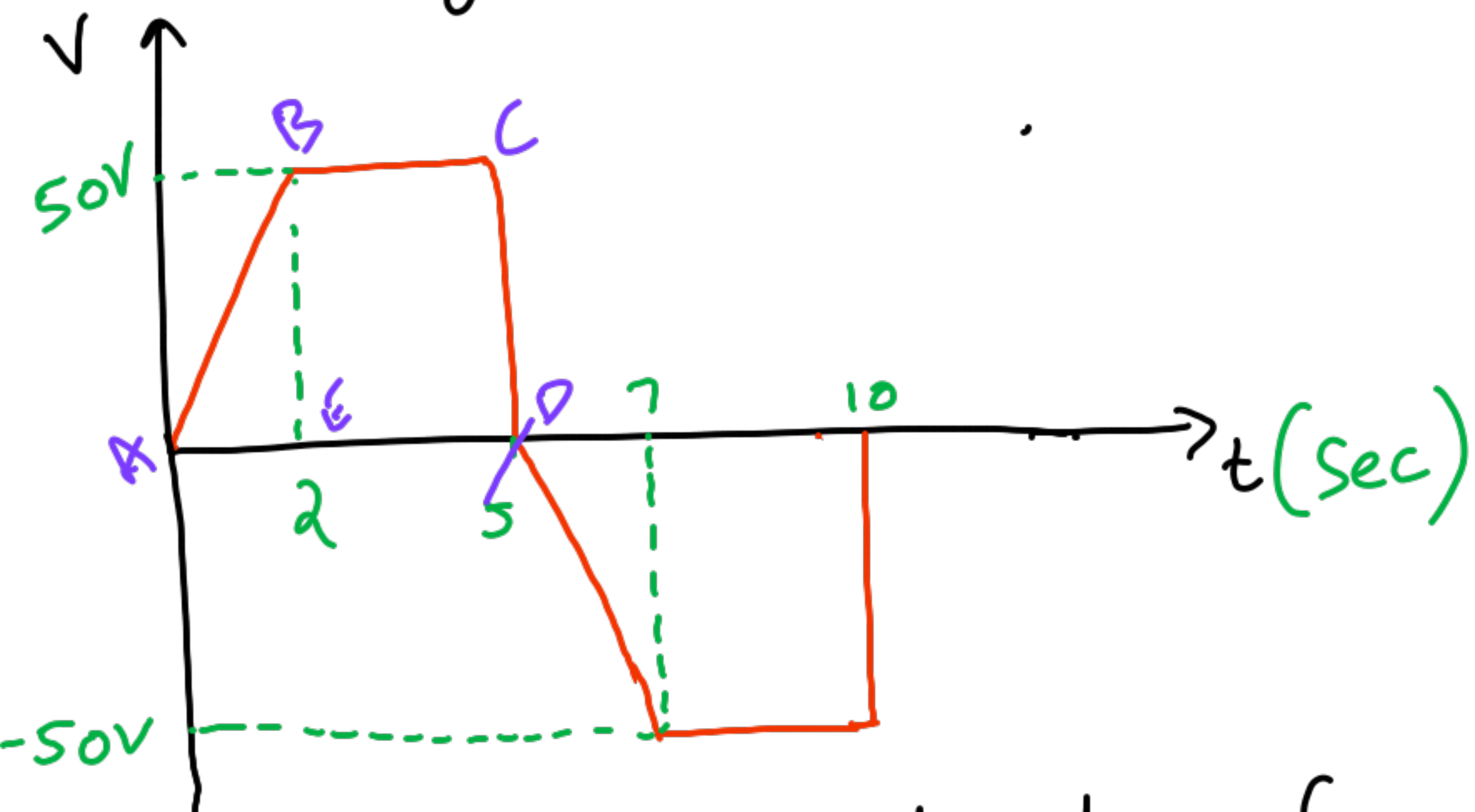
This is UNSymmetry.

Average value : $\frac{\text{Area under the Curve over the Complete Cycle}}{\text{time period.}}$

$$= \frac{\frac{1}{2}bh}{\text{time period}}$$

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

2) Calculate the average Value of the following waveform.



This is a symmetrical waveform.

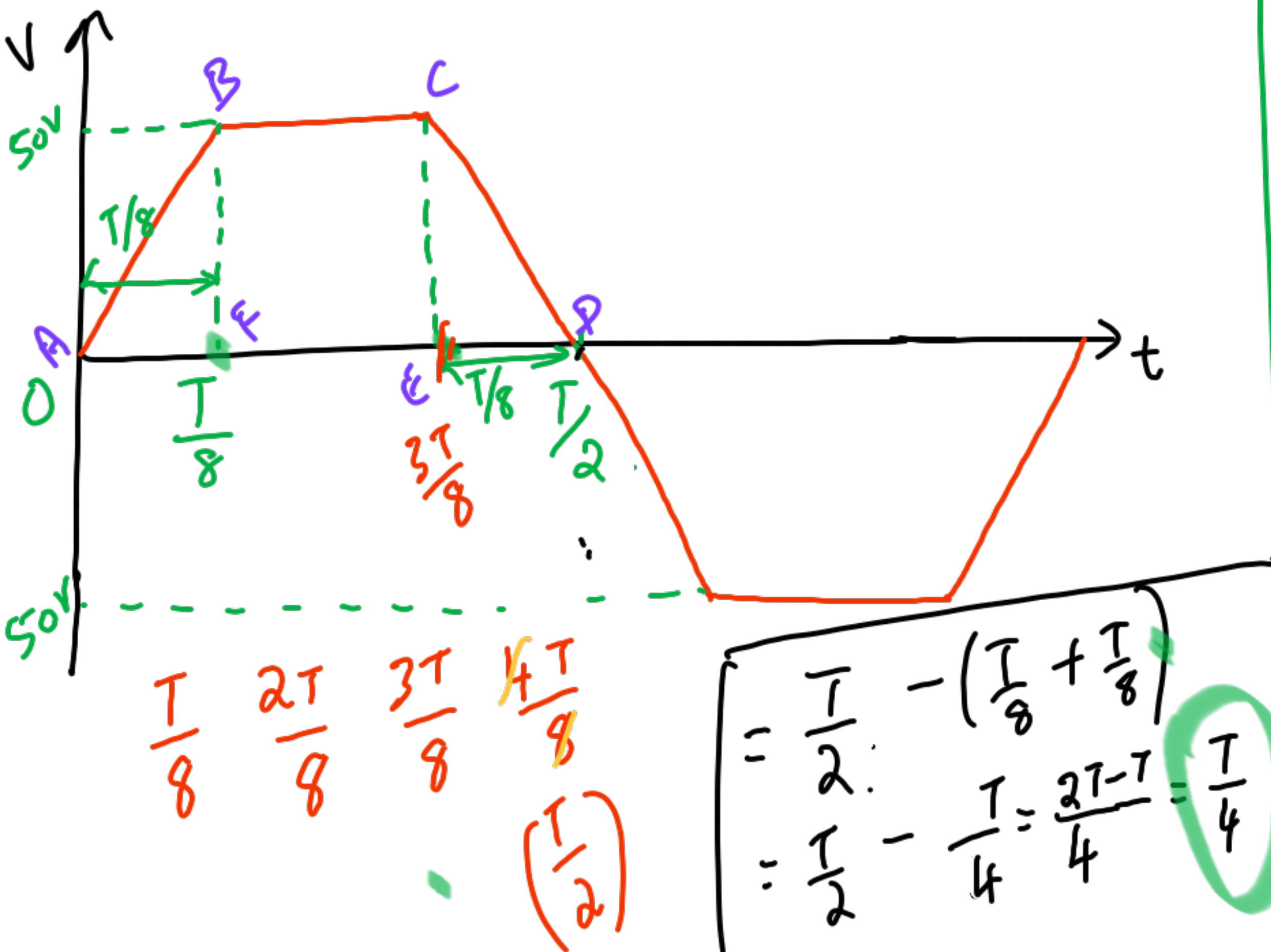
$$\text{Average value} = \frac{\text{Area under the curve over half the cycle}}{\text{half the time period}}$$

$$\text{Average value} = \frac{\text{Area of } \triangle ABE + \text{Area of Rect } BCDE}{5}$$

$$= \frac{\frac{1}{2}bh + bh}{5}$$

$$\text{Average value} = \frac{\frac{1}{2} \times 2 \times 50 + 3 \times 50}{5} = 40 \text{ V}$$

4) Determine the Form factor and peak factor for the following waveform, if the RMS value is 40.83V.



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

Symmetric waveform

$$\text{Average value} = \frac{\text{Area of the triangle ABE} + \text{Area of Rectangle BDEF} + \text{Area of triangle CDE}}{T/2}$$

$$= \frac{\frac{1}{2}bh + bh + \frac{1}{2}bh}{T/2}$$

$$\text{Average value} = \frac{\frac{1}{2} \times \frac{T}{8} \times 50 + \frac{T}{4} \times 50 + \frac{1}{2} \times \frac{T}{8} \times 50}{T/2} = \frac{T \left(\frac{50}{2 \times 8} + \frac{50}{4} + \frac{50}{2 \times 8} \right)}{T/2}$$

$$\text{Average value: } 37.5 \text{ V}$$

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

$$\text{Peak factor} = \frac{\text{Maximum value}}{\text{RMS value}}$$

$$= \frac{T \left(3.125 + 12.5 + 3.125 \right)}{T/2}$$

$$= \frac{18.75}{1/2}$$

$$= 18.75 \times 2$$

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

$$\text{Form factor} = \frac{40.83}{37.5} = 1.09$$

$$\text{Peak factor} = \frac{50}{40.83} = 1.22$$

