Values of alternating voltage & current.

1) Peak value — V_m, I_m

$$v = V_m \sin\theta \quad , \quad i = I_m \sin\theta$$
$$v = V_m \sin\omega t \quad \quad i = I_m \sin\omega t$$

2) Average value

$$\text{Average value} = \frac{\text{Area under the curve}}{\text{Base}}$$

3) RMS value or effective value.

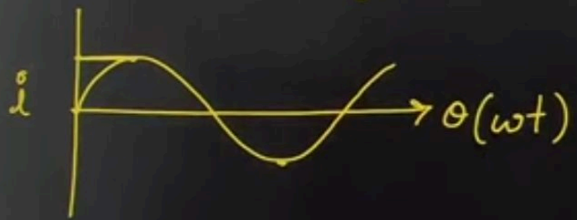
$$\text{RMS value} = \sqrt{\frac{\text{Area under the wave squared}}{\text{Base length}}}$$

Average value of Sinusoidal AC = $I_{average} = \underline{0.637} I_m$

Similarly for voltage : $V_{average} = 0.637\, V_m$.

$i = I_m \sin\theta$

$I_m \sin(\omega t)$



RMS Value of sinusoidal AC = $I_{rms} = 0.707\, I_m$

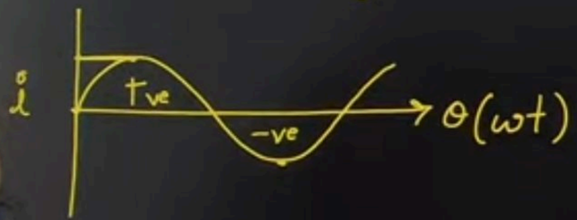
Similarly for voltage : $V_{rms} = 0.707\, V_m$.

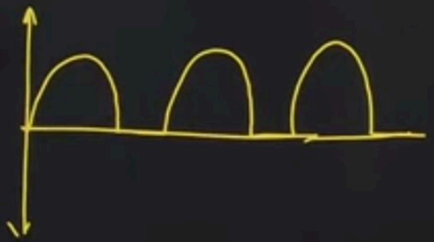
Average value of Sinusoidal AC = $I_{average} = 0.637\, I_m$

Similarly for voltage : $V_{average} = 0.637\, V_m$.

$i = I_m \sin\theta$

$I_m \sin(\omega t)$

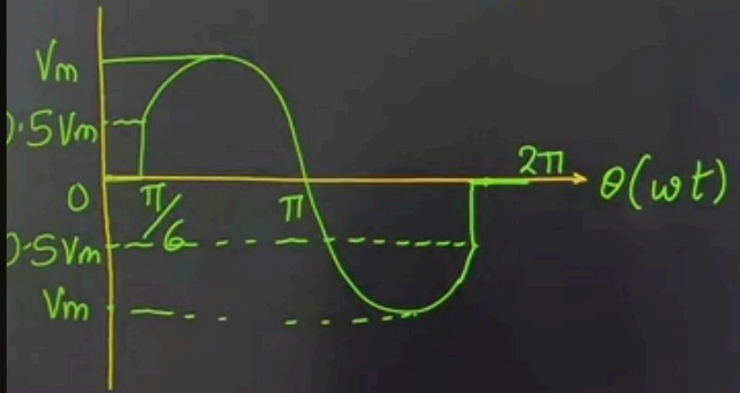




RMS Value of sinusoidal AC = $I_{rms} = 0.707\, I_m$

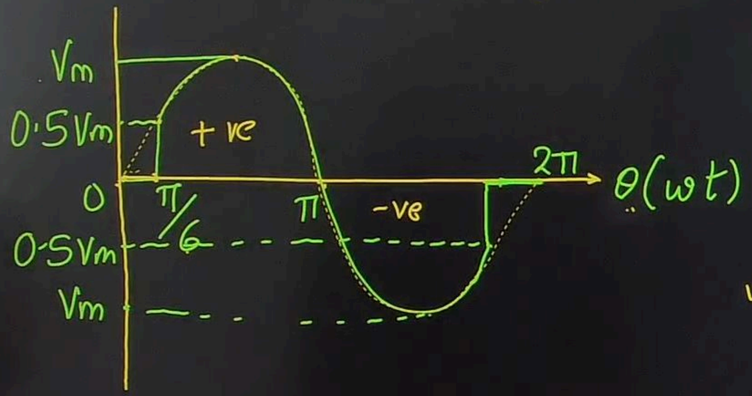
Similarly for voltage : $V_{rms} = 0.707\, V_m$.

Q1. Find the average value of waveform shown.



288 768

Q1. Find the average value of waveform shown.



Avg: $\dfrac{\text{Area under curve}}{\text{Base}}$.

$$\text{Area} = \int_0^{\pi} v \cdot d\theta$$

$V = 0 \quad 0 < \theta < \frac{\pi}{6}$

$V = V_m \sin\theta \quad \frac{\pi}{6} < \theta < \pi$.

$$\text{Avg} = \frac{\int_0^{\pi/6} 0 \cdot d\theta + \int_{\pi/6}^{\pi} V_m \sin\theta \cdot d\theta}{\pi}$$

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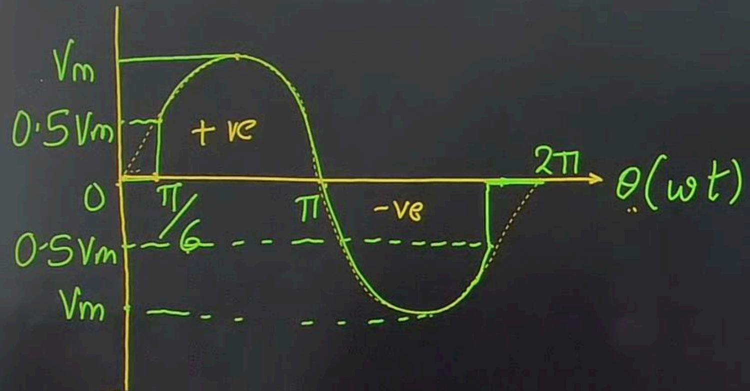


$$Area = \int_0^{\pi} v \cdot d\theta$$

$v = 0 \quad 0 < \theta < \frac{\pi}{6}$

$V = V_m \sin\theta \quad \frac{\pi}{6} < \theta < \pi$

$$\boxed{V_{avg} = 0.5939\, V_m}$$

$$V_{Avg} = \frac{\int_0^{\pi/6} 0 \cdot d\theta + \int_{\pi/6}^{\pi} V_m \sin\theta \cdot d\theta}{\pi}$$

$$V_{avg} = \frac{1}{\pi}\left[0 + V_m \int_{\pi/6}^{\pi} \sin\theta \cdot d\theta\right]$$

$$= \frac{1}{\pi}\left[V_m \left[-\cos\theta\right]_{\pi/6}^{\pi}\right]$$

$$= \frac{V_m}{\pi}\left[(-\cos\pi) - (-\cos\pi/6)\right] \qquad \boxed{\pi = 180 \text{ in calci}}$$

$$= \frac{V_m}{\pi}\left[-(-1) + 0.866\right]$$

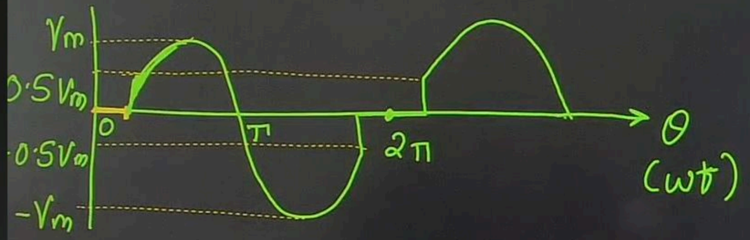
$$= V_m \frac{[+1 + 0.866]}{\pi} = 0.5939\, V_m$$

(i) Graph analysis

(ii) Wave form.
continuous,
symmetrical, etc.

(iii) Integration.

Find the rms value of waveform.



$$0.5\,V_m = V = V_m \sin\theta$$

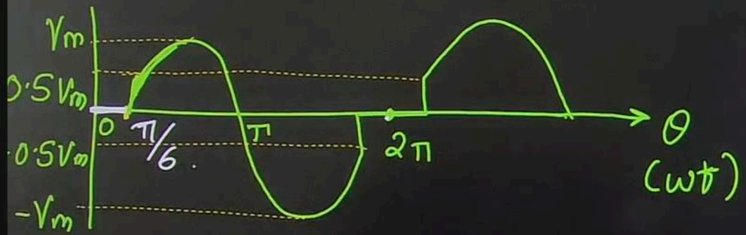
$$0.5\,\cancel{V_m} = \cancel{V_m}\sin\theta$$

$$0.5 = \sin\theta$$

$$\theta = \sin^{-1}(0.5)$$

$$\boxed{\theta = \pi/6}$$

Find the rms value of waveform.



Since it is a symmetrical wave consider eqve 0 to π.

$$rms = \sqrt{\frac{\int_0^{\pi} v^2 \, d\theta}{Base}}$$

$v = 0 \quad 0 < \theta < \pi/6$

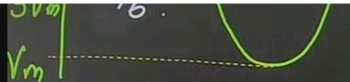
$v = V_m \sin\theta \quad \frac{\pi}{6} < \theta < \pi$

$$V_{rms} = \sqrt{\frac{\int_0^{\pi/6} v^2 \cdot d\theta + \int_{\pi/6}^{\pi} v^2 \cdot d\theta}{\pi}}$$

Squaring both the sides.

$$V_{rms}^2 = \frac{1}{\pi}\left[\int_0^{\pi/6} \cancel{0 \cdot d\theta}^{\,0} + \int_{\pi/6}^{\pi} V_m^2 \sin^2\theta \cdot d\theta\right]$$

$$V_{rms}^2 = \frac{1}{\pi}\left[0 + V_m^2 \int_{\pi/6}^{\pi} \frac{1-\cos 2\theta}{2} \cdot d\theta\right]$$



(ωt)

ince it is a symmetrical wave consider cycle 0 to π.

$$V_{rms} = \sqrt{\frac{\int_0^{\pi} v^2 \, d\theta}{Base}}$$

$V = 0 \quad 0 < \theta < \pi/6$

$V = V_m \sin\theta \quad \frac{\pi}{6} < \theta < \pi$

$$V_{rms}^2 = \frac{1}{\pi}\left[\cancel{\int_0^{\pi/6} 0 \cdot d\theta} + \int_{\pi/6}^{\pi} V_m^2 \sin^2\theta \cdot d\theta\right]$$

$$V_{rms}^2 = \frac{1}{\pi}\left[0 + V_m^2 \int_{\pi/6}^{\pi} \frac{1-\cos 2\theta}{2} \cdot d\theta\right]$$

$$= \frac{1}{\pi}\left[V_m^2\left(\int_{\pi/6}^{\pi} \frac{1}{2} \cdot d\theta - \int_{\pi/6}^{\pi} \frac{\cos 2\theta}{2} \cdot d\theta\right)\right]$$

$$= \frac{V_m^2}{\pi}\left[\frac{1}{2}[\theta]_{\pi/6}^{\pi} - \left[\frac{\sin 2\theta}{2 \times 2}\right]_{\pi/6}^{\pi}\right]$$

$$= \frac{V_m^2}{\pi} \cdot \left[\frac{1}{2}[\pi - \pi/6] - \left[\frac{\sin 2\pi}{4} - \frac{\sin 2(\pi/6)}{4}\right]\right]$$

$6 \cdot$

$$\boxed{\begin{array}{l} \sin \pi \cdot \\ \cos \pi \cdot \\ \pi = 180 \\ \pi \neq 3.14 \end{array}}$$

V_{rms}

$$= \frac{V_m^2}{\pi}\left[\frac{1}{2}(\theta)_{\pi/6}^{\pi} - \left[\frac{\sin 2\theta}{2\times 2}\right]_{\pi/6}^{\pi}\right]$$

$$= \frac{V_m^2}{\pi}\cdot\left[\frac{1}{2}[\pi - \pi/6] - \left[\frac{\sin 2\pi}{4} - \frac{\sin 2(\pi/6)}{4}\right]\right]$$

$$= \frac{V_m^2}{\pi}\left[1.3089 - (-0.2165)\right]$$

$$= V_m^2\left[\frac{1.3089 + 0.2165}{\pi}\right]$$

$$V_{rms}^2 = 0.4855\, V_m^2$$

Taking square root on both side.

$$V_{rms} = \sqrt{0.4855}\, V_m$$

$$V_{rms} = 6967\, V_m.$$

026 624

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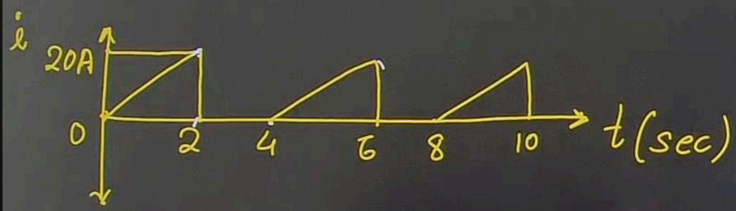
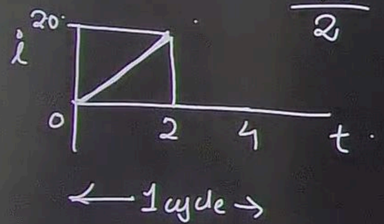
ACADEMY

Q. Find the average value of waveform.



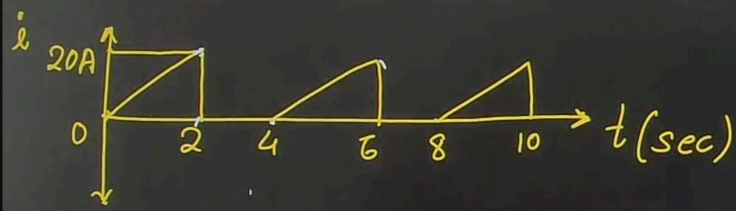


$$\frac{20}{2} = 10$$

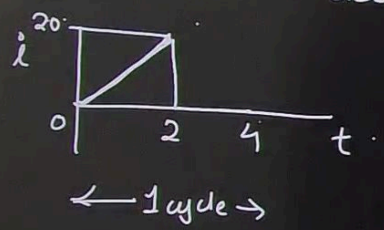
$i = 10t \quad 0 < t < 2$

$i = 0 \quad 2 < t < 4$

Q. Find the average value of waveform.



The waveform is assymetrical.



$i = 10t \quad 0 < t < 2$

$i = 0 \quad 2 < t < 4$

$$\boxed{\int t^n \cdot dt = \frac{t^{n+1}}{n+1}}$$

Avg = $\frac{\text{Area under one cycle}}{\text{Base}}$.

$$i_{avg} = \frac{\int_0^4 i \cdot dt}{4}$$

$$i_{avg} = \frac{1}{4}\left[\int_0^2 10t \cdot dt + \int_2^4 0 \cdot dt\right]$$

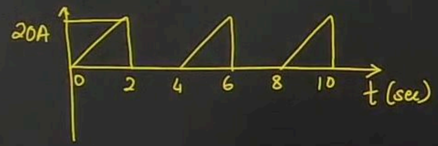
$$= \frac{1}{4}\left[10\int_0^2 t^1 \cdot dt + 0\right]$$

$$= \frac{1}{4}\left[10\left[\frac{t^2}{2}\right]_0^2\right]$$

$$= \frac{1}{4} \times 10\left[\frac{2^2}{2} - \frac{0^2}{2}\right] \quad \text{limit put.}$$

$$i_{avg} = 5A$$

find the rms value of waveform shown.



$$RMS = \sqrt{\frac{(\text{Area under cycle})^2}{\text{Base}}} = \sqrt{\frac{\int_0^4 i^2 \cdot dt}{4}}$$

$$i_{RMS} = \sqrt{\frac{\int_0^2 i^2 dt + \int_2^4 i^2 \cdot dt}{4}}$$

The graph is assymmetrical.
So we consider cycle 0-4.

$i = 10t \quad 0 < t < 2$

$i = 0 \quad 2 < t < 4$

$V_m \sin\theta$

Taking square on both side.

$$i_{rms}^2 = \frac{1}{4}\left[\int_0^2 (10t)^2 \cdot dt + 0\right]$$

$$= \frac{1}{4} \times 100 \left[\int_0^2 t^2 \cdot dt\right]$$

$$= 25 \left[\frac{t^3}{3}\right]_0^2$$

$$= 25 \times \left[\frac{2^3}{3} - 0\right]$$

$$i_{rms}^2 = 66.66 \text{ A}$$

$$\sqrt{i_{rms}^2} = \sqrt{66.66}$$

$$\boxed{i_{rms} = 8.164 \text{ A}}$$