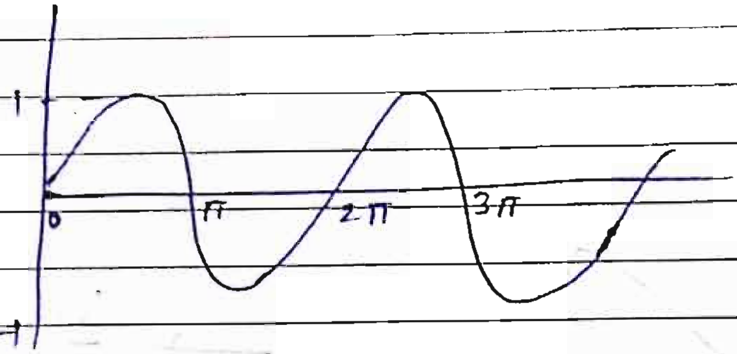
RMS value of

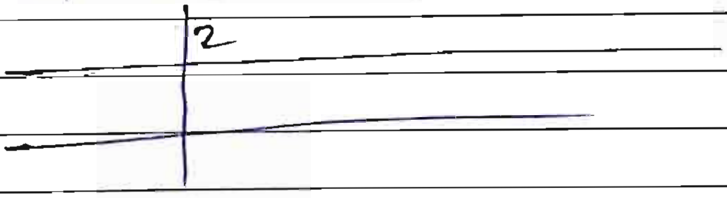
(9) AC + DC signal

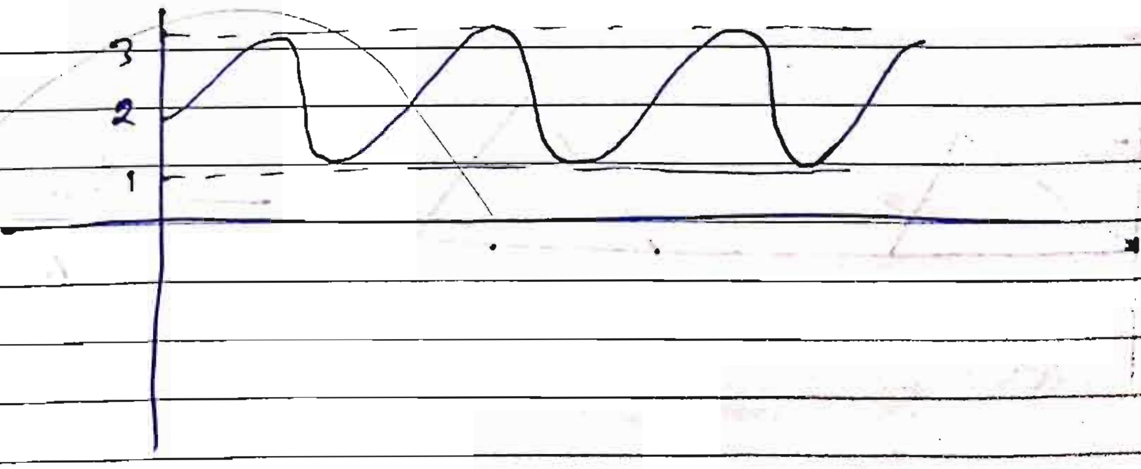
If. $x(t) = A + B \sin \omega t$

Graph of $\sin t$



add. →





Note:→ AC → AC + DC

↳ f, T ↳ f, T

June'11

Monday		6	13	20	27
Tuesday		7	14	21	28
Wednesday	1	8	15	22	29
Thursday	2	9	16	23	30
Friday	3	10	17	24	

Notes

Appointment

$T = 2\pi$

$$RMS^2 = \frac{1}{T}\int_0^T [x(t)]^2 \, d\omega t$$

$$= \frac{1}{2\pi}\int_0^{2\pi} (A + B\sin\omega t)^2 \, d\omega t$$

$(a+b)^2 = a^2 + b^2 + 2ab$

$$= \frac{1}{2\pi}\left[\int_0^{2\pi} (A^2 + B^2 \sin^2\omega t + 2AB\sin\omega t)\, d\omega t\right]$$

$$= \frac{1}{2\pi}\left[\int_0^{2\pi} A^2 d\omega t + B^2\int_0^{2\pi} \sin^2\omega t \, d\omega t + \int_0^{2\pi} 2AB\sin\omega t \, d\omega t\right] \quad (=0)$$

$$= \frac{1}{2\pi}\left[A^2\int_0^{2\pi} 1 \, d\omega t + B^2\int_0^{2\pi} \frac{1-\cos 2\omega t}{2} d\omega t + 0\right]$$

$$= \frac{1}{2\pi}\left[A^2(2\pi - 0) + \frac{B^2}{2}\left(\int_0^{2\pi} 1 \, d\omega t - \int_0^{2\pi} \cos 2\omega t \, d\omega t\right)\right] \quad (=0)$$

$$= \frac{1}{2\pi}\left[2\pi A^2 + \frac{B^2}{2}(2\pi - 0)\right]$$

$$= \frac{1}{2\pi} \times 2\pi \left(A^2 + \frac{B^2}{2}\right)$$

$$RMS^2 = A^2 + \frac{B^2}{2}$$

$$RMS = \sqrt{(DC)^2 + (AC_{rms})^2 + \cdots}$$

Notes

$$RMS = \sqrt{A^2 + \frac{B^2}{2}}$$

$$RMS = \sqrt{A^2 + \left(\frac{B}{\sqrt{2}}\right)^2}$$

Appointment

July '11

Monday		4	11	18	25
Tuesday		5	12	19	26
Wednesday		6	13	20	27
Thursday		7	14	21	28
Friday	1	8	15	22	29
Saturday	2	9	16	23	30
Sunday	3	10	17	24	31

Ex.

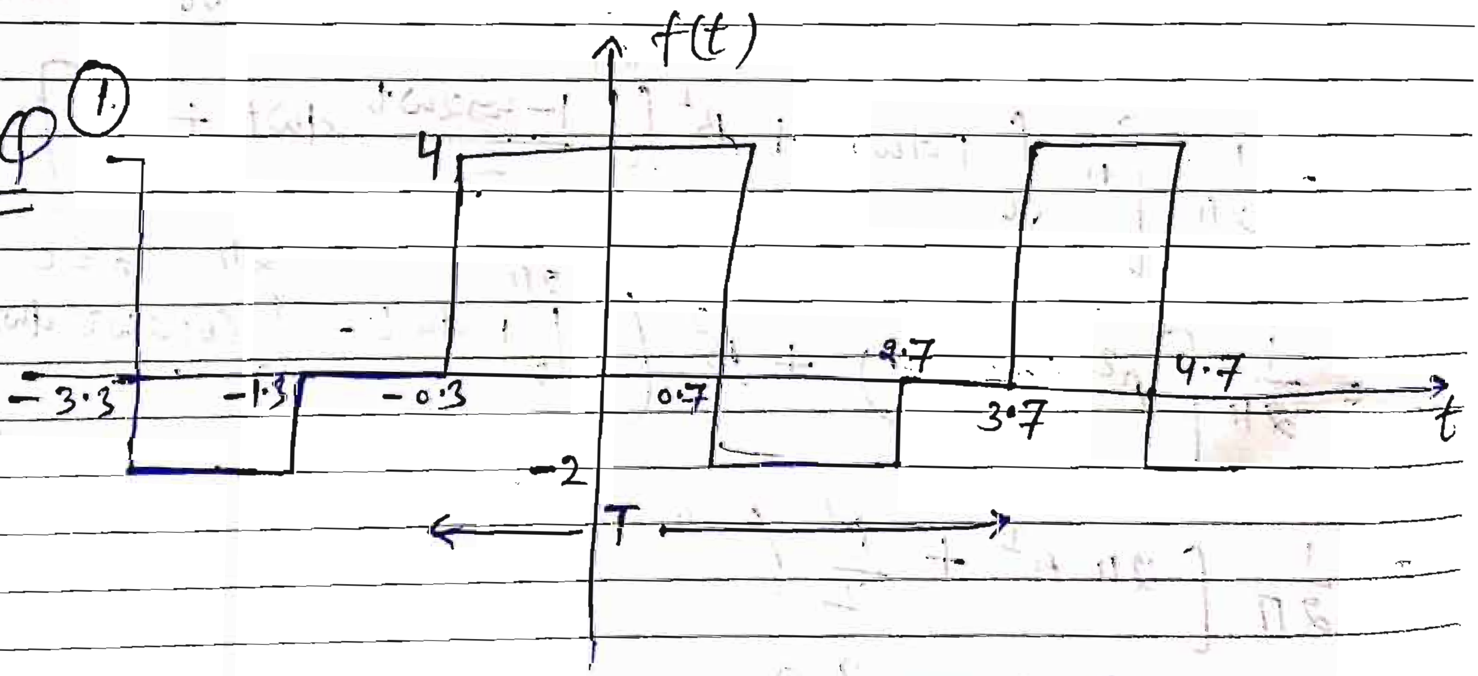
Note :→

If you have a function

$A + B \sin \omega_1 t + C \sin \omega_2 t + D \cos \omega_3 t + \cdots$

$$RMS = \sqrt{A^2 + \left(\frac{B}{\sqrt{2}}\right)^2 + \left(\frac{C}{\sqrt{2}}\right)^2 + \left(\frac{D}{\sqrt{2}}\right)^2 + \cdots}$$

Q ①



find the mean squar value of f(t)

(M.S)

Ans fundamental Time Period

$T = 3.7 - (-0.3)$

$T = 4$

Now break the limits of $f(t)$

$$f(t) = \begin{cases} 4 & -0.3 < t < 0.7 \\ -2 & 0.7 < t < 2.7 \\ 0 & 2.7 < t < 3.7 \end{cases}$$

(Mean Square)

$$MS = \frac{1}{4}\left[\int_{-0.3}^{0.7} 4^2\,dt + \int_{0.7}^{2.7} (-2)^2\,dt + \int_{2.7}^{3.7} 0\,dt\right]$$

$$= \frac{1}{4}\left[16\,[t]_{0.3}^{0.7} + 4\,(t)_{0.7}^{2.7} + 0\right]$$

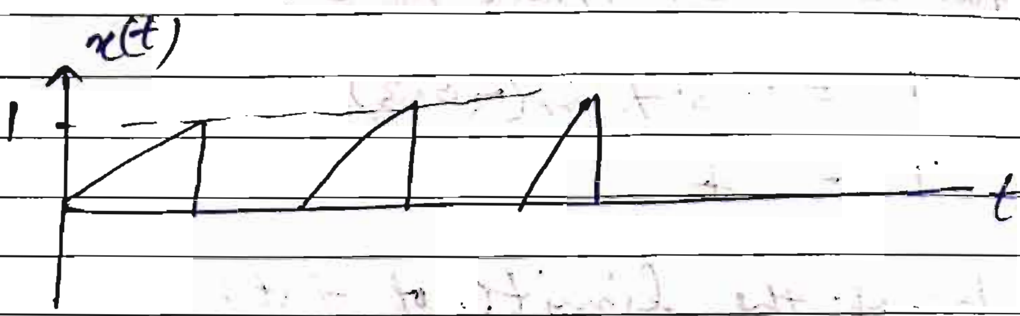
$$= \frac{1}{4}\left[16 \times (0.7 - (-0.3)) + 4(2.7 - 0.7)\right]$$

$$= \frac{1}{4} \times (16 + 4 \times 2)$$

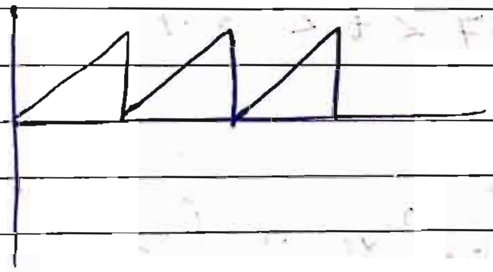
$$= \frac{1}{4} \times 24$$

$$= 6 \text{ Ans}$$

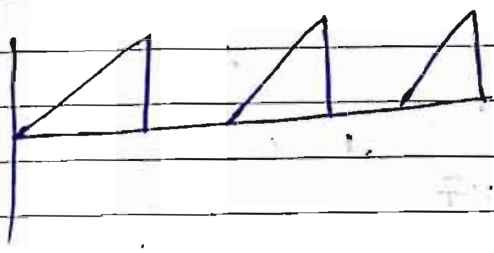
Q (2)



find the R.M.S value.
when saw tooth wave form given.



RMS $\rightarrow \frac{V_m}{\sqrt{3}}$



RMS $\rightarrow \frac{V_m}{\sqrt{3}} \times \frac{1}{\sqrt{2}} = \frac{V_m}{\sqrt{6}}$

$V_m = 1$ ∵ in the given question

RMS $= \frac{1}{\sqrt{6}}$

Ans

(13) Value of

Q find RMS voltage.

$$v(t) = 3 + 4\cos 3t$$

Ans

$$RMS = \sqrt{(DC)^2 + (VAC_{rms})^2 +}$$

$$RMS = \sqrt{(3)^2 + \left(\frac{4}{\sqrt{2}}\right)^2}$$

$$= \sqrt{9 + \frac{16}{2}}$$

$$= \sqrt{9+8}$$

$$= \sqrt{17}$$

Q (4) R.M.S Value of Resultant current which carries a DC current of 10A sinusoidal current (A.C) of Peak value 20A is

Ans $i(t) = 10 + 20 \sin \omega t$

$$RMS = \sqrt{(10)^2 + \left(\frac{20}{\sqrt{2}}\right)^2}$$

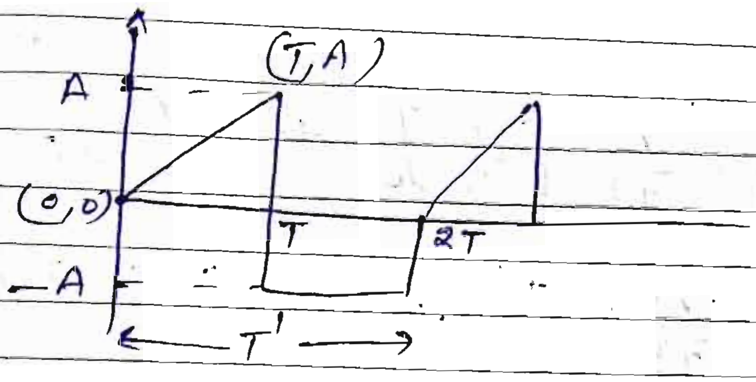
$$= \sqrt{100 + 200}$$

$$RMS = \sqrt{300}$$

Q(5)

find the RMS value.

Q5
Ans



fundamental Time Period. $T' = 2T$

$$x(t) = \begin{cases} \text{--?--} & 0 < t < T \\ -A & T < t < 2T \end{cases}$$

These are the co-ordinate $(0,0)\ (T,A)$
$x_1\ y_1 \quad x_2\ y_2$

find the value of $x(t)$ when limit is $0 \to T$

$$(y - y_1) = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

$$x(t) - 0 = \frac{A - 0}{T - 0}(t - 0)$$

$$x(t) = \frac{A}{T} t.$$

Now,

$$RMS^2 = \frac{1}{2T}\left[\int_0^T \left(\frac{A}{T}t\right)^2 dt + \int_T^{2T} (-A)^2 dt\right]$$

$$= \frac{1}{2T}\left[\frac{A^2}{T^2}\int_0^T t^2 dt + A^2 \int_T^{2T} dt\right]$$

Notes

Appointment

$$RMS^2 = \frac{1}{2T}\left[\frac{A^2}{T^2}\left[\frac{t^3}{3}\right]_0^T + \left[A^2\right]_T^{2T}\right]$$

$$= \frac{1}{2T}\left[\frac{A^2}{T^2} \times \frac{T^3}{3} + A^2(2T-T)\right]$$

$$= \frac{1}{2T}\left[\frac{A^2T}{3} + A^2T\right]$$

$$= \frac{A^2T}{2T}\left[\frac{1}{3} + 1\right]$$

$$RMS^2 = \frac{A^2}{2} \times \frac{4}{3}$$

$$RMS = A\sqrt{\frac{2}{3}} \qquad \underline{Ans}$$