EE 220 CIRCUITS I

Lecture 23

11/23/2022

$1K(180f + 20f)$

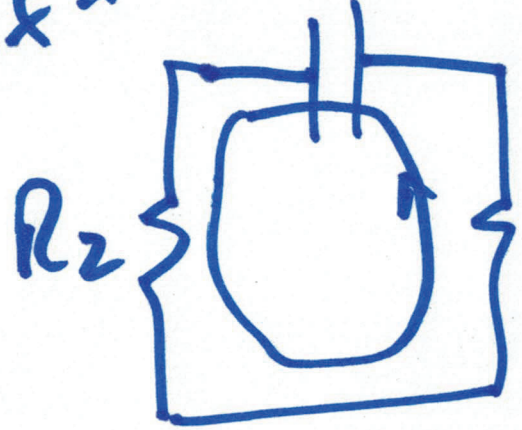
$1K \cdot \frac{20f \cdot 180f}{20f + 180f}$ C

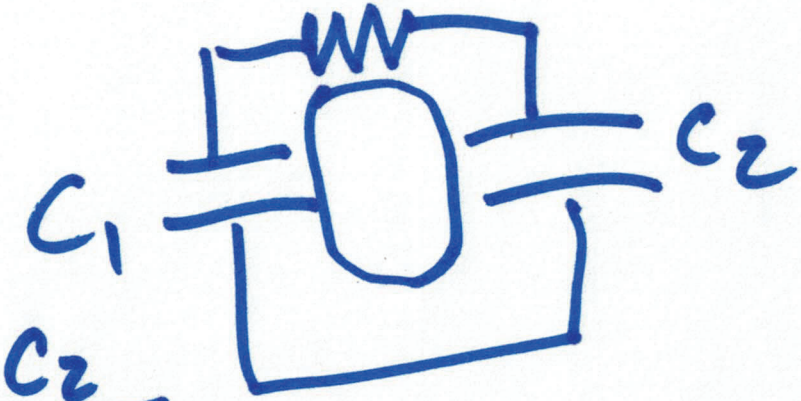
$\frac{3600}{200}$

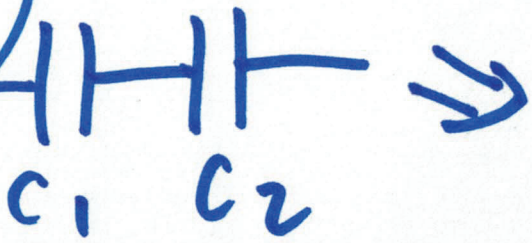
$1K \cdot 18ff$

18ps

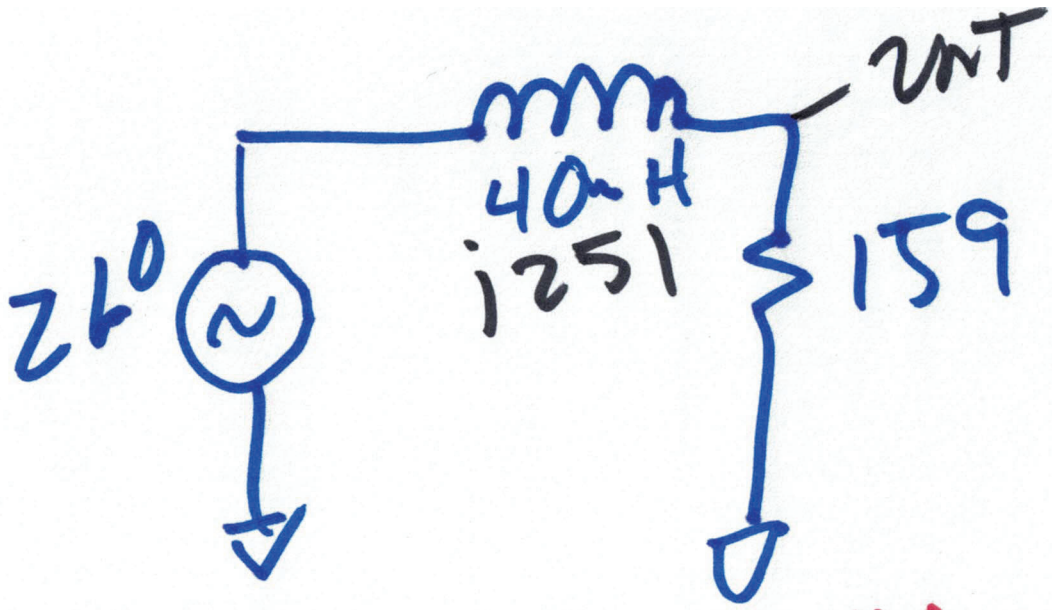
$\tau = (R_1 + R_2)C$







$\Rightarrow \frac{C_1 C_2}{C_1 + C_2}$



$$Z_C = \frac{1}{j\omega C}$$

$$Z_L = j \cdot \omega \cdot L$$

$$= j 2\pi f L$$

$$j \cdot 2\pi \cdot \underbrace{10^3}_{1\,KHz} \cdot \underbrace{40 \times 10^{-3}}_{40mH} = j \cdot 251$$

$$V_{out} = 2\angle 0 \cdot \frac{159 + j0}{159 + j251}$$

$$V_{out} = 2\angle 0 \cdot \frac{159\angle 0}{159 + j251}$$

$$V_{out} = \frac{318\angle 0}{297.1\angle 57.65^\circ}$$

$$V_{OT} = \frac{318}{297.1} \angle -57.65 = 1.07 \angle -57.6$$

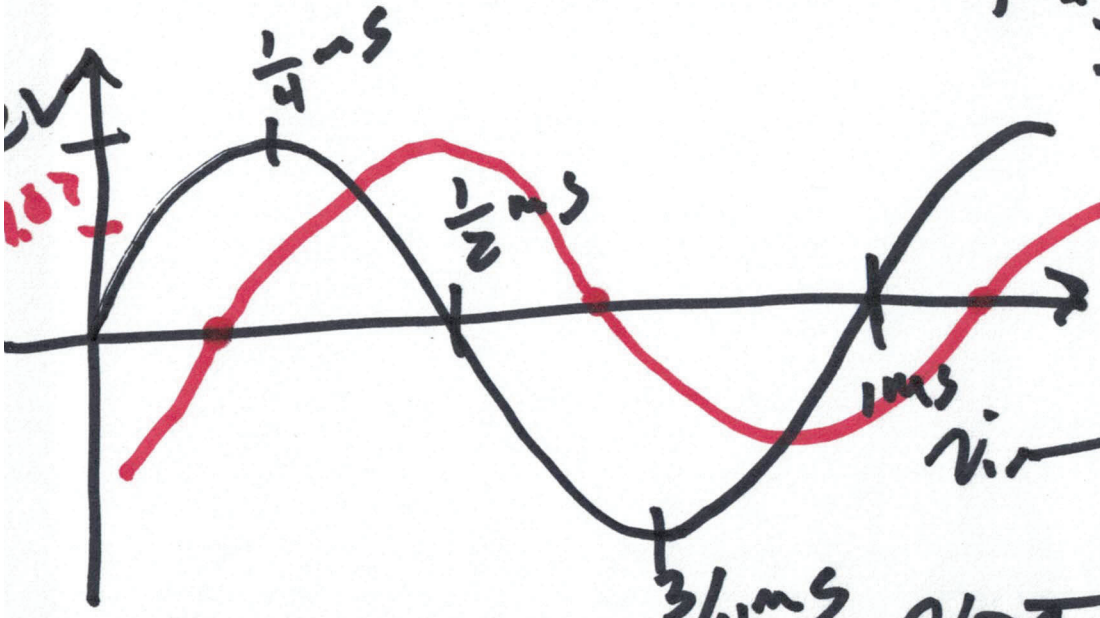
$$v_{OT} = 1.07 \sin(2\pi \cdot 10^3 \cdot t - 57.65)$$

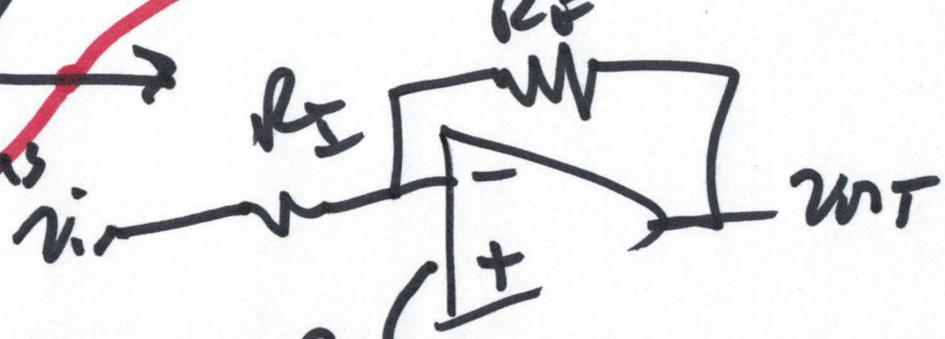
$$v_{IN} = 2.5 \sin(2\pi \cdot 10^3 \cdot t)$$

$$\theta = \frac{t_d}{T} \cdot 360 = 57.65$$

$$\frac{1}{f} = 10^{-3} \quad t_d = \frac{57.65}{360} \cdot 10^{-3}$$

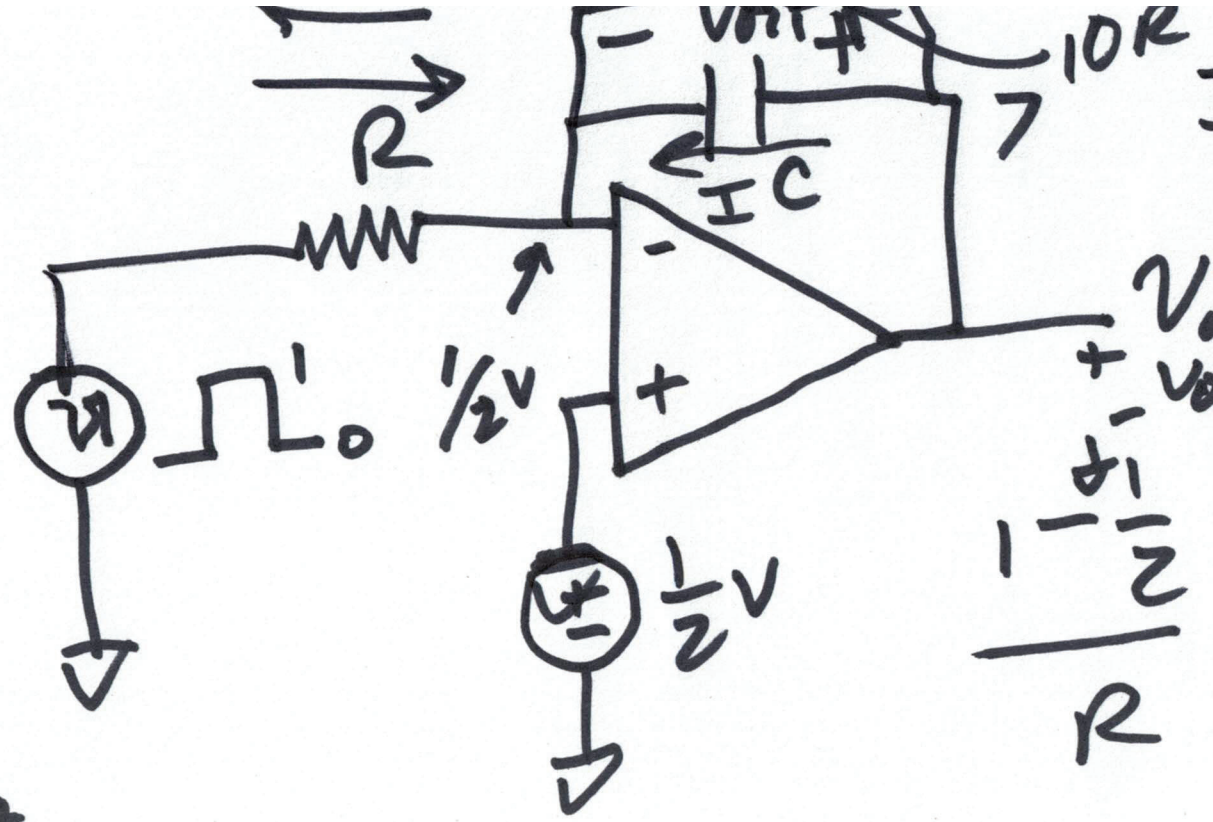
$$t_d = 160\,\mu s$$





$$\frac{v_{OT}}{v_{IN}} = -\frac{R_F}{R_I}$$

3)



$$I = C\frac{dv}{dt}$$

$$\frac{1 - \frac{1}{2}}{R} = I = \frac{\frac{1}{2}}{R}$$

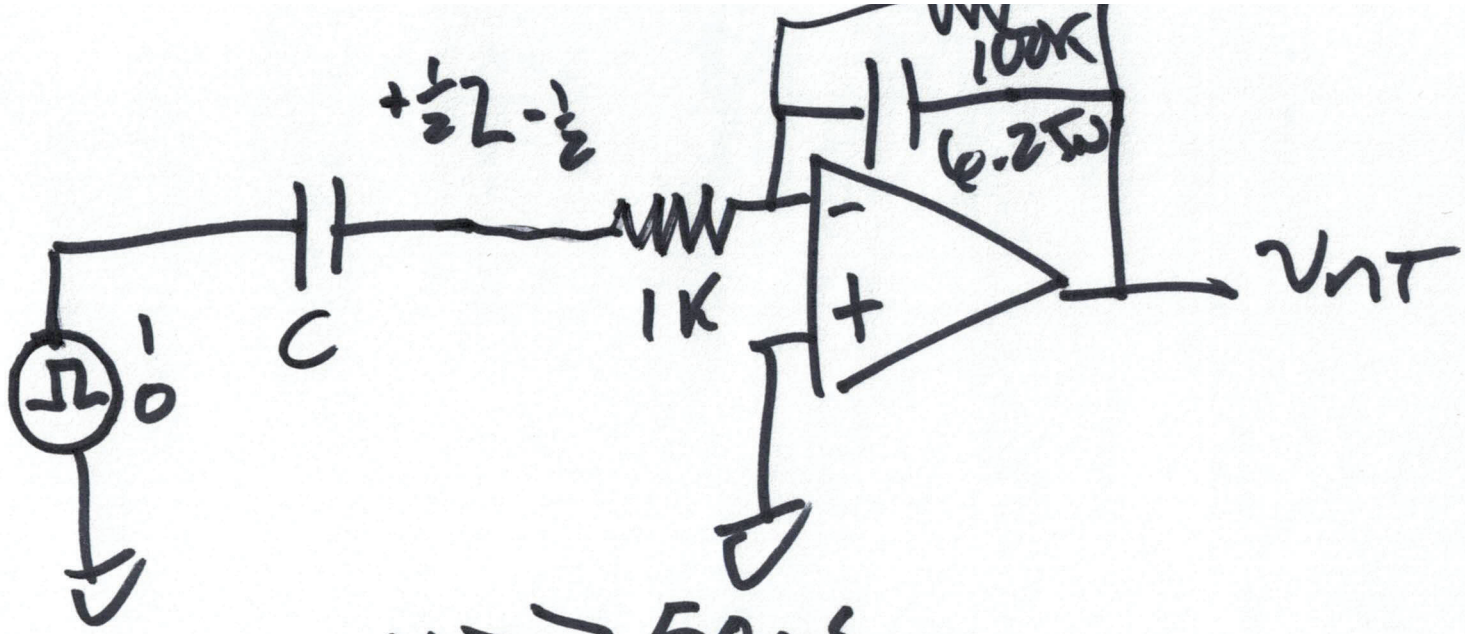
10 KHz
100μs

$$\frac{\frac{1}{2}}{R} = C \cdot \frac{dV}{dt} = C \cdot \frac{4V}{50\mu}$$

$$RC = \frac{50\mu}{2.4} = 6.25\mu s$$

$R = 1K$

$C = 6.25nF = 6,250pF$



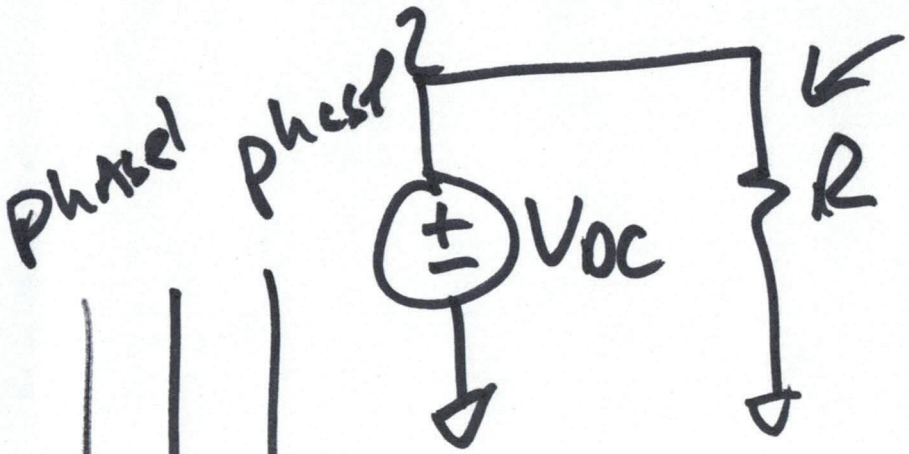
$C \cdot 1K >> 50\mu s$

$4.74F \cdot 1K$

$= 4.7ms$

Root Mean Square (RMS)

$$P = \frac{V_{DC}^2}{R}$$



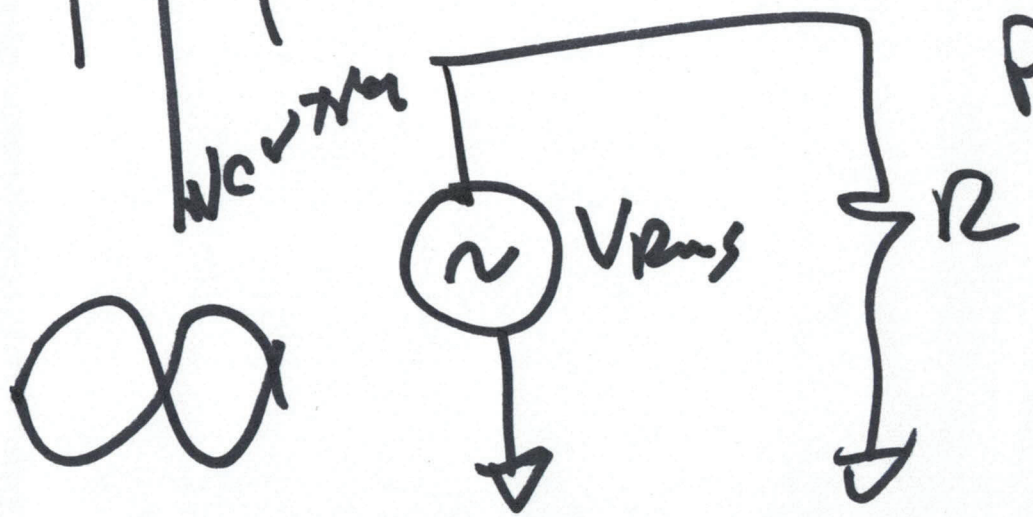
120 V Rms

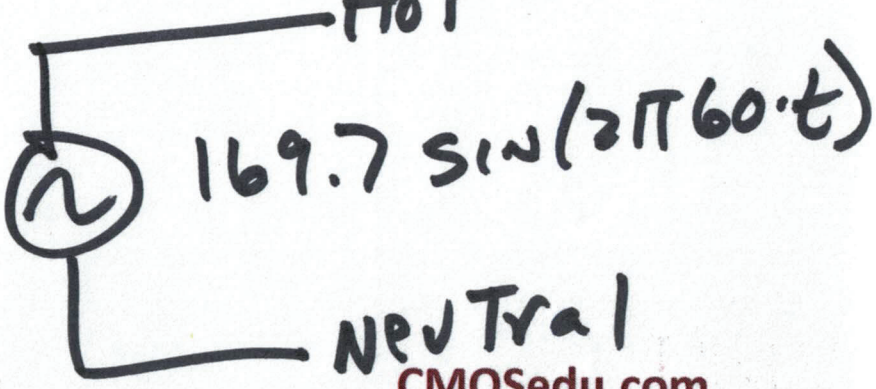
$$V_{Rms} = \frac{V_p}{\sqrt{2}}$$

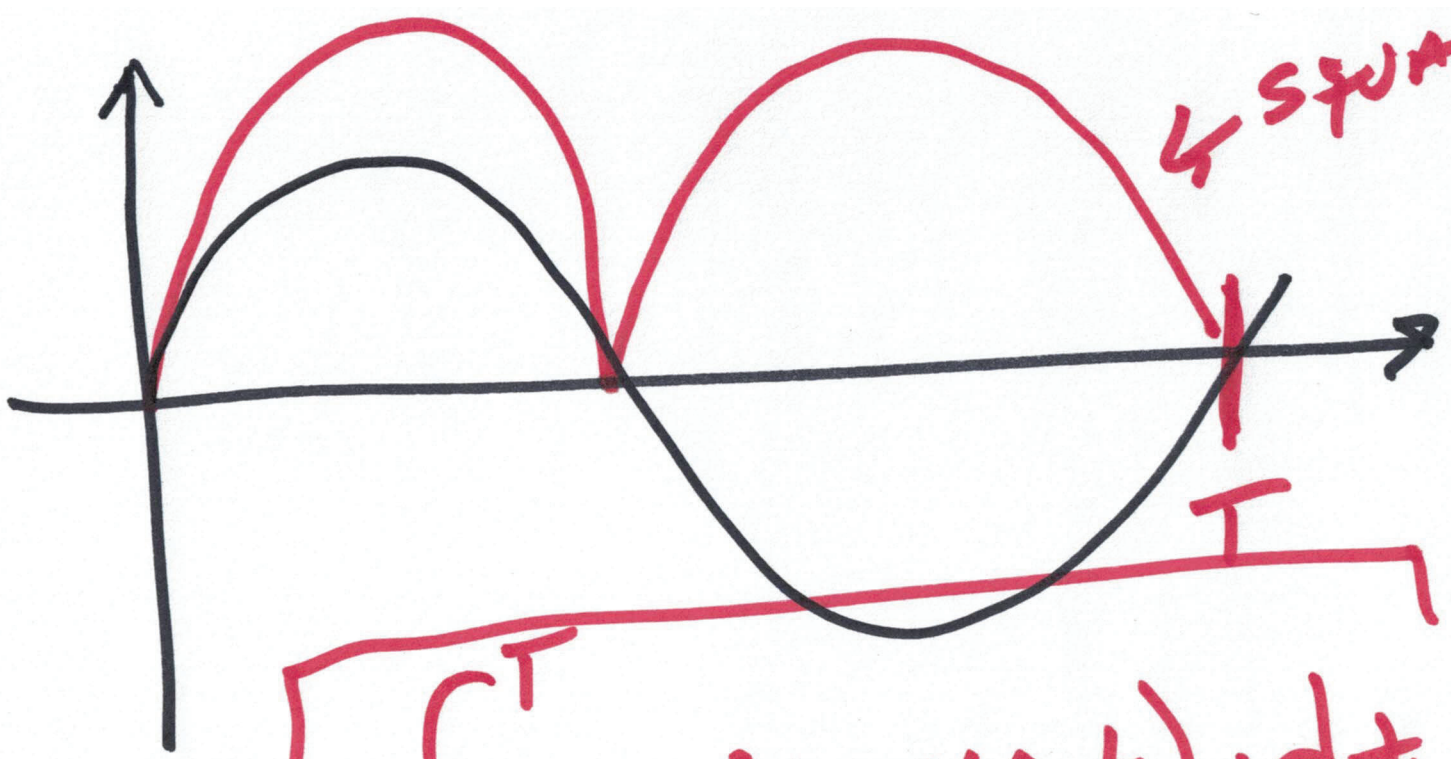
$$120 \cdot \sqrt{2} = V_p$$

$$V_p = 169.7$$

$$P = \frac{V_{Rms}^2}{R}$$







$$\text{RMS} = \sqrt{\frac{1}{T}\int_0^T V_p^2 \sin^2(2\pi 60 \cdot t)\cdot dt}$$

square → mean → root

$$\sin^2 x = \frac{1-\cos 2x}{2}$$

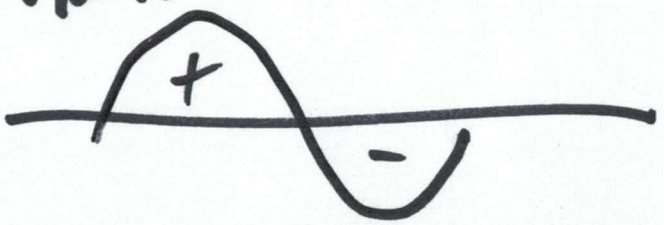
$$\frac{V_p^2}{T}\int_0^T \frac{1-\cos 2x}{2}\cdot dx$$

$$\int dx = x$$

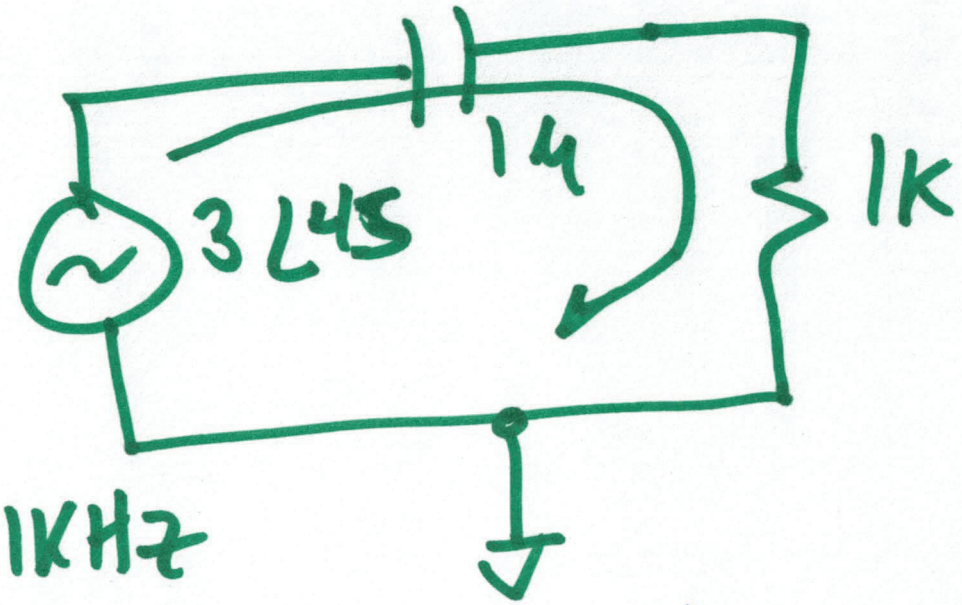
$$V_{rms} = \frac{V_p^2}{T}\left(\int_0^T \frac{1}{2}\cdot dx - \frac{1}{2}\int_0^T \cos 2x\, dx\right)$$

$$= \frac{V_p^2}{2T}\cdot x\Big|_0^T$$

$$= \frac{V_p^2}{2} \Rightarrow \sqrt{\quad} \Rightarrow \frac{V_p}{\sqrt{2}} = V_{rms}$$

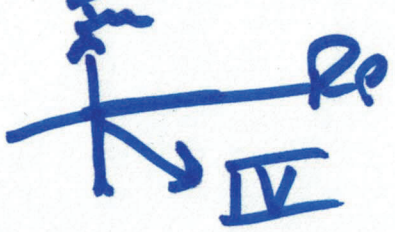


b)



$$Z_C = \frac{1}{j \cdot 2\pi \cdot 10^3 \cdot 10^{-6}} = -j159$$

$$i = \frac{3\angle 45}{10^3 + (-j159)} = \frac{3\angle 45}{1012\angle -90}$$



$$= 2.96\text{mA} \angle 540$$