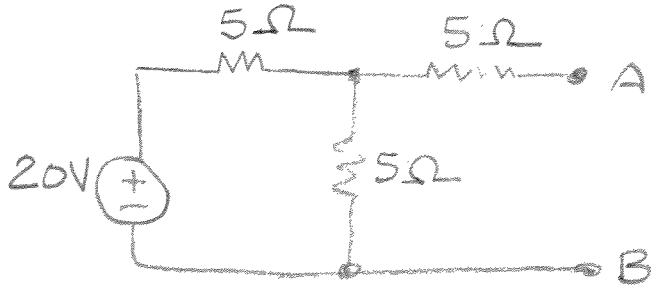
2/16/10

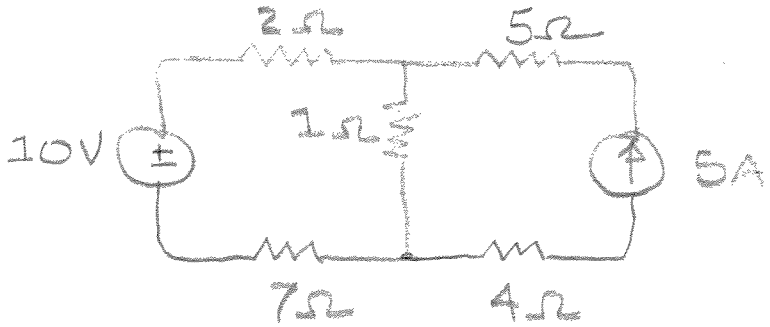
(1)



FIND THE THEVENIN VOLTAGE AND THE MAXIMUM POWER TRANSFER FOR THIS CIRCUIT.

A. 20V ; 10.0W
B. 20V ; 6.66W
C. 10V ; 3.33W
D. 5V ; 1.0W

(2)



USE MESH ANALYSIS

FIND THE POWER SUPPLIED OR DISSIPATED BY THE 10 V SOURCE.

A. 10W SUPPLIED
B. 5W SUPPLIED
C. 5W DISSIPATED
D. 2.5W DISSIPATED

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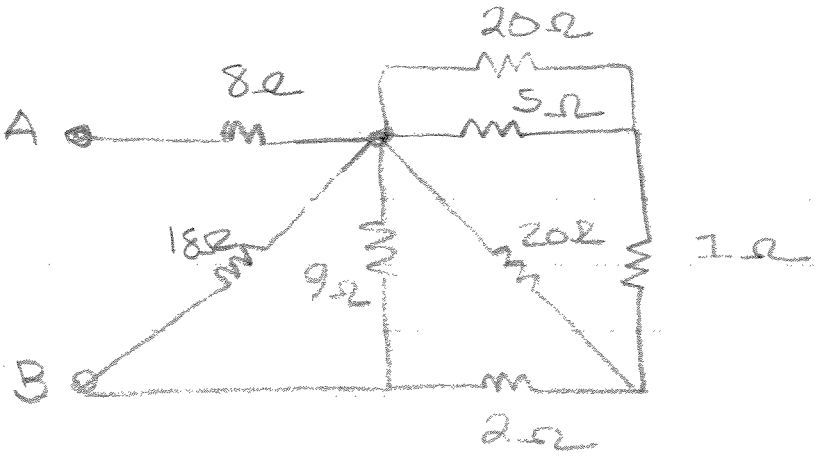
(2)

(3)



FIND THE EQUIVALENT RESISTANCE OF THIS CIRCUIT.

A 83Ω
B. 65Ω
C. 22Ω
D. 17Ω

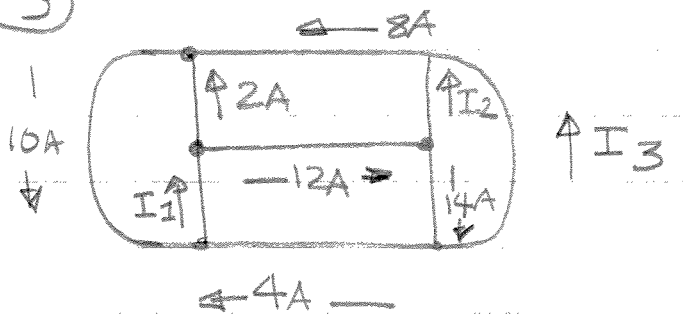
(4) A SOLID COPPER CONDUCTOR AT 20°C HAS THE FOLLOWING CHARACTERISTICS. RESISTIVITY = 1.77×10^{-8} Ωm, diameter = 5mm, AND LENGTH = 5000m. WHAT IS THE RESISTANCE OF THE CONDUCTOR?

A. 0.017Ω
B. 4.5Ω
C. 12Ω
D 18Ω

2/16/10

(3)

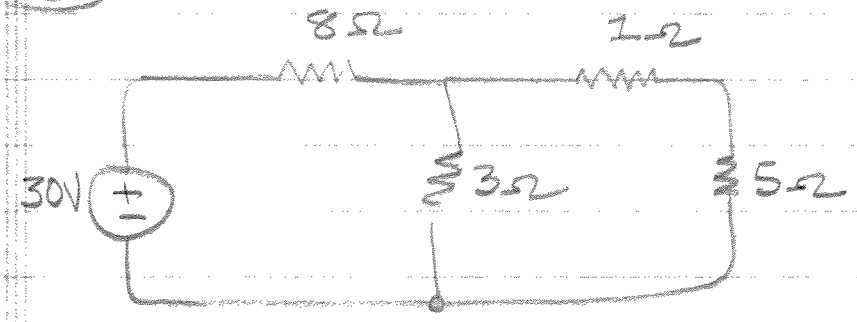
(5)



USE KCL TO FIND I_1 & I_2

A 14A & 2A
B -14A & 2A
C 14A & -2A
D 10A & -2A

(6)

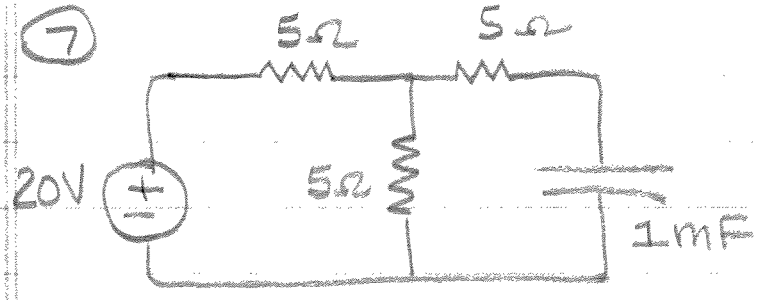


FIND THE CURRENT THROUGH THE 5Ω RESISTOR?

A. 4A
B. 3A
C. 2A
D. 1A

2/16/10
(4)

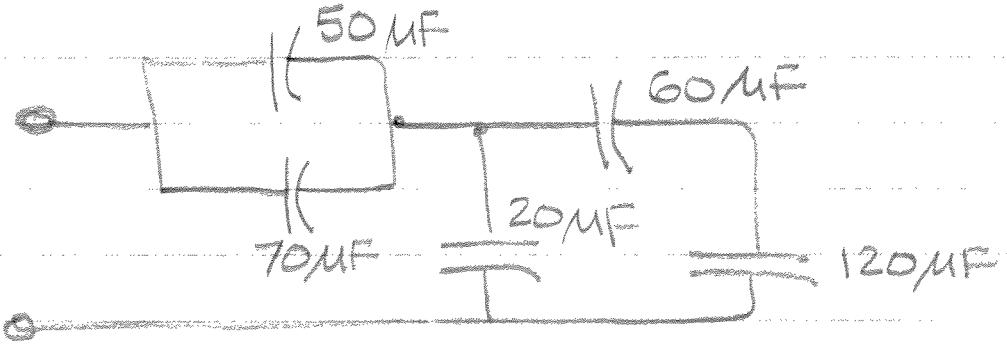
(7)



FIND THE ENERGY STORED IN THE 1MF CAPACITOR. THE CIRCUIT IS AT DC STEADY STATE.

A. 200m Joules
B. 67m Joules
C. 50m Joules
D 100m Joules

(8)



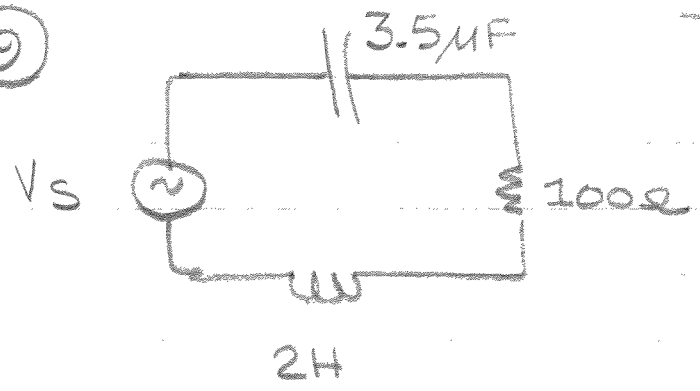
FIND THE EQUIVALENT CAPACITANCE AT THE TERMINALS OF THE CIRCUIT.

A. 20.9MF
B. 40MF
C. 120MF
D 320MF

2/16/10

AC CIRCUIT (5)

(9)



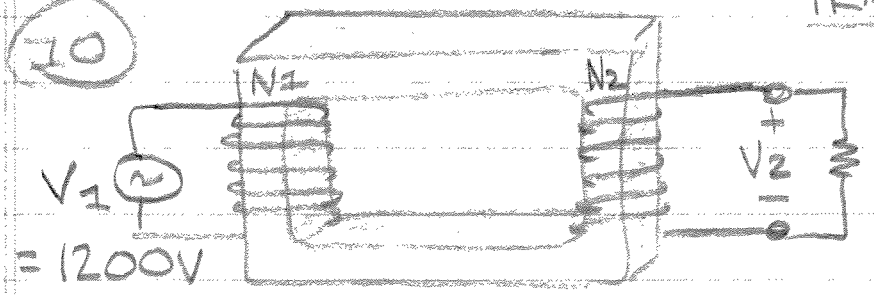
$V_S = 100\cos(377t - 90°)$

WHAT IS THE IMPEDANCE OF THIS AC CIRCUIT?

A. $100\Omega + 3.5\mu F + 2H$
B. $100 + j377\ \Omega$
C. $100\ \Omega$
D $-j744\ \Omega$

TRANSFORMER

(10)



IF THE PRIMARY COIL, N_1, OF THE TRANSFORMER HAS 500 TURNS, AND THE VOLTAGE ACROSS THE SECONDARY COIL IS 240V, HOW MANY TURNS DOES N_2 HAVE?

A. 100 TURNS
B. 200 TURNS
C. 500 TURNS
D 1000 TURNS

2/16/10

2/16/09
(6)

CE MOCK FE
ANSWER KEY

1. 10V & 3.3W
2. 5W
3. 11 Ω
4. 4.5 Ω
5. 14A & -2A
6. 1 A
7. 50mJoules
8. 40 μF
9. 100 Ω
10. 100 TURNS

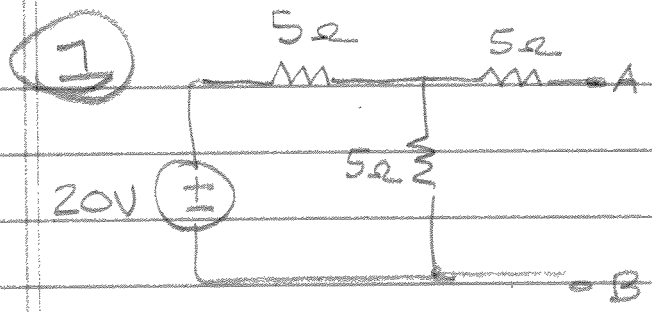
SEE PP 7-12 FOR DETAILED SOLUTIONS

THEVENIN EQUIVALENT CIRCUIT / MAX POWER TRANSFER

2/16/10

(7)

(7)

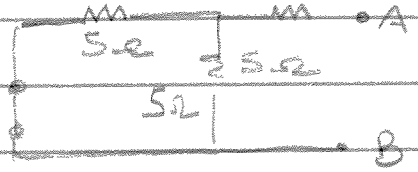


$V_{TH} = V_{OC} = V_{5\Omega}$ (VERTICAL)

VOLTAGE DIVISION:

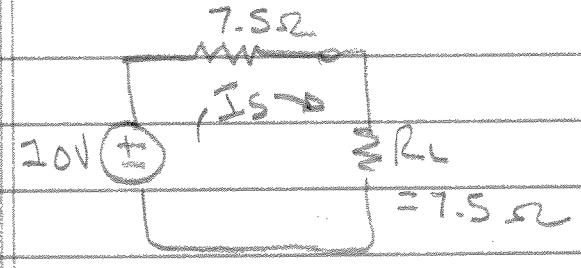
$$V_{R_2} = V_S \frac{R_2}{R_1 + R_2} = 20 \times \frac{5}{5+5} = 10V = V_{TH}$$

$R_{LOAD} = R_{TH}$ → MAX POWER TRANSFER



KILL SOURCE

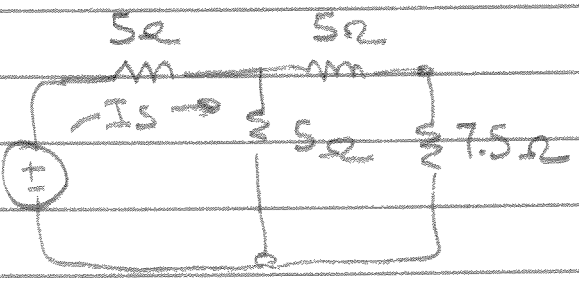
$R_{TH} = 5 + 5 \| 5 = 7.5\Omega$



$$I_S = \frac{10}{15} = 0.667A$$

THEVENIN EQUIVALENT CIRCUIT

$$P_L = I^2R = (0.667)^2(7.5) = 3.33W$$



$R_E = 5 + 5 \| 12.5 = 8.57\Omega$

$I_S = 20/8.57 = 2.33A$

$I_{LOAD} = 2.33 \times 5/7.5 = 0.667A$

$P_L = (0.667)^2(7.5)$

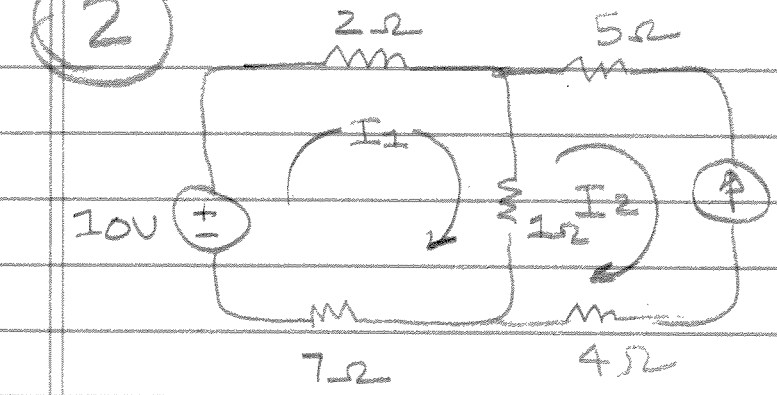
$= 3.33W$ ✓

CHECK

2/16/10

(8)

(2)



MESH #1 $-10 + 2I_1 + 1(I_1 - I_2) + 7I_1 = 0$

$-10 + 10I_1 - I_2 = 0$

MESH #2 $I_2 = -5A$

$\therefore 10I_1 - (-5) - 10 = 0$

$10I_1 = 5 \Rightarrow I_1 = 0.5A$

$P_{10V} = IV = 0.5 \times 10 = 5W$

KVL CHECK: $-10 + 2(0.5) + 1(0.5 - [-5]) + 7(0.5)$

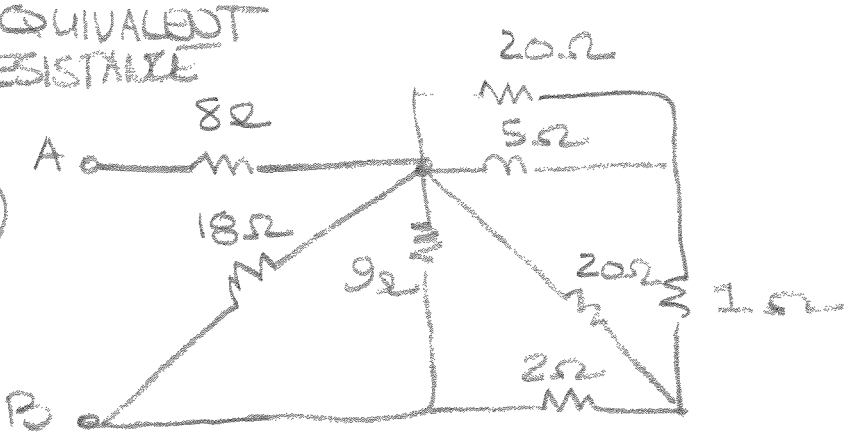
$-10 + 1 + 5.5 + 3.5 = 0$

EQUIVALENT RESISTANCE

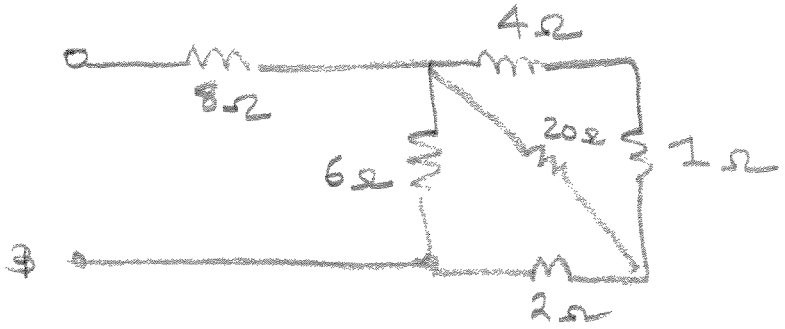
2/16/10

9

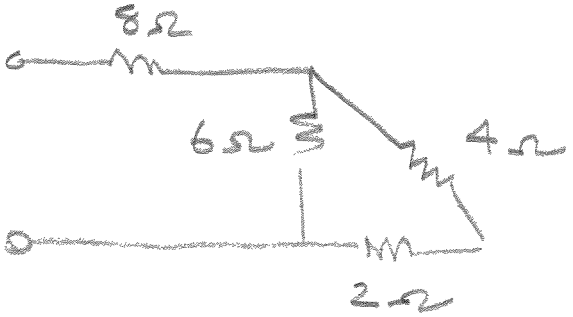
(3)



$20 \| 5 = 4\Omega$; $18 \| 9 = 6\Omega$



$(4+1) \| 20 = 4\Omega$



$(2+4) \| 6 = 3\Omega$; $3 + 8 = \boxed{11\Omega}$

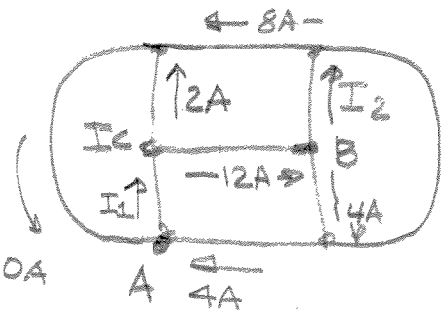
(4) COPPER WIRE : USE $R = \rho \ell / A$

$$R = \frac{(1.77 \times 10^{-8}\ \Omega \cdot m)(5000 m)}{\pi/4 \left[(5mm)\left(\frac{1m}{1000mm}\right) \right]^2} = \boxed{4.51\Omega}$$

2/16/10

(10)

(5)



KCL

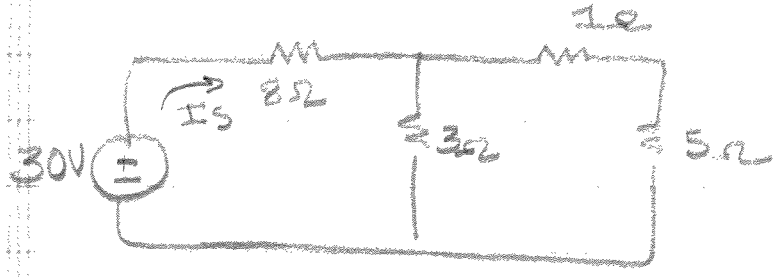
$\Sigma I_{NODE} = 0$

$\Sigma I_A = \underbrace{4 + 10}_{I_N} = \underbrace{I_1}_{I_{out}}$ $= 14A = I_1$

$\Sigma I_B = \underset{IN}{12} = \underbrace{14 + I_2}_{out}$, $I_2 = -2A$

$\Sigma I_C = \underset{IN}{14} = \underset{out}{2 + 12}$ ✓

(6)



$R_E = 8 + 3||6 = 10\Omega$

$I_S = 30/10 = 3A$

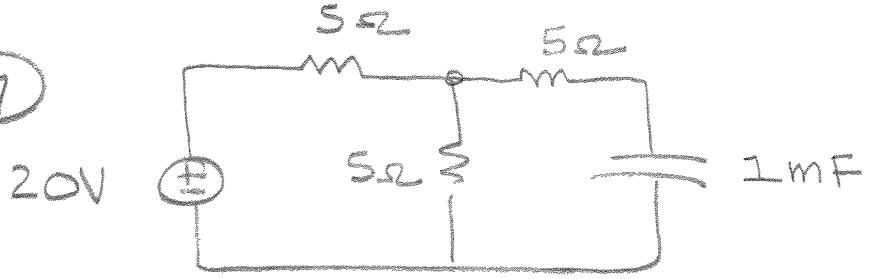
$I_{5\Omega} = I_{6\Omega} = 3 \times 3/9 =$ 1A

USE RE;
OHMS LAW
CURRENT DIVISION

2/16/10

(11)

(7)



$$W_{CAP} = \frac{1}{2} C V^2$$

$$V_{CAP} = V_{5\Omega\ \text{VERTICAL}} = 20 \times \frac{5}{10} = 10V$$

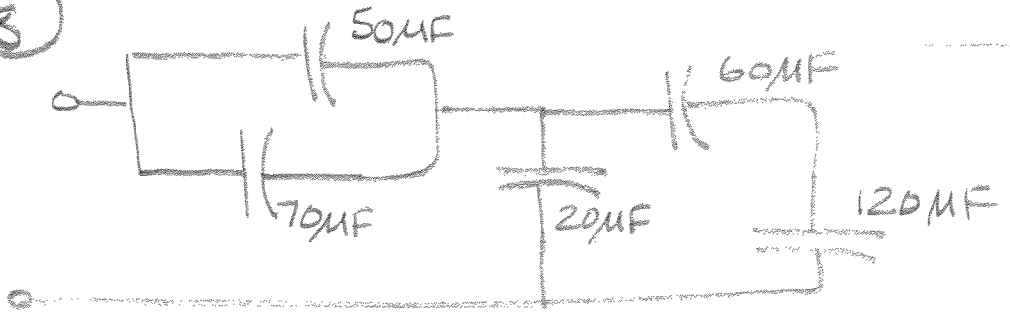
VOLTAGE DIV.

NOTE, NO CURRENT FLOWS IN RIGHT LOOP,

SO $V_{\substack{\text{RIGHT} \\ 5\Omega}} = 0$, $\therefore V_{CAP} = V_{\substack{5\Omega \\ \text{VERTICAL}}} = 10V$

$$W = \frac{1}{2} C V^2 = \frac{1}{2}(1 \times 10^{-3})(10)^2 = 50 \text{mJoules}$$

(8)



$$50\mu F \,||\, 70\mu F = 120\mu F$$

$$60\mu F + 120\mu F = \frac{(60\mu F)(120\mu F)}{(60\mu F + 120\mu F)} = 40\mu F$$

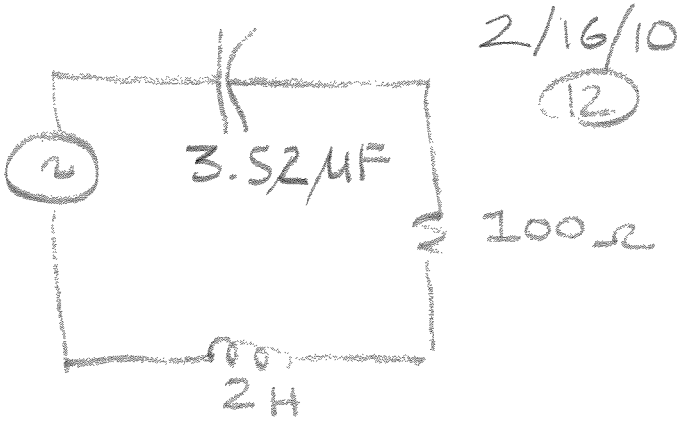
$$40\mu F \,||\, 20\mu F = 60\mu F$$

$$120\mu F + 60\mu F = \frac{(120\mu F)(60\mu F)}{(120 + 60)\mu F} = 40\mu F$$

2/16/10

(12)

$100\cos(377t - 90°)$ VOLTS



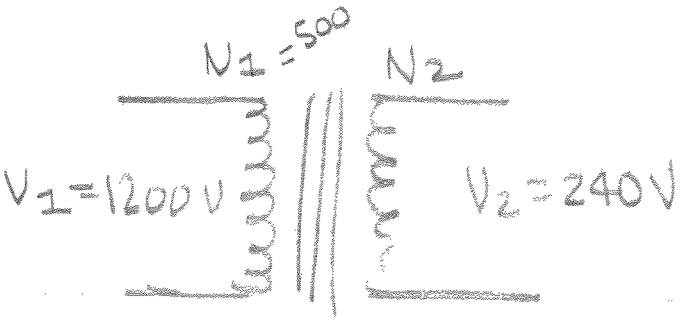
$Z_R = 100\Omega$

$$Z_C = -\frac{J}{\omega C} = -\frac{J}{(377)(3.52\times10^{-6})} = -J754\Omega$$

$$Z_L = J\omega L = J(377)(2) = +754\Omega$$

$$Z_{EQ} = 100\Omega - J754\Omega + J754\Omega$$
$$= 100\Omega$$

THIS IS CALLED A RESONANT CIRCUIT



$$\frac{V_2}{V_1} = \frac{N_2}{N_1} \qquad \frac{240}{1200} = \frac{N_2}{500}$$

$$N_2 = 500\left(\frac{240}{1200}\right) = 100 \text{ TURNS}$$