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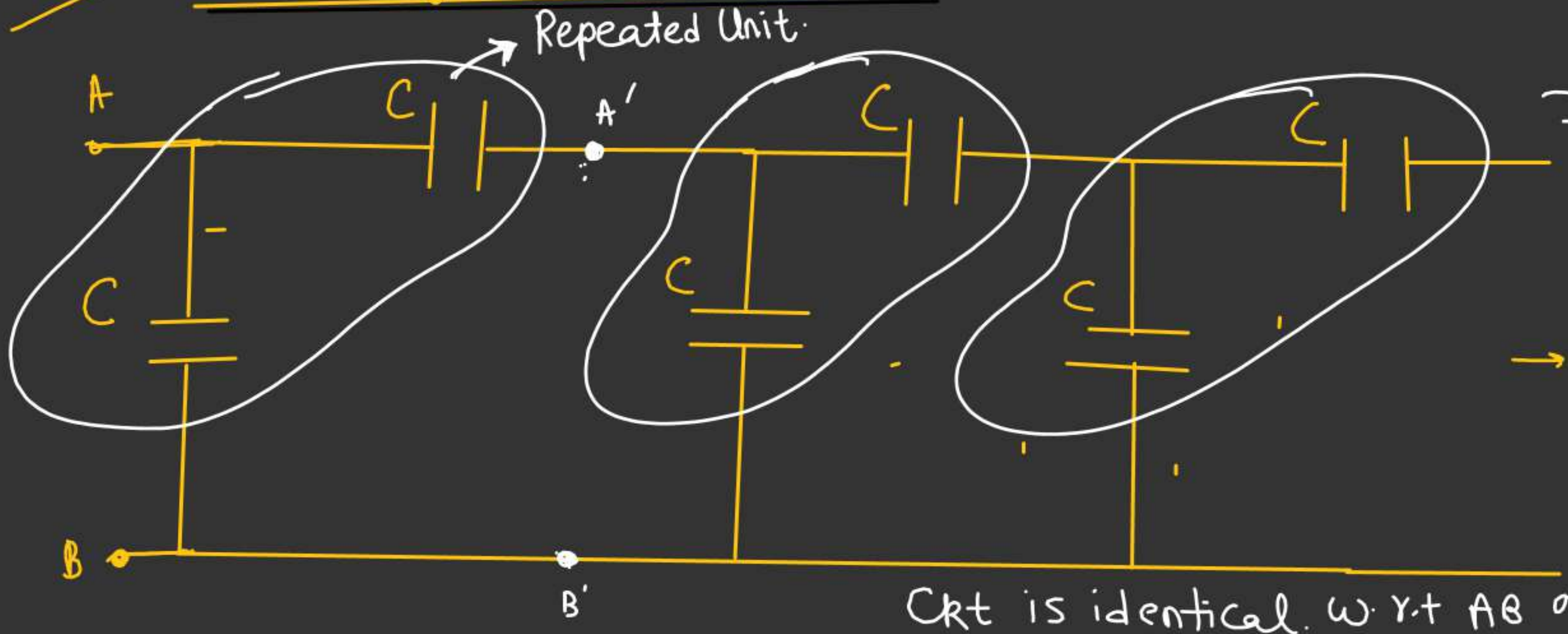
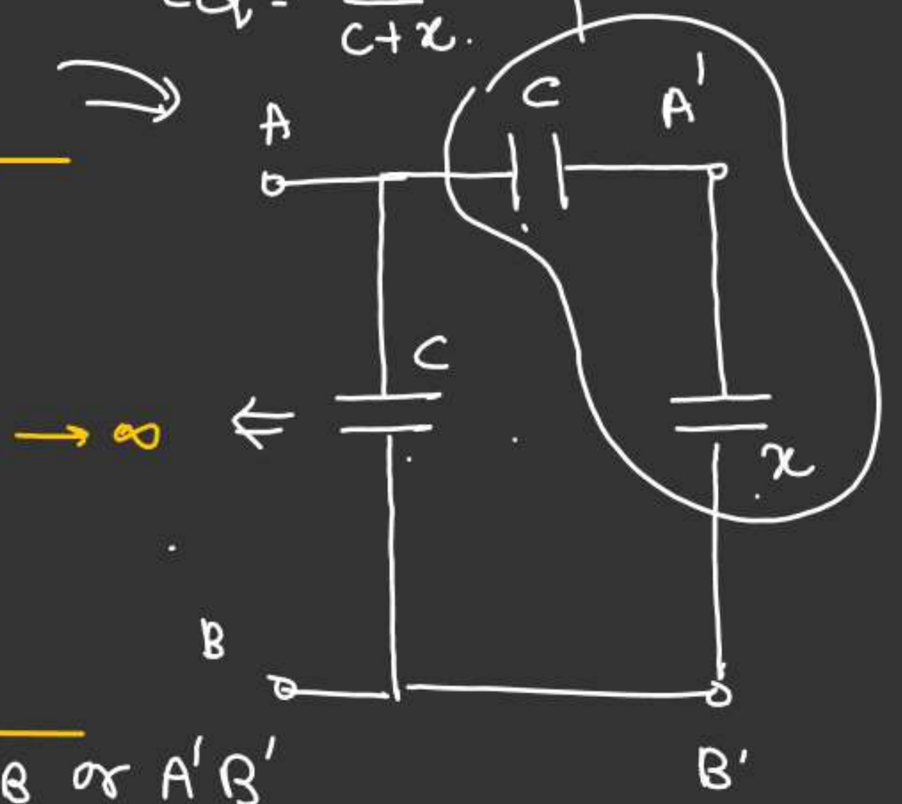
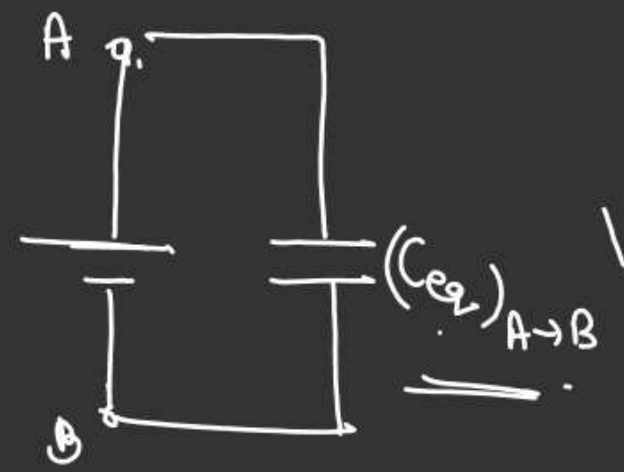
(8). Case of infinite ladder :→

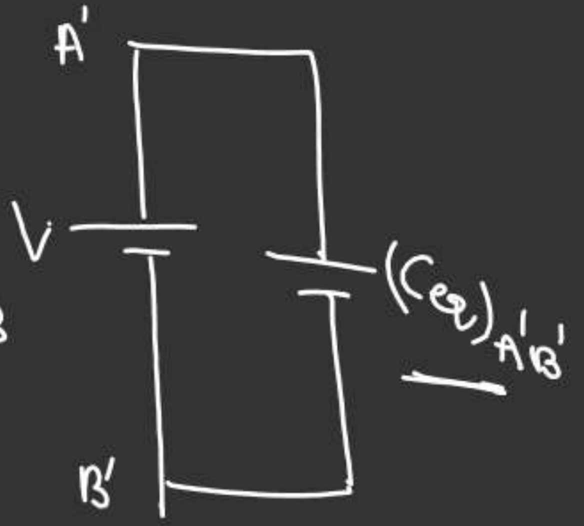


$$\frac{1}{C_{eq}} = \frac{1}{C} + \frac{1}{x}$$

$$C_{eq} = \frac{Cx}{C+x}$$







Ckt is identical w.r.t AB or A'B'

$$(C_{eq})_{AB} = (C_{eq})_{A'B'} = x \checkmark$$

$$x = \frac{Cx}{C+x} + C \Rightarrow x(C+x) = Cx + C(C+x)$$

$$\Rightarrow \cancel{xC} + x^2 = \cancel{Cx} + C^2 + Cx.$$

$$x^2 - Cx - C^2 = 0 \Rightarrow x = \frac{C \pm \sqrt{C^2+4C^2}}{2}$$

$$\frac{C(1+\sqrt{5})}{2}$$ Ans (+ve Roots)

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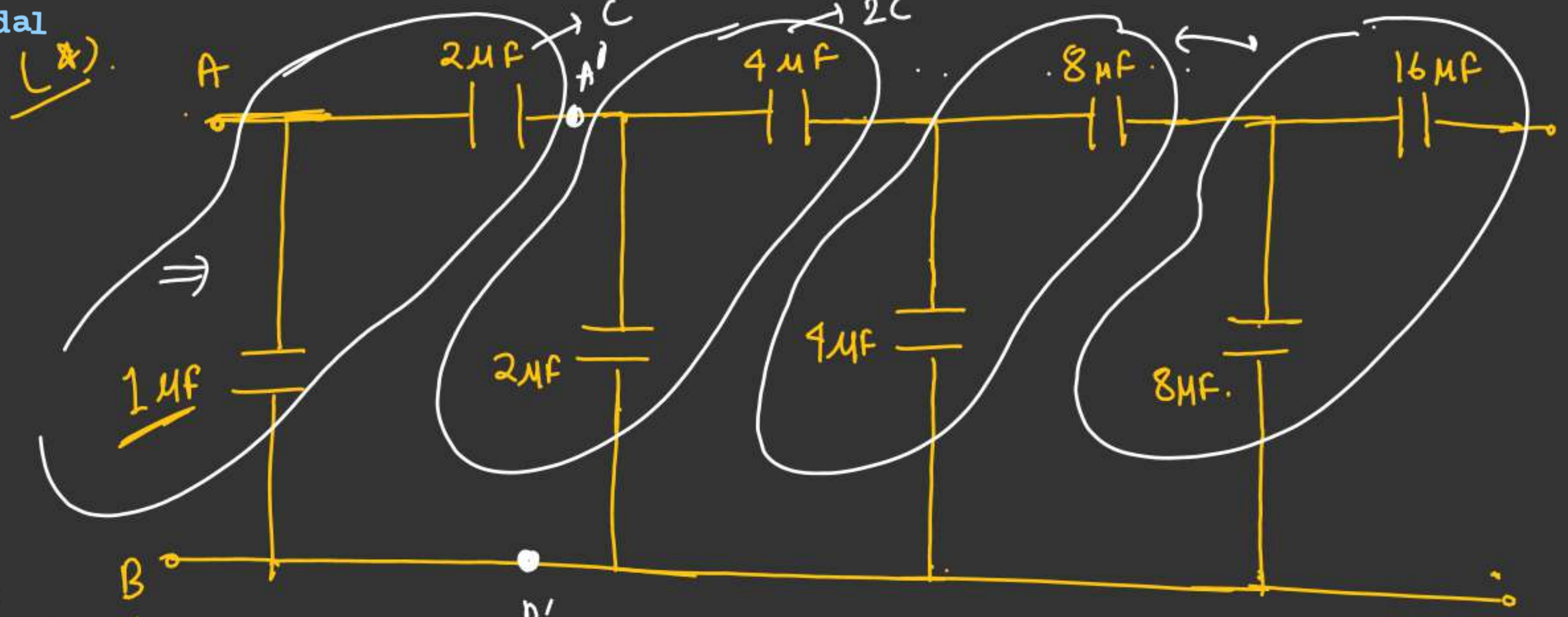
(*).

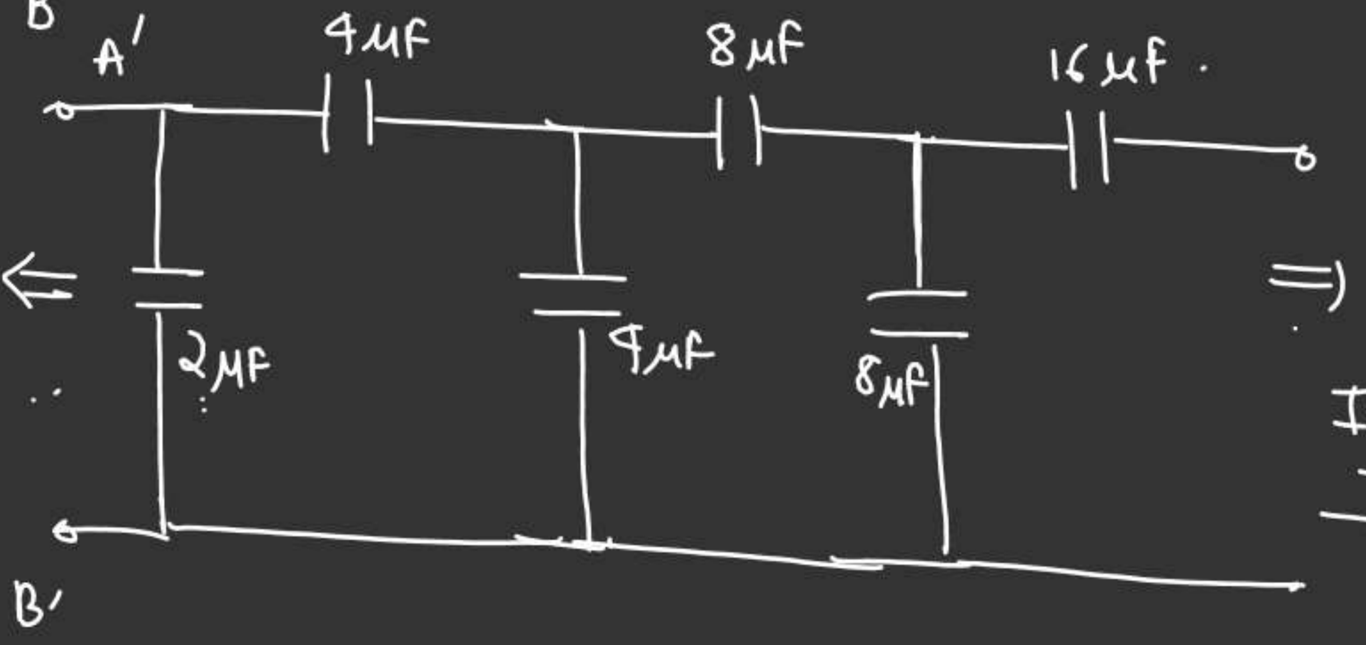


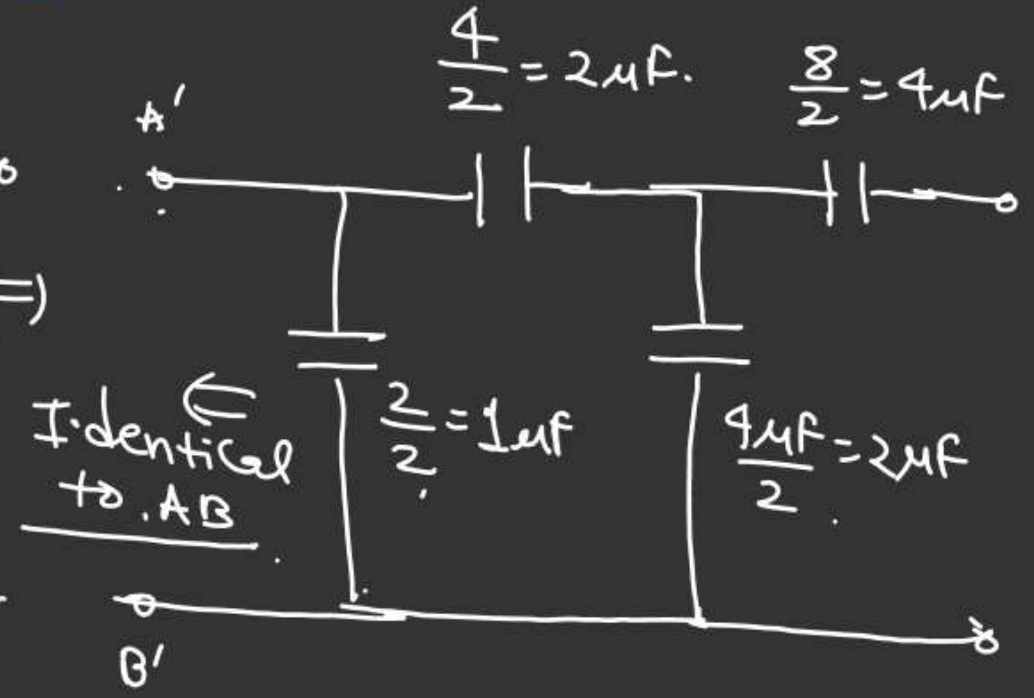
x

$\frac{1}{2}(C_{eq})_{A'B'} = (C_{eq})_{A-B}$

$(C_{eq})_{A-B} = ??$

$(C_{eq})_{A'B'} = x$ ✓





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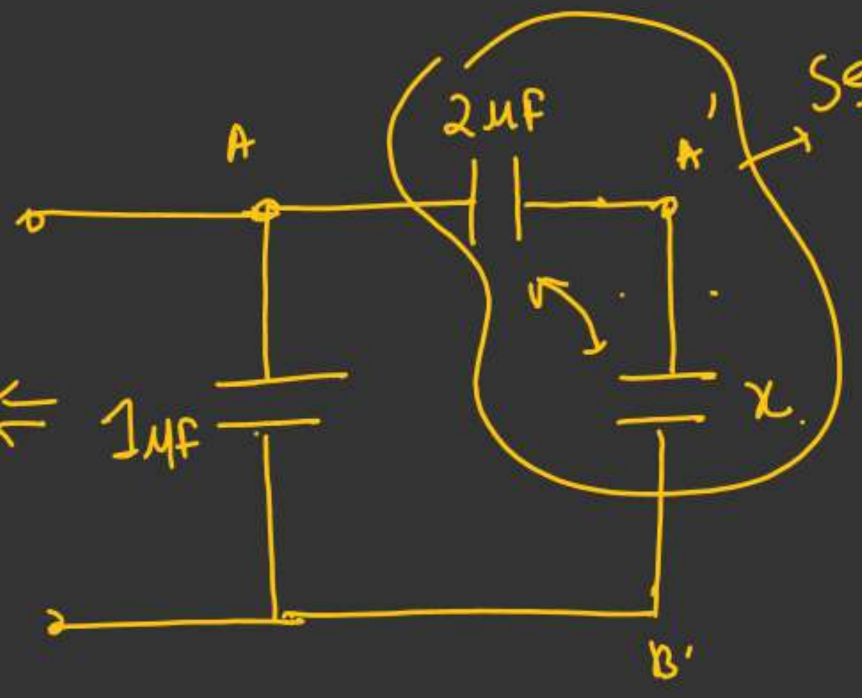

Series.

$\underline{(C_{eq})_{A'B'} = x}$

$\frac{x}{2} \Leftarrow$

$$\frac{2x}{2+x} + 1 = \frac{x}{2}$$

$$\Rightarrow \frac{2x+2+x}{2+x} = \frac{x}{2}$$

$$\Rightarrow 2(3x+2) = x(2+x)$$

$$\Rightarrow \underline{6x}+4 = \underline{2x}+x^2$$

$$x^2 - 4x - 4 = 0$$

$$x = \frac{4 \pm \sqrt{16+16}}{2}$$

$$x = \frac{4(1 \pm \sqrt{2})}{2}$$

$$\underline{x = 2(1+\sqrt{2})}\ \underline{\text{Ans}}\ \checkmark$$

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Equivalent capacitance (Symmetry) CAPACITOR

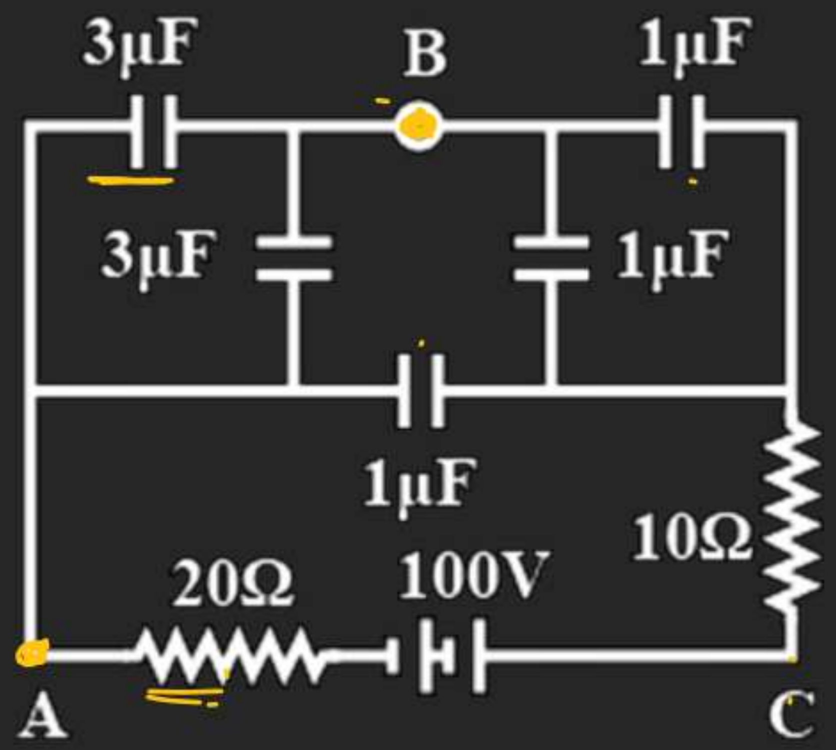
H.W

Q.1 In circuit shown in figure calculate the potential difference between the points A and B and between the points B and C in the steady state.

R-C Ckt

⇓

In Current Electricity



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Equivalent capacitance (Symmetry) CAPACITOR

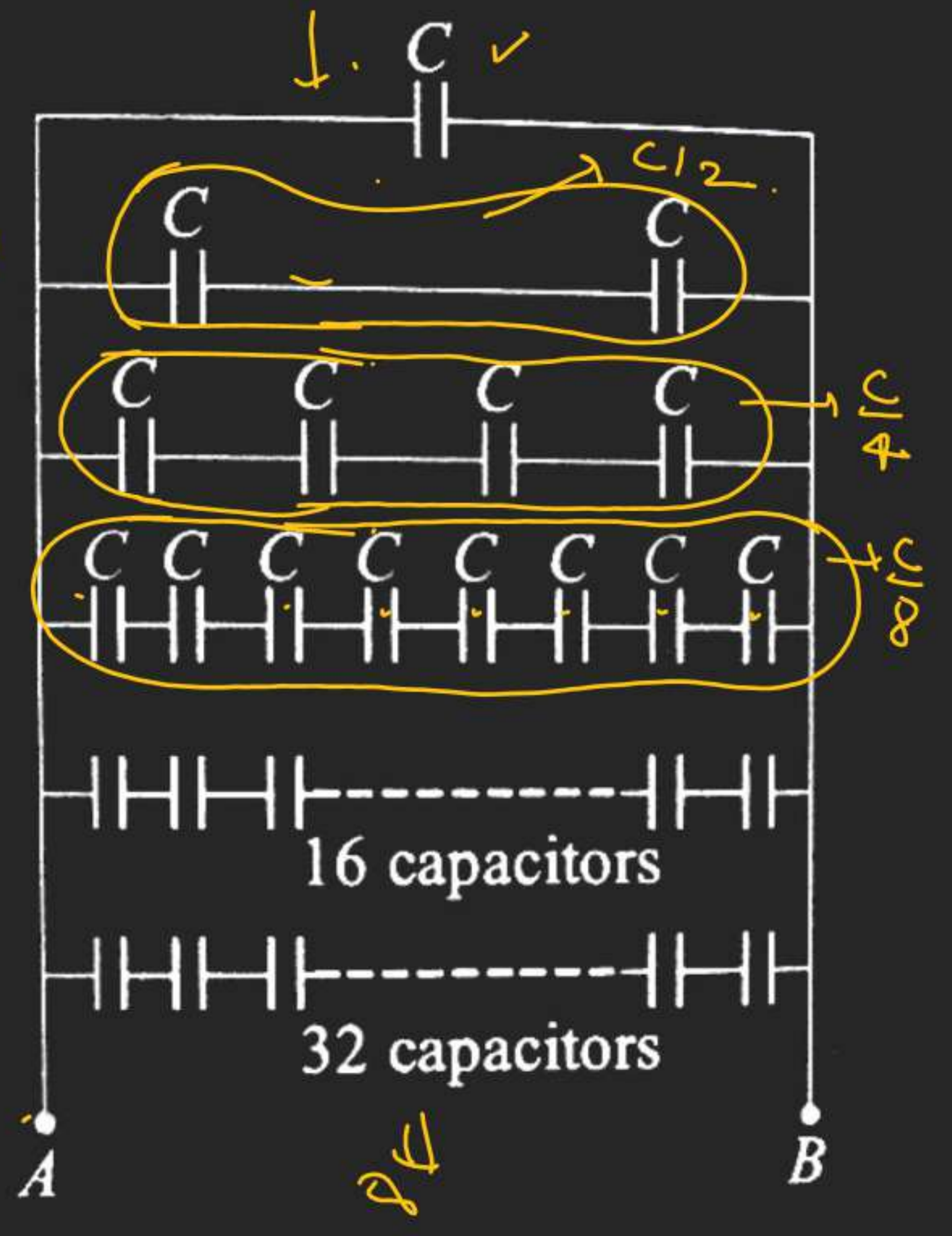
H-W

(iii) Infinite number of identical capacitors each of capacitance 1μF are connected as shown in figure. Find the equivalent capacitance of system between the terminals A and B shown in figure.

$$C_{eq} = C + \frac{C}{2} + \frac{C}{4} + \frac{C}{8} + \frac{C}{16} + \frac{C}{32} \dots \infty$$

$$C_{eq} = C\left[1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \frac{1}{2^4} + \frac{1}{2^5} \dots \infty\right]$$

$$C_{eq} = C\left(\frac{1}{1-\frac{1}{2}}\right) = 2C = 2\mu F \text{ Ans}$$



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Equivalent capacitance (Symmetry) CAPACITOR

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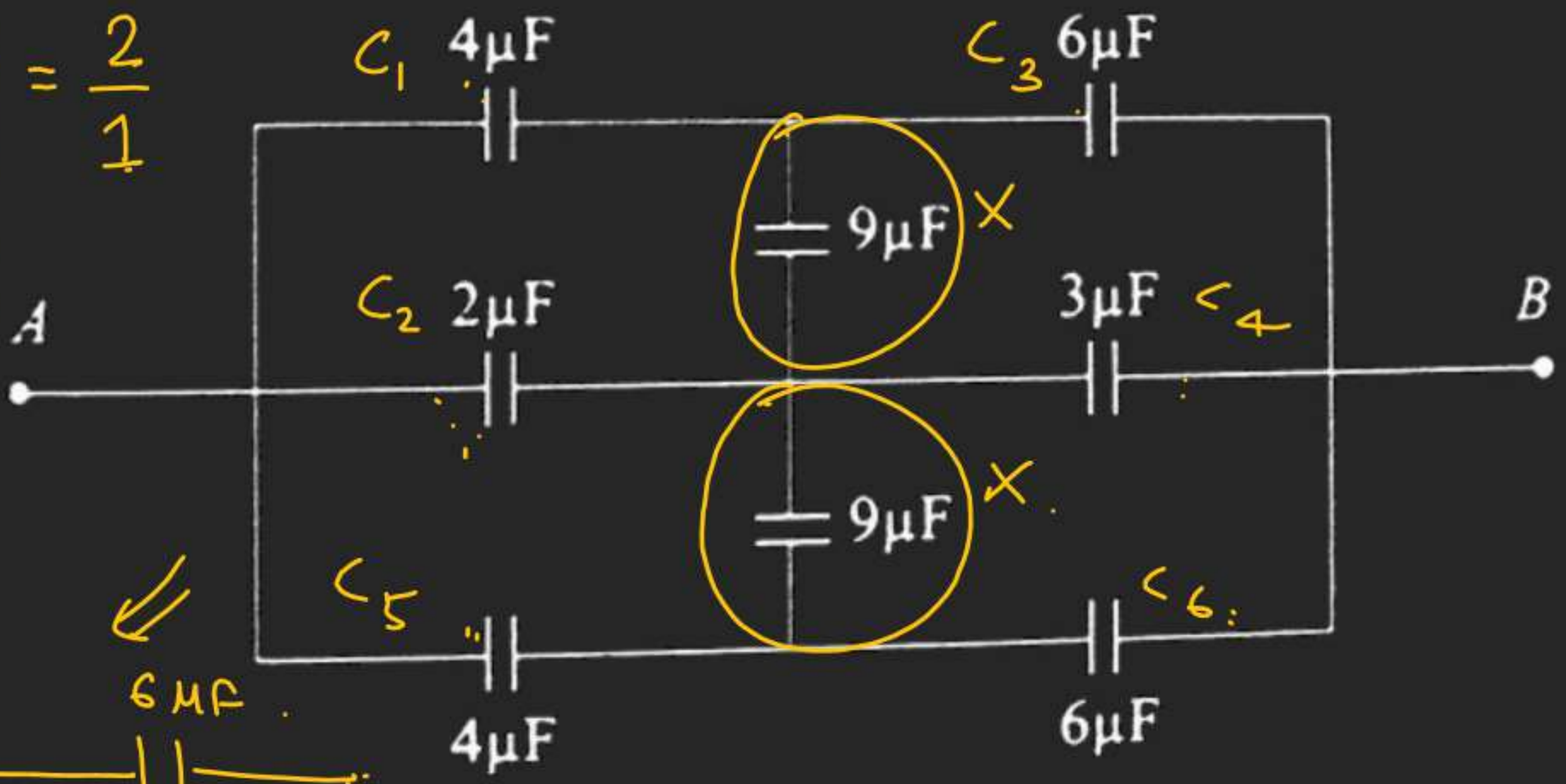
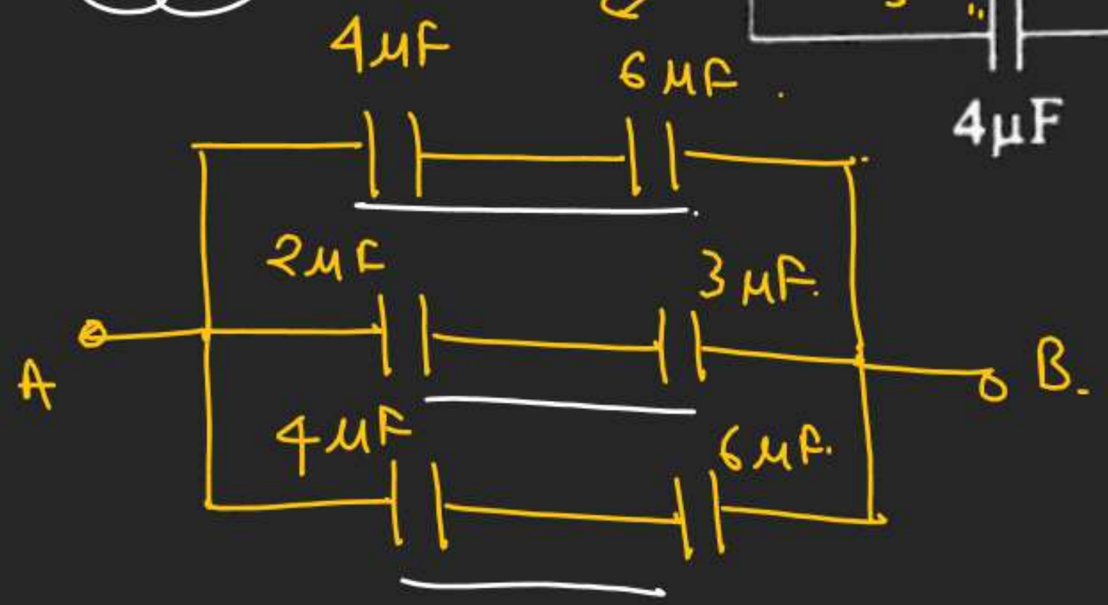
$(C_{eq})_{A-B} = ??$



$$\frac{C_1}{C_2} = \frac{C_3}{C_4} = \frac{2}{1}$$

$$\frac{C_2}{C_5} = \frac{C_4}{C_6} = \frac{1}{2}$$

$$(C_{eq})_{A-B} = \boxed{6\,\mu F}$$



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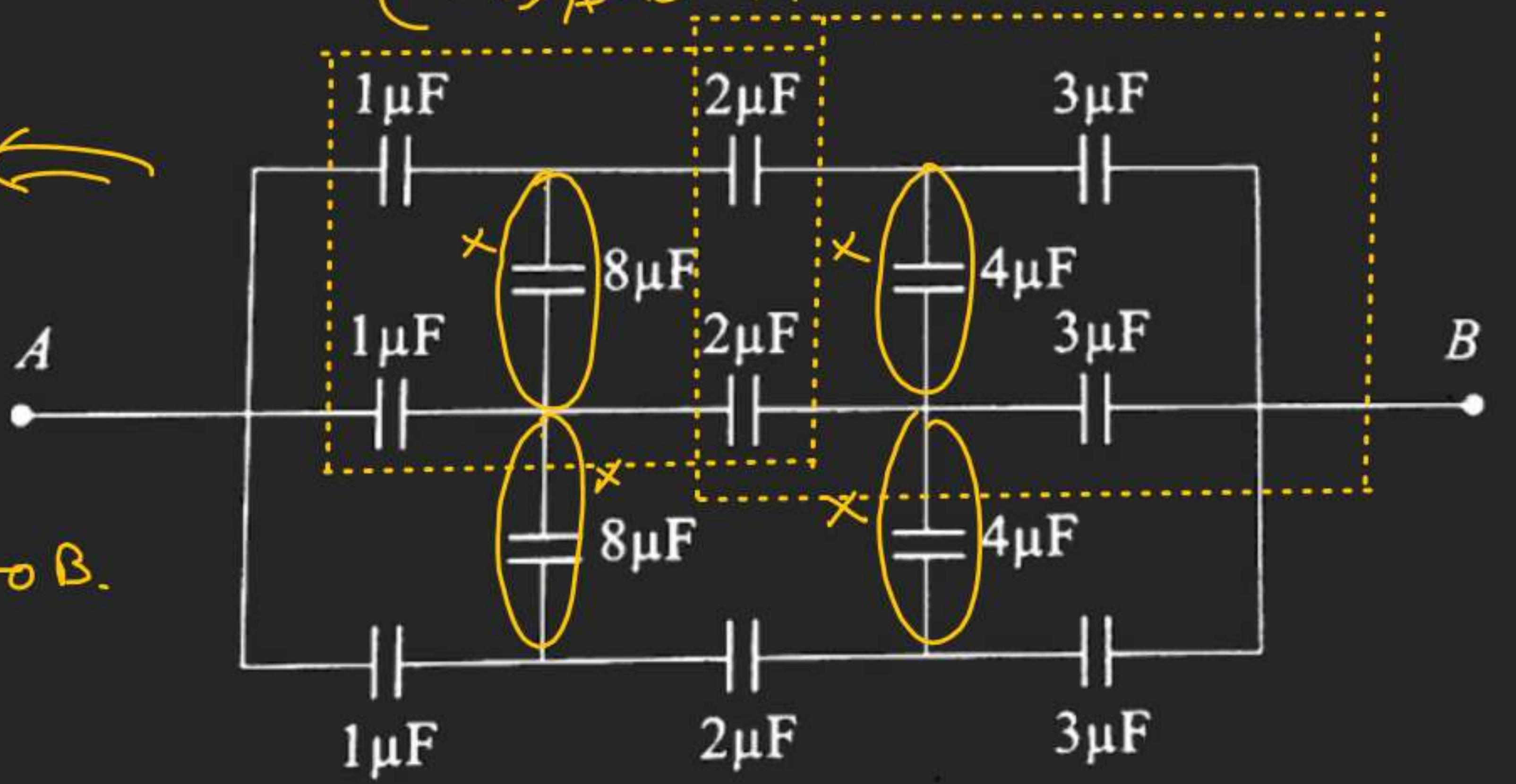
Equivalent capacitance (Symmetry)

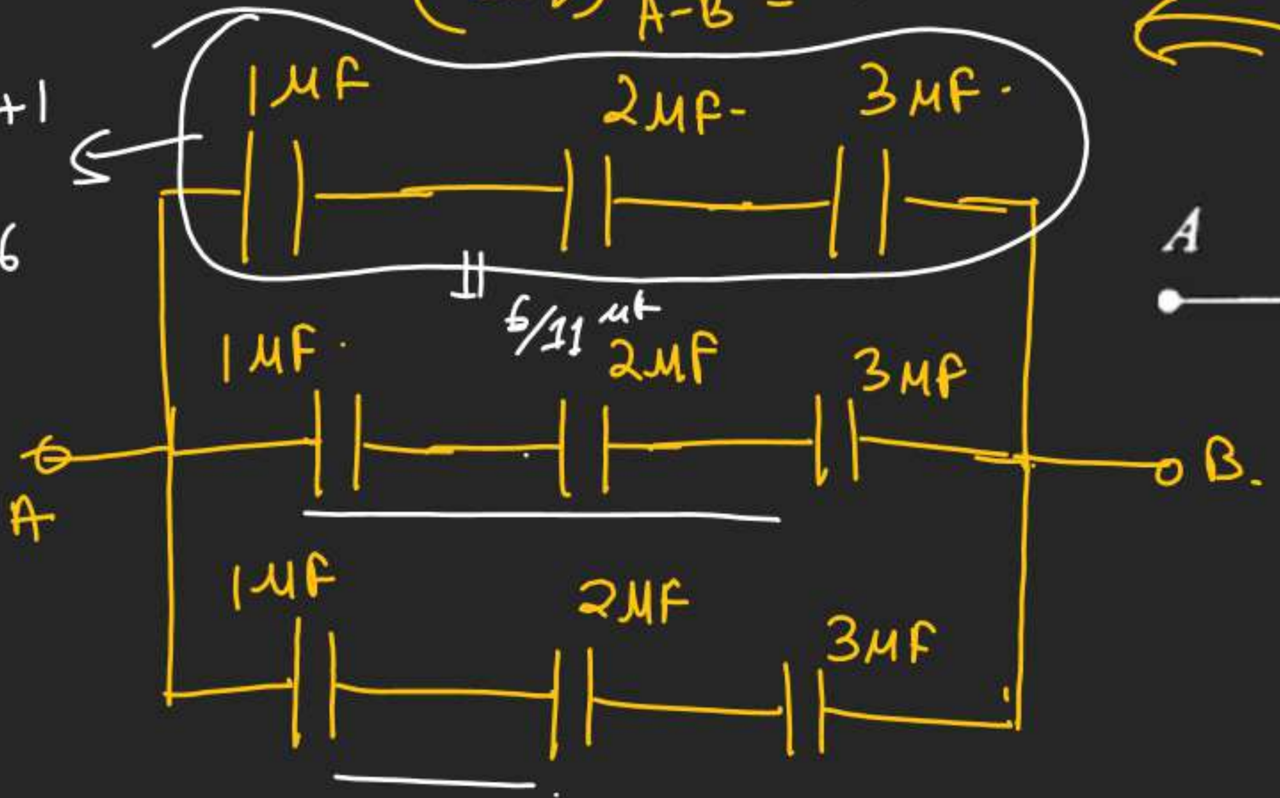
CAPACITOR

H.W

$(C_{eq})_{A-B} = ??$



$(C_{eq})_{A-B} =$



$$\frac{1}{C_{eq}} = \frac{1}{2} + \frac{1}{3} + 1$$

$$\frac{1}{C_{eq}} = \frac{3+2+6}{6}$$

$$\frac{1}{C_{eq}} = \frac{11}{6}\,\mu F$$

$$C_{eq} = \frac{6}{11}\,\mu F.$$

$$(C_{eq})_{A-B} = 3 \times \frac{6}{11} = \frac{18}{11}\,\mu F$$

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Equivalent capacitance (Symmetry)

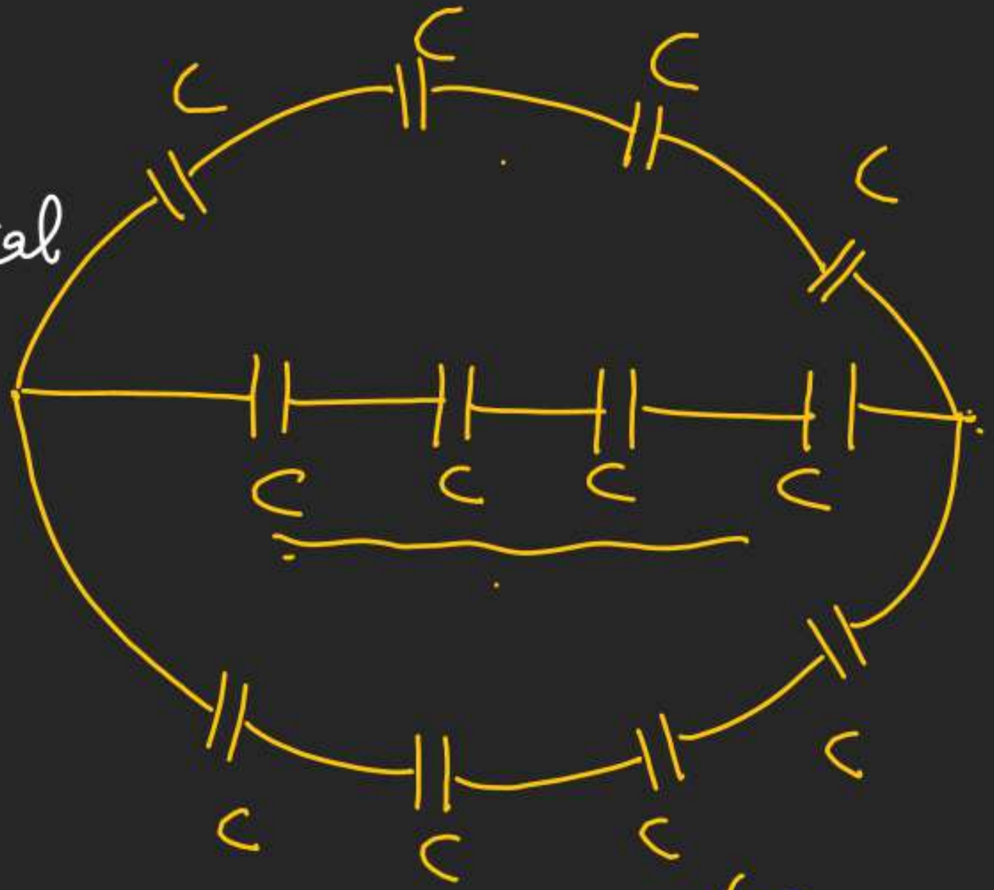
CAPACITOR

H.W

Sol^n

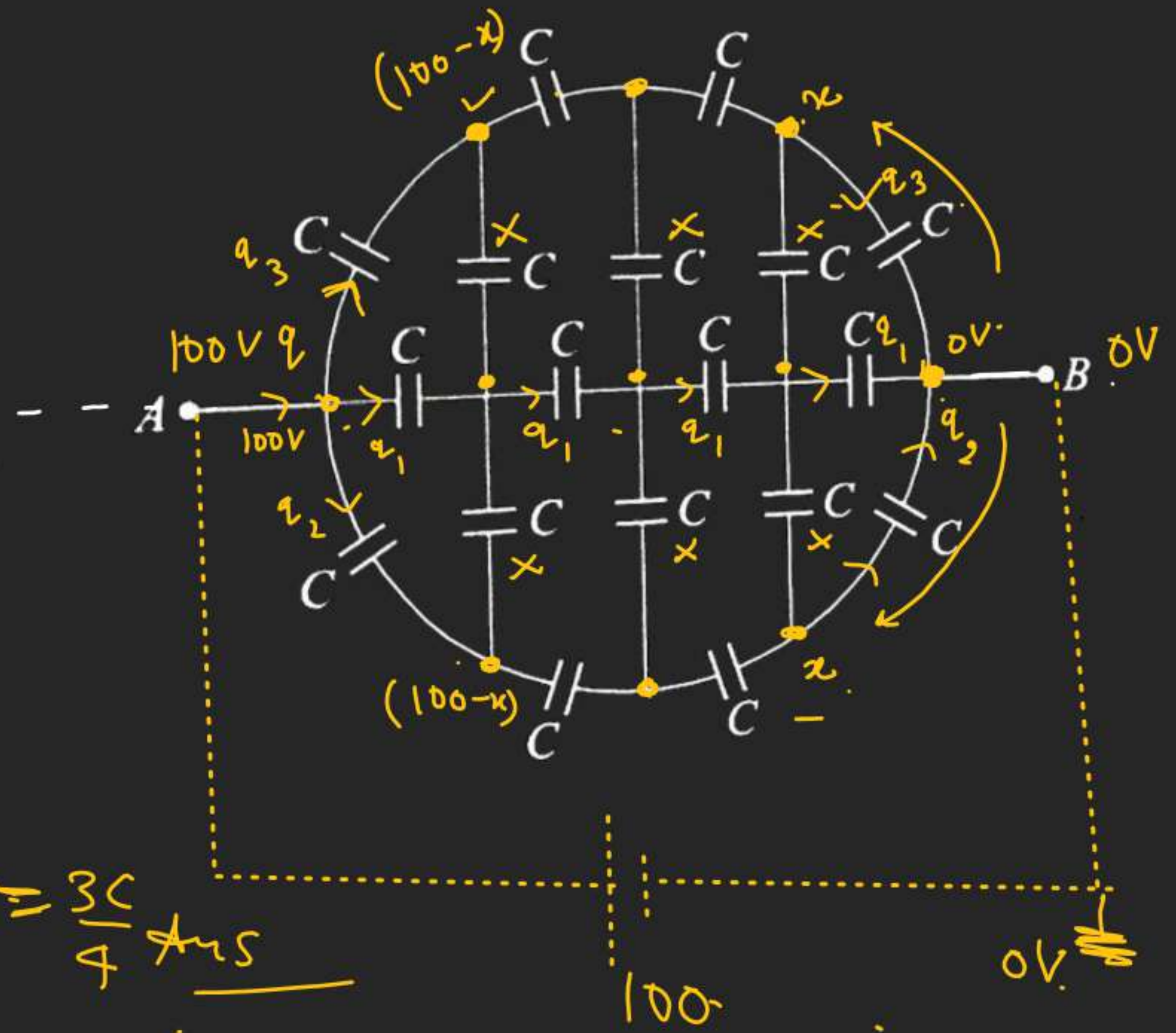
Note :-

Nodes Symmetrical about any axis of Symmetry are at Same potential.



$(C_{eq})_{A-B} = \frac{3C}{4}$ Ans

$(C_{eq})_{A-B} = ??$



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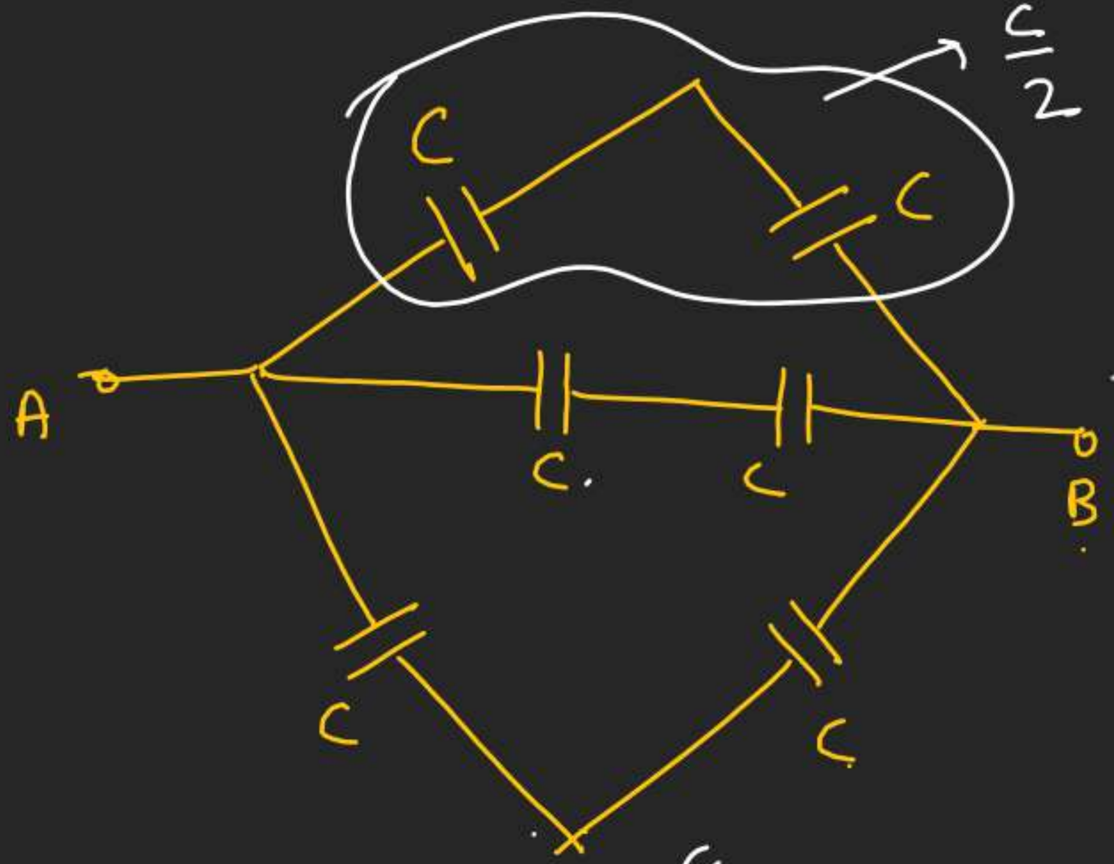
Equivalent capacitance (Symmetry)

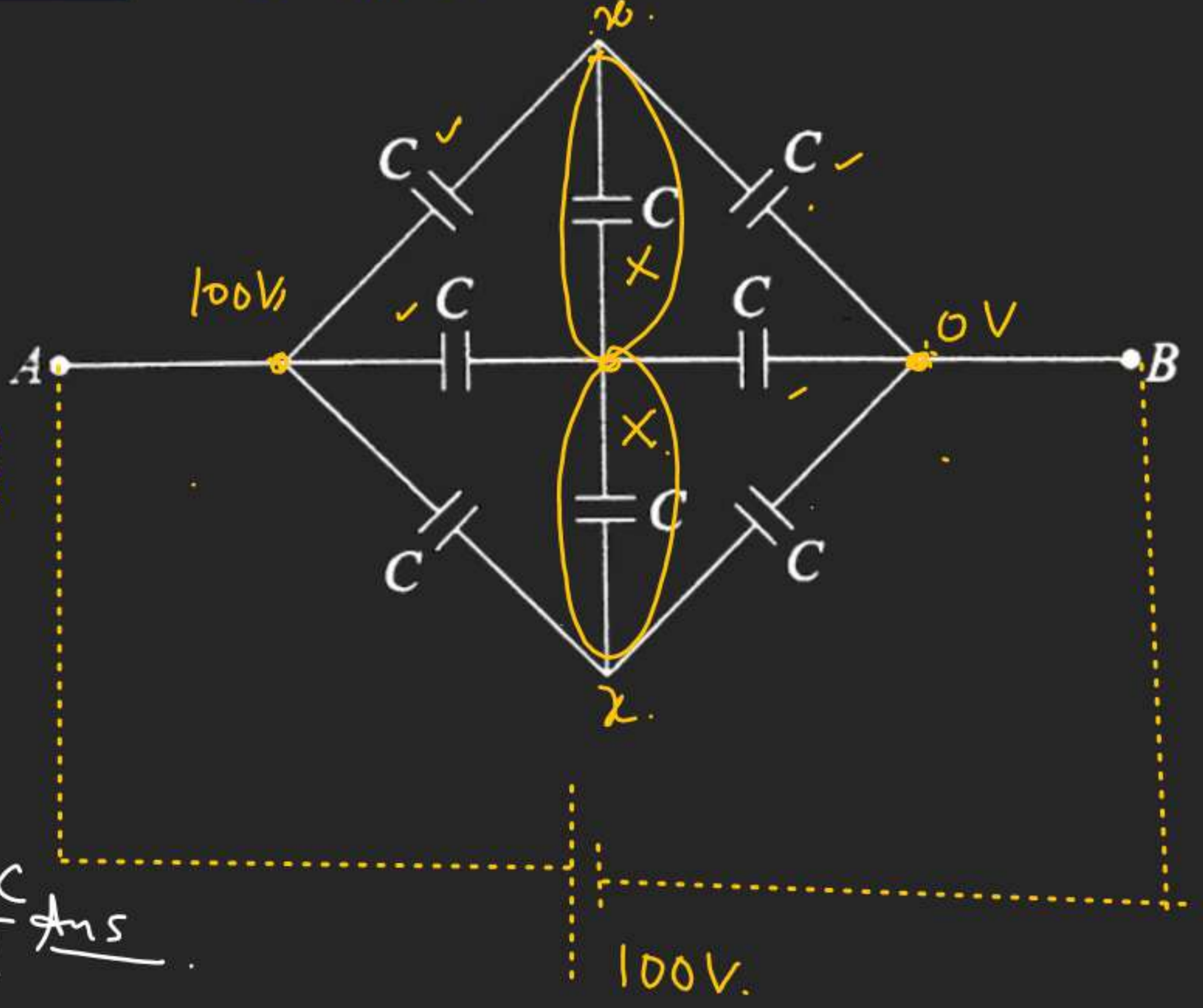
CAPACITOR

H-W



$(C_{eq})_{A-B} = \frac{3C}{2}$ Ans

$(C_{eq})_{A-B} = ??$



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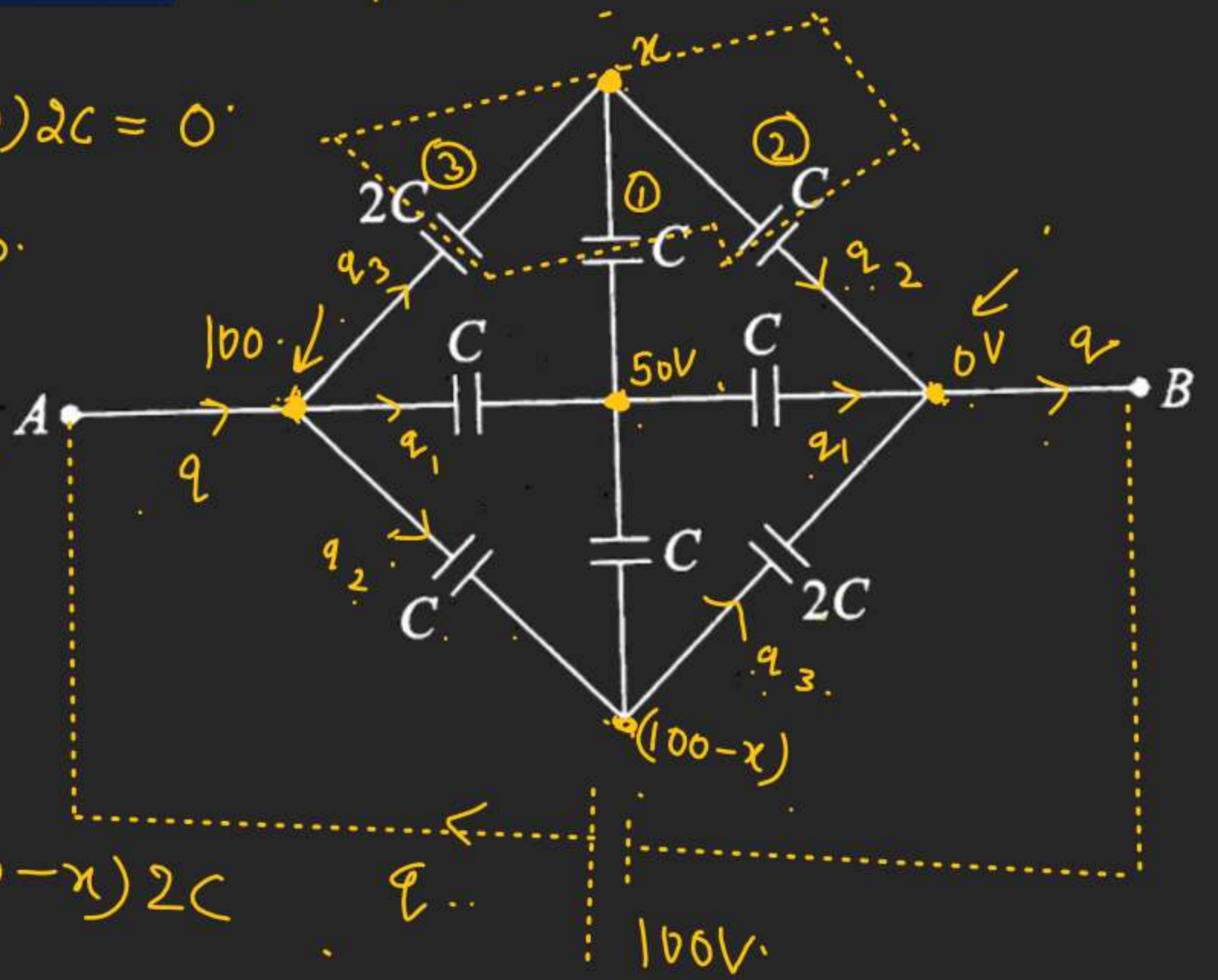
Equivalent capacitance (Symmetry) CAPACITOR

$(C_{eq})_{A-B} = ??$

H.W



$C(x-50) + (x-0)C + (x-100)2C = 0$

$x - 50 + x + 2x - 200 = 0$

$4x = 250$

$x = \frac{250}{4} = \left(\frac{125}{2}\right)$

$x = 62.5 \text{ volt}$

$q = q_1 + q_2 + q_3$

$C_{eq}(100) = (50)C + (x-0)C + (100-x)2C$

$(C_{eq})100 = 250C - xC$

$(C_{eq})100 = \left(250C - \frac{125}{2} \times C\right) = 125C\left(2 - \frac{1}{2}\right) = \left(125C \times \frac{3}{2}\right)$

$C_{eq} = \frac{125C \times 3}{2 \times 100} = \left(\frac{15C}{8}\right)$ Ans

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Equivalent capacitance (Symmetry) CAPACITOR

$(C_{eq})_{A-B} = ??$

H.W

$V_A = V_B = V_C = V_D = V_E$

$(C_{eq})_{AB} = ?\ \left(\frac{9C}{4}\right)$