-: ASSIGNMENT #2 SOLUTION :-

Q#1:- Perform the following operations:

a) $2\angle 45^\circ + 3\angle 45^\circ$

Sol:-

$2\angle 45^\circ + 3\angle 45^\circ$

First change them in rectangular form.

$2\angle 45^\circ$, $3\angle 45^\circ$

$x = r\cos\theta = 2\cos 45^\circ \Rightarrow 1.414$, $x = r\cos\theta = 3\cos 45^\circ \Rightarrow 2.121$

$y = r\sin\theta = 2\sin 45^\circ \Rightarrow 1.414$, $y = r\sin\theta = 3\sin 45^\circ \Rightarrow 2.121$

$2\angle 45^\circ \Rightarrow 1.414 + j1.414$, $3\angle 45^\circ \Rightarrow 2.121 + j2.121$

$$[1.414 + j1.414] + [2.121 + j2.121] = (1.414 + 2.121) + j(1.414 + 2.121)$$
$$\Rightarrow 3.535 + j3.535.$$

b) $2\angle 0^\circ - 4\angle 180^\circ$

Sol:-

First change them in rectangular form.

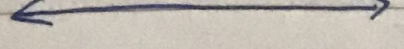
$2\angle 0^\circ$, $4\angle 180^\circ$

$x = r\cos\theta = 2\cos 0^\circ \Rightarrow 2$, $x = r\cos\theta = 4\cos 180^\circ \Rightarrow -4$

$y = r\sin\theta = 2\sin 0^\circ \Rightarrow 0$, $y = r\sin\theta = 4\sin 180^\circ \Rightarrow 0$

$2\angle 0^\circ \Rightarrow 2 + j0 \Rightarrow 2$, $4\angle 180 = -4 + j0 \Rightarrow -4$

$$2\angle 0^\circ - 4\angle 180^\circ = 2 - (-4) \Rightarrow 6.$$



Date:

$$\frac{C_1}{C_2} = \frac{4.123\angle 75.9^\circ}{6.403\angle 51.3^\circ} = \frac{4.123}{6.403} \angle 75.9^\circ - 51.3^\circ$$

$$\frac{C_1}{C_2} \Rightarrow 0.643 \angle 24.6^\circ$$

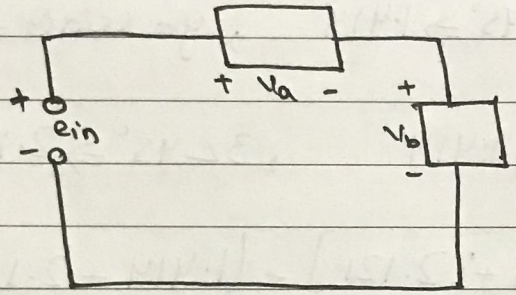
Question #1
Part C
remaining

Q#2- Find the input voltage e_{in} of the circuit shown below:

$v_a = 50\sin(377t + 30^\circ)$

$v_b = 30\sin(377t + 60^\circ)$

$f = 60Hz$



Sol:

Applying Kirchhoff's voltage law, we have

$$e_{in} = v_a + v_b$$

Converting from time domain to phasor domain:

$v_a = 50\sin(377t + 30^\circ)V \Rightarrow \bar{V}_a = 50\angle 30^\circ$

$v_b = 30\sin(377t + 60^\circ)V \Rightarrow \bar{V}_b = 30\angle 60^\circ$

Converting in rectangular form:

$\bar{V}_a = 50\angle 30^\circ$ V

$x = r\cos\theta = 50\cos 30^\circ \Rightarrow 43.30$

$y = r\sin\theta = 50\sin 30^\circ \Rightarrow 25$

$\bar{V}_a = (43.30 + j25)V$

$\bar{V}_b = 30\angle 60^\circ$ V

$x = r\cos\theta = 30\cos 60^\circ \Rightarrow 15$

$y = r\sin\theta = 30\sin 60^\circ \Rightarrow 25.98$

$\bar{V}_b = (15 + 25.98j)V$

Then, $\bar{E}_{in} = \bar{V}_a + \bar{V}_b$

$= (43.30 + j25) + (15 + 25.98j)$

$= (43.30 + 15) + j(25 + 25.98)$

$\bar{E}_{in} \Rightarrow (58.3V + j50.98)V$

Convert $\bar{E}_{in}$ in polar form.

$r = \sqrt{x^2 + y^2} = \sqrt{(58.3)^2 + (50.98)^2} \Rightarrow 77.44$

$\theta = \tan^{-1}\frac{y}{x} = \tan^{-1}\frac{50.98}{58.3} \Rightarrow 41.16^\circ$

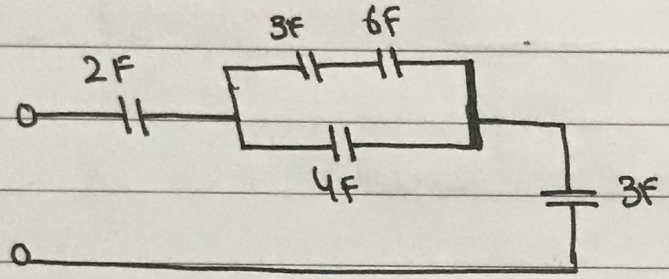
Date:

$\bar{E}_{in} = \quad : 77.44 \angle 41.16^\circ$

Now convert it in time domain.

$e_{in} = 77.44 \sin(377t + 41.16^\circ)$

Q#3: Determine the equivalent capacitance for the following circuit:



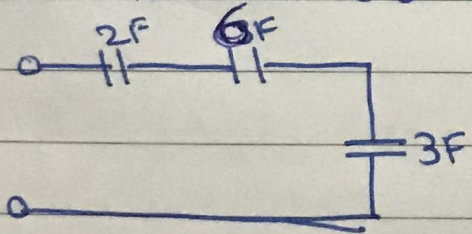
Solu

3F and 6F are in series and parallel with 4.

3F & 6F $\Rightarrow \frac{1}{1/3} + \frac{1}{1/6} =$ 2F

4F + 2F $\Rightarrow$ 6F

Now 2F and 13F and 3F are in series



$1/C_T = \frac{1}{2F} + \quad + \frac{1}{3F} + \frac{1}{6F}$

$C_T = \frac{1}{1/2F + 1/6 + 1/3} \Rightarrow$

$C_T = \frac{1}{1/2 + 1/6 + 1/3} \Rightarrow 1F$

Question #1
Part C

c) $\frac{c_1}{c_2}$ if $c_1 = 1+j4$ and $c_2 = 4+j5$

Sol:-

First change in polar form.

$c_1 = 1+j4$

$r = \sqrt{x^2+y^2} = \sqrt{1^2+4^2} \Rightarrow 4.123$

$\theta = \tan^{-1}\frac{y}{x} = \tan^{-1}\frac{4}{1} \Rightarrow 75.9°$

$c_1 \Rightarrow 4.123 \angle 75.9°$

, $c_2 = 4+j5$

, $r = \sqrt{4^2+5^2} \Rightarrow 6.403$

, $\theta = \tan^{-1}\frac{5}{4} \Rightarrow 51.34°$

, $c_2 \Rightarrow 6.403 \angle 51.34°$