

TCA1

sub

total

1)

$$F_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$2\pi\sqrt{LC} F_0 = 1$$

$$\sqrt{LC} = \frac{1}{2\pi F_0}$$

$$LC = \left(\frac{1}{2\pi F_0} \right)^2$$

$$LC = \frac{1}{4\pi^2 F_0^2}$$

$$C = \frac{1}{4\pi^2 F_0^2 L}$$

$$2) \quad 3(x-5) - 2(4-5x) - 3 = 0$$

$$3x - 15 - 8 + 10x - 3 = 0$$

$$13x - 26 = 0$$

$$13x = 26$$

$$x = 2$$

$$ii) \quad 3x^2 + 11x - 4 = 0$$

$$(3x - 1)(x + 4) = 0$$

$$3x - 1 = 0$$

$$x + 4 = 0$$

$$3x = 1$$

$$x = -4$$

$$x = \frac{1}{3}$$

$$iii) \quad 1.5 \times 10^{2x-1} = 153$$

$$10^{2x-1} = 102$$

$$\log_{10} 10^{2x-1} = \log_{10} 102$$

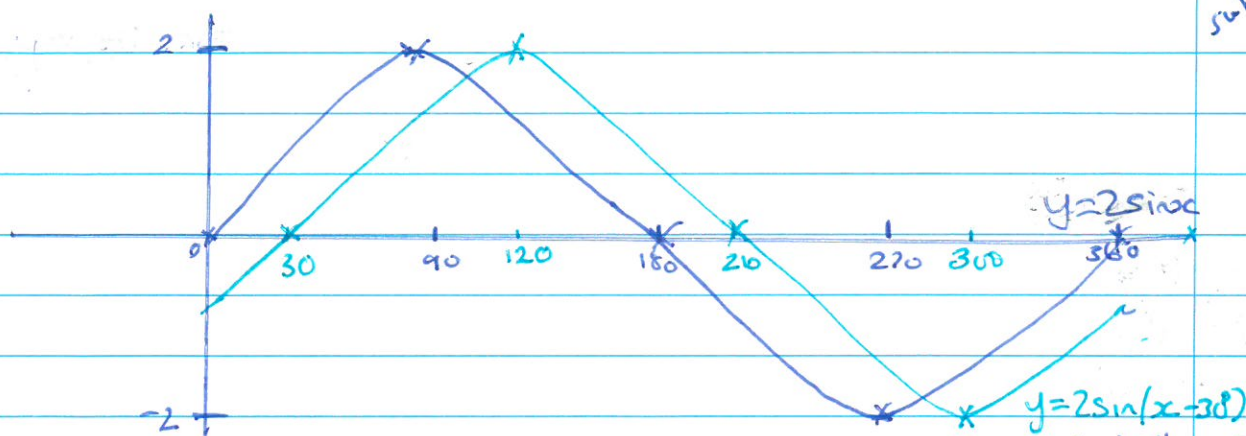
$$2x-1 = \log_{10} 102$$

$$2x = \log_{10} 102 + 1$$

$$x = \frac{\log_{10} 102 + 1}{2}$$

$$x = 1.504$$

3i)



$y = 2 \sin(x)$
 $y = 2 \sin(x - 30^\circ)$
 correct shift 2
 correct amp 2
 shape 1
 full cycle 1

ii)

$$\sin 2x = 0.5$$

$$2x = \sin^{-1}(0.5)$$

$$2x = 30, 180 - 30, 360 + 30, 360 + (180 - 30)$$

$$2x = 30^\circ, 150^\circ, 390^\circ, 510^\circ$$

$$x = 15^\circ, 75^\circ, 195^\circ, 255^\circ$$

13

$$4i) \quad 3 + j2 - (-1 - j5)$$

$$= 4 + j7$$

3

$$ii) \quad (3 + j2)(-1 - j5) = -3 - j15 - j2 - j^2 10$$

$$= -3 - j17 - (-1)10$$

$$= -3 - j17 + 10$$

$$= 7 - j17$$

$$iii) \quad \frac{3 + j2}{-1 - j5} = \frac{(3 + j2)(-1 + j5)}{(-1 - j5)^* (-1 + j5)}$$

$$= \frac{-3 + j15 - j2 + j^2 10}{1 - j5 + j5 - j^2 25}$$

$$= \frac{-3 + j13 + (-1)10}{1 - (-1)25}$$

$$= \frac{-3 + j13 - 10}{1 + 25}$$

$$= \frac{-13}{26} + j \frac{13}{26}$$

$$= -\frac{1}{2} + j \frac{1}{2}$$

12

$$5i) 3 \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix} - \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 3 \\ -9 & 6 \end{pmatrix} - \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix}$$

$$= \begin{pmatrix} -1 & 0 \\ -8 & 8 \end{pmatrix}$$

Sub
Total

1

2

$$ii) \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix} = \begin{pmatrix} 0-9 & 1+6 \\ 0+6 & -1-4 \end{pmatrix}$$

$$= \begin{pmatrix} -9 & 7 \\ 6 & -5 \end{pmatrix}$$

2

2

$$iii) AB \neq BA$$

$$BA = \begin{pmatrix} 0 & 1 \\ -3 & 2 \end{pmatrix} \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} = \begin{pmatrix} 0+(-1) & 0+(-2) \\ -3+(-2) & -9+(-4) \end{pmatrix}$$

$$= \begin{pmatrix} -1 & -2 \\ -5 & -13 \end{pmatrix} \neq AB$$

2

2

$$iv) |A| = 1 \times -2 - 3 \times -1 = -2 + 3 = 1$$

2

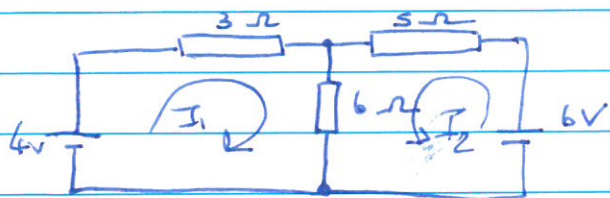
$$\frac{1}{1} \begin{bmatrix} -2 & -3 \\ 1 & 1 \end{bmatrix}$$

2

$$= \begin{bmatrix} -2 & -3 \\ 1 & 1 \end{bmatrix}$$

2

17



$$4 = 3I_1 + 6(I_1 + I_2) \quad 6 = 5I_2 + 6(I_1 + I_2) \quad 1$$

$$4 = 3I_1 + 6I_1 + 6I_2 \quad 6 = 5I_2 + 6I_1 + 6I_2 \quad 1$$

$$4 = 9I_1 + 6I_2 \quad 6 = 6I_1 + 11I_2 \quad 1$$

$$\begin{bmatrix} 9 & 6 \\ 6 & 11 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix} \quad 2$$

$$\frac{1}{99-36} \begin{bmatrix} 11 & -6 \\ -6 & 9 \end{bmatrix} = \begin{bmatrix} \frac{11}{63} & \frac{-6}{63} \\ \frac{-6}{63} & \frac{9}{63} \end{bmatrix} \quad 2$$

$$\begin{bmatrix} \frac{11}{63} & \frac{-6}{63} \\ \frac{-6}{63} & \frac{9}{63} \end{bmatrix} \begin{bmatrix} 4 \\ 6 \end{bmatrix} = \begin{bmatrix} \frac{44-36}{63} \\ \frac{-24+54}{63} \end{bmatrix} \quad 2$$

$$= \begin{bmatrix} \frac{8}{63} \\ \frac{30}{63} \end{bmatrix} \quad 2$$

$$\text{current through } 3\Omega = \frac{8}{63} \text{ A } (0.127 \text{ A}) \quad 1$$

$$\text{current through } 5\Omega = \frac{30}{63} \text{ A } (0.476 \text{ A}) \quad 1$$

$$\text{current through } 6\Omega = I_1 + I_2 = \frac{38}{63} \text{ A } (0.603 \text{ A}) \quad 2 \quad 15$$

$$7i) m = \frac{8 - -4}{1 - 4} = \frac{12}{-3} = -4$$

$$y = -4x + c \quad (1, 8)$$

$$8 = -4 \times 1 + c$$

$$8 = -4 + c$$

$$c = 12$$

$$y = -4x + 12$$

$$ii) m = \frac{1}{4}$$

$$y = \frac{1}{4}x + c \quad (-1, 0)$$

$$0 = \frac{1}{4}(-1) + c$$

$$0 = -\frac{1}{4} + c$$

$$c = \frac{1}{4}$$

$$y = \frac{1}{4}x + \frac{1}{4}$$

$$8) a = 150 \quad d = 79 \quad n = 12$$

$$\begin{aligned} & 150 + (12 - 1)79 \\ &= 150 + 11 \times 79 \\ &= \pounds 1019 \end{aligned}$$

$$9) a = 10 \quad ar^{n-1} = 600 \quad \text{when } n = 5$$

$$10 \times r^4 = 600$$

$$r^4 = 60$$

$$r = \sqrt[4]{60}$$

$$r = 2.783$$

9) $a = 10$ $r = 2.783$

$n=1$ $10 \times 2.783^0 = 10 \text{ rev/min}$

$n=2$ $10 \times 2.783 = 28 \text{ rev/min}$

$n=3$ $10 \times 2.783^2 = 77 \text{ rev/min}$

$n=4$ $10 \times 2.783^3 = 216 \text{ rev/min}$

$n=5$ $10 \times 2.783^4 = 600 \text{ rev/min}$

sub total

1

1

1

7