

Q1

a)

i) AB 3×3 3×3 ii) AC 3×3 3×2

$$\begin{pmatrix} 1 & 3 & 3 & 1 & 2 \\ -6 & 2 & 2 & 2 & 6 \\ -8 & -1 & 0 & 1 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 6 & 3 & 0 \\ -1 & 5 & 2 \\ -3 & 0 & 1 \end{pmatrix}$$

iii) $A+B$ 3×3 3×3 iv) $A+D$ 3×3 2×2

$$\begin{pmatrix} 8 & 6 & 3 \\ 0 & 6 & 6 \\ -2 & 5 & 2 \end{pmatrix}$$

cannot be calculated
dimensions are not
compatible

v) BD 3×3 2×2 vi) $2D$ $2 \times D$

cannot be calculated
dimensions are not
compatible

$$\begin{pmatrix} 1 & 8 & 2 & 0 \\ 4 & 3 & 0 & 1 \end{pmatrix}$$

b) $\begin{pmatrix} 3 & 2 & 1 \\ 1 & -1 & 4 \\ 2 & 5 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 15 \\ -2 \\ 16 \end{pmatrix}$ $|A| = 3(-2 - 20) - 2(2 - 8) + 1(5 + 2)$
 $|A| = -47$

$A_1 \begin{pmatrix} 15 & 2 & 1 \\ -2 & -1 & 4 \\ 16 & 5 & 2 \end{pmatrix} |A_1| = 15(-2 - 20) - 2(-4 - 64) + 1(-10 + 16)$
 $|A_1| = -188$

$A_2 \begin{pmatrix} 3 & 15 & 1 \\ 1 & -2 & 4 \\ 2 & 16 & 2 \end{pmatrix} |A_2| = 3(-4 - 64) - 15(2 - 8) + 1(16 + 4)$
 $|A_2| = -94$

$A_3 \begin{pmatrix} 3 & 2 & 15 \\ 1 & -1 & -2 \\ 2 & 5 & 16 \end{pmatrix} |A_3| = 3(-16 + 10) - 2(16 + 4) + 15(5 + 2)$
 $|A_3| = 47$

$x = \frac{-188}{-47} = 4$ $y = \frac{-94}{-47} = 2$ $z = \frac{47}{-47} = -1$

c) $|A|$ is the determinant

Q2

a

i) $Z_1 + Z_2 (2+5j) + (1-8j)$

$$2+5j+1-8j = 3-3j$$

ii) $Z_1 - Z_2 (2+5j) - (-3+2j)$

$$2+5j+3-2j = 5+3j$$

iii) $\frac{Z_1}{Z_2} = \frac{(2+5j)}{(1-8j)} \quad \bar{Z}_2 = 1+8j$

$$\frac{(2+5j)(1+8j)}{(1-8j)(1+8j)} \quad j^2 = -1$$

$$\frac{2+16j+5j+40(-1)}{1+8j-8j-64(-1)} \quad -80+$$

$$\frac{1+8j-8j-64(-1)}{-38+21j} \quad \frac{-38}{65} + \frac{21j}{65}$$

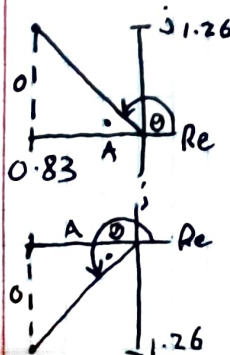
b) $12x^2+2x+19=0 \quad a=12 \quad b=2 \quad c=19$

$$x = \frac{-2 \pm \sqrt{2^2 - 4(12)(19)}}{2(12)} \quad x = \frac{-2 \pm \sqrt{4-912}}{24}$$

$$x = \frac{-2 \pm \sqrt{908} \sqrt{-1}}{24} \quad x = \frac{-2 \pm 30.13j}{24}$$

$$x = \frac{-2}{24} + \frac{30.13}{24}j \quad x = \frac{-2}{24} - \frac{30.13j}{24}$$

$$x = -0.83 + 1.26j \quad x = -0.83 - 1.26j$$



$$r = \sqrt{0.83^2 + 1.26^2} \quad r = \sqrt{2.28} \quad r = 1.51$$

$$\tan \theta = \frac{1.26}{0.83}$$

$$\theta = \frac{O}{A}$$

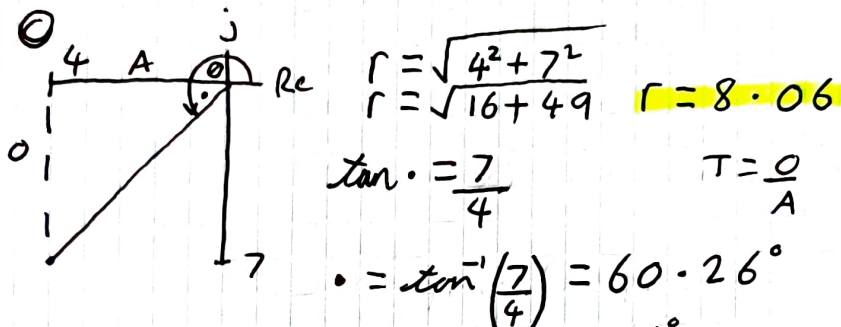
$$\theta = \tan^{-1}\left(\frac{1.26}{0.83}\right) = 56.63^\circ$$

$$\theta = 180 - 56.63 = 123.37^\circ$$

$$1.51(\cos 123.37^\circ + j \sin 123.37^\circ)$$

$$\theta = 180 + 56.63 = 236.63^\circ$$

$$1.51(\cos 236.63^\circ + j \sin 236.63^\circ)$$



$$\theta = 180 + 60.26 = 240.26^\circ$$

polar form $= 8.06(\cos 240.26^\circ + j \sin 240.26^\circ)$

de Moivre's theorem =

$$8.06^6(\cos 6 \times 240.26^\circ + j \sin 6 \times 240.26^\circ)$$

$$274163.89(\cos 1441.56^\circ + j \sin 1441.56^\circ)$$

$$274163.89 \cos 1441.56^\circ + j \sin 1441.56^\circ$$

rectangular form =

$$274062.2751 + 7463.78j$$

Q3

Q

i) $\int 5x^3 - 2x^2 + 4x - 1 \, dx$
 $= \frac{5x^4}{4} - \frac{2x^3}{3} + \frac{4x^2}{2} - x + C$

ii) $\int (x+2)(x+5)(x-1) \, dx$
 $\int (x^2 + 5x + 2x + 10)(x-1) \, dx$
 $\int (x^2 + 7x + 10)(x-1) \, dx$

$$\int x^3 - x^2 + 7x^2 - 7x + 10x - 10 \, dx$$

$$\int x^3 + 7x^2 - 3x - 10 \, dx$$
$$= \frac{x^4}{4} + \frac{7x^3}{3} - \frac{3x^2}{2} - 10x + C$$

iii)

$$\int 3 \cos 2x - \frac{1}{x} \, dx$$

$$= \frac{3}{2} \sin(2x) - \ln(x) + C$$

iv)

$$\int_3^6 (5x+2)(2x+3) \, dx = \int_3^6 10x^2 + 15x + 4x + 6 \, dx$$

$$\int_3^6 10x^2 + 19x + 6 \, dx = \left[\frac{10x^3}{3} + \frac{19x^2}{2} + 6x \right]$$

$$\left[\frac{10(6)^3}{3} + \frac{19(6)^2}{2} + 6(6) \right] - \left[\frac{10(3)^3}{3} + \frac{19(3)^2}{2} + 6(3) \right]$$

$$= 904.5$$

v)

$$\int_0^3 (3x+1)^2 + 2e^{3x} \, dx = \int_0^3 3x^2 \, dx$$

(b)

(i) $\int 3x \sin 4x \, dx$

diff $u = 3x$ $\frac{du}{dx} = 3$ int $V = -\frac{1}{4} \cos 4x$ $\frac{dV}{dx} = \sin 4x$

$$= 3x - \frac{1}{4} \cos 4x - \int \left(-\frac{1}{4} \cos 4x\right)(3) \, dx$$

$$= \underline{\underline{-\frac{3x}{4} \cos 4x + \frac{3}{4} \sin 4x + C}}$$

(ii) $\int 2x e^{3x} \, dx$

$u = 2x$ $V = \frac{1}{3} e^{3x}$
 $\frac{du}{dx} = 2$ $\frac{dV}{dx} = e^{3x}$

$$= 2x \frac{1}{3} e^{3x} - \int \frac{1}{3} e^{3x} (e^{3x}) \, dx$$