Kyle Evans 2029909 engineering mathematics
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Q1

(a)

(i) AB 3×3 3×3

$$\begin{pmatrix} 13 & 33 & 12 \\ -6 & 22 & 26 \\ -8 & -10 & 1 \end{pmatrix}$$

(ii) AC 3×3 3×2

$$\begin{pmatrix} 6 & 30 \\ -1 & 52 \\ -3 & 0 \end{pmatrix}$$

(iii) A+B 3×3 3×3

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

(iv) A+D 3×3 2×2

cannot be calculated dimensions are not compatible

(v) BD 3×3 2×2

cannot be calculated dimensions are not compatible

(vi) 2D $2\times D$

$$\begin{pmatrix} 18 & 20 \\ 4 & 30 \end{pmatrix}$$

(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

ⓐ

ⓘ $Z_1 + Z_2 \quad (2+5j)+(1-8j)$

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

ⓘⓘ $Z_1 - Z_3 \quad (2+5j)-(-3+2j)$

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

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

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

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

$\frac{-38+21j}{65} \qquad \frac{-38}{65} + \frac{21j}{65}$

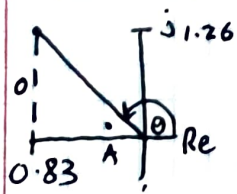
ⓑ $12x^2+2x+19=0 \qquad a=12 \quad b=2 \quad c=19$

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

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

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

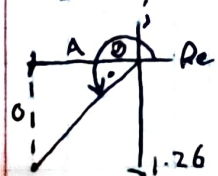
$x = -0.83 + 1.26j \qquad x = -0.83 - 1.26j$



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

$r = \sqrt{2.28} \qquad r = 1.51$

$\tan \cdot = \frac{1.26}{0.83} \qquad T = \frac{O}{A}$



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

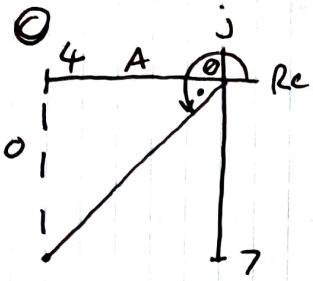
$\theta = 180 - 56.63 = 123.37^\circ$

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

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

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

(c)



$r = \sqrt{4^2 + 7^2}$

$r = \sqrt{16 + 49}$ $\quad r = 8.06$

$\tan\cdot = \frac{7}{4}$ $\quad T = \frac{O}{A}$

$\cdot = \tan^{-1}\left(\frac{7}{4}\right) = 60.26^\circ$

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

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

de moires theorum =

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

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

$274163.89\cos 1441.56 + j\sin 1441.56$

rectangular form =

$274062.2751 + 7463.78j$

Q3

(a)

(i) $\int 5x^3 - 2x^2 + 4x - 1 \, dx$

$= \frac{5x^4}{4} - \frac{2x^3}{3} + \frac{4x^2}{2} - x + C$

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

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

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

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

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

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

(iii)

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

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

(iv)

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

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

$$_0^6\left[\frac{10(6)^3}{3} + \frac{19(6)^2}{2} + 6(6)\right] - {}_0^3\left[\frac{10(3)^3}{3} + \frac{19(3)^2}{2} + 6(3)\right]$$

$$= 904.5$$

(v)

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

(b)

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

$u = 3x \qquad V = -\frac{1}{4}\cos 4x$

dif $\qquad$ int

$\frac{du}{dx} = 3 \qquad \frac{dV}{dx} = \sin 4x$

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

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

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

$u = 2x \qquad V = \frac{1}{3}e^{3x}$

$\frac{du}{dx} = 2 \qquad \frac{dv}{dx} = e^{3x}$

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