

SIMON HARRIS - 2116866

10/12/21

PART - TIME  
ENGINEERING MATHEMATICS  
ACMA 4006

i)  $A \begin{pmatrix} 5 & 1 & 2 \\ 2 & 6 & 3 \\ -2 & 1 & 0 \end{pmatrix} \quad B \begin{pmatrix} 3 & 5 & 1 \\ -2 & 0 & 3 \\ 0 & 4 & 2 \end{pmatrix}$

$$AB \begin{pmatrix} 15 + (-2) + 0 & 25 + 0 + 8 & 5 + 3 + 4 \\ 6 - 12 + 0 & 10 + 0 + 12 & 2 + 18 + 6 \\ -6 - 2 + 0 & -10 + 0 + 0 & -2 + 3 + 0 \end{pmatrix}$$

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

ii)  $A \begin{pmatrix} 5 & 1 & 2 \\ 2 & 6 & 3 \\ -2 & 1 & 0 \end{pmatrix} \quad C \begin{pmatrix} 1 & 2 \\ -1 & 4 \\ 1 & 8 \end{pmatrix}$

$$\begin{pmatrix} 5 - 1 + 2 & 10 + 8 + 16 \\ 2 - 6 + 3 & 4 + 24 + 24 \\ -2 - 1 + 0 & -4 + 4 + 0 \end{pmatrix}$$

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

iii)  $A+B \begin{pmatrix} 8 & 6 & 3 \\ 0 & 6 & 6 \\ -2 & 5 & 2 \end{pmatrix}$

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iv) N/A

v) N/A

vi)  $\begin{pmatrix} 18 & 20 \\ 4 & 36 \end{pmatrix}$

b)  $A \begin{pmatrix} 3 & 2 & 1 \\ 1 & -1 & 4 \\ 2 & 5 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 15 \\ -2 \\ 16 \end{pmatrix}$

$A = 3(-2-20) - 2(2-8) + 1(5+2) = -66 + 12 + 7 = -47$

$A1 \begin{pmatrix} 15 & 2 & 1 \\ -2 & -1 & 4 \\ 16 & 5 & 2 \end{pmatrix}$

$A1 = 15(-2-20) - 2(-10-64) + 1(-10+16) = -330 + 136 + 6 = -188$

$A2 \begin{pmatrix} 3 & 15 & 1 \\ 1 & -2 & 4 \\ 2 & 16 & 2 \end{pmatrix}$

$A2 = 3(-4-64) - 15(2-8) + 1(16+4) = -204 + 90 + 20 = -94$

$A3 \begin{pmatrix} 3 & 2 & 15\frac{1}{2} \\ 1 & -1 & -2\frac{1}{2} \\ 2 & 5 & 16\frac{1}{2} \end{pmatrix}$

~~$A3 = 3(-2-20) - 2(2-8) + 1(5+2) = -66 + 12 + 7 =$~~

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$A3 = 3(-16+10) - 2(16+4) + 15(5+2) = -18 - 40 + 105 = 47$

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b)  $\frac{(13)}{Z} = \frac{47}{-47} = -1$      $(A1) X = \frac{-188}{-47} = 4$      $A2(Y) = \frac{-94}{-47} = 2$

c) Determinant

2ai)  $(2+5j) + (1-8j) = 3-3j$

ii)  $(2+5j) - (-3+2j) = 5+7j$

iii)  $\frac{(2+5j)}{(1-8j)} \times \frac{(1+8j)}{(1+8j)} = \frac{2+16j+5j+40j^2}{1+8j-8j-64j^2}$   
 $= \frac{-38+2j}{65} = \frac{-38}{65} + \frac{2j}{65}$

b)  $12x^2 + 2x + 19 = 0$      $x = \frac{-2 \pm \sqrt{(2)^2 - 4(12)(19)}}{2(12)}$

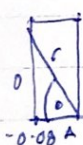
$x = \frac{-2 \pm 30.13}{24}$

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

$x = -0.083 + 1.26j$

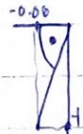
$x = \frac{-2}{24} - \frac{30.13}{24}$

$x = -0.08 - 1.26j$

  $r = \sqrt{0.08^2 + 1.26^2} = 1.26$   
 $\theta = \tan^{-1} \frac{1.26}{0.08} = 86.37^\circ$

$\theta = 180 - 86.37 = 93.63$

$1.26 \angle 93.63^\circ$

  $\theta = 180 + 86.37 = 266.37^\circ$   
 $1.26 \angle 266.37^\circ$

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

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

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

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

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

$$\int x^3 + 6x^2 + 3x - 10 \, dx$$

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

~~iv)  $\int_3^6 (5x+2)(2x+3) \, dx$~~

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

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

iv)  $\int_3^6 (5x+2)(2x+3) \, dx$

$$\int_3^6 10x^2 + 15x + 4x + 6 \, dx$$

$$\left[ \frac{10x^3}{3} + \frac{15x^2}{2} + 2x^2 + 6x \right] = \left[ \frac{10(6)^3}{3} + \frac{15(6)^2}{2} + 2(6)^2 + 6(6) \right] = 1098$$

$$(720 + 270 + 72 + 36)$$

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$$1098 - 193.5 = 904.5 = \left[ \frac{10(3)^3}{3} + \frac{15(3)^2}{2} + 2(3)^2 + 6(3) \right] = 193.5$$

$$(90 + 67.5 + 18 + 18)$$

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

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

$$= \int_0^3 9x^2 + 6x + 1 + 2e^{3x} dx$$

$$= \int_0^3 \frac{9x^3}{3} + 3x^2 + x + \frac{2e^{3x}}{3}$$

$$= \left[ \frac{9(3)^3}{3} + 3(3)^2 + 3 + \frac{2e^{3(3)}}{3} \right] = [81 + 27 + 3 + 5462.10] = 5513.1$$

$$\left[ \frac{9(0)^3}{3} + 3(0)^2 \right] \quad \left[ 0 + 0 + 0 + 0.6 \right] = 0.6$$

$$5513.1 - 0.6 = 5512.5$$

$$3 b) \int_0^{\frac{\pi}{4}} 3x \sin 4x dx$$

$$u = 3x$$

$$v = -\frac{1}{4} \cos 4x$$

$$\frac{du}{dx} = 3$$

$$\frac{dv}{dx} = \frac{1}{4} \cos 4x \sin 4x$$

$$\int \frac{3x \cos 4x}{4} - \frac{3}{4} \int \cos 4x$$

$$\int \frac{3x \cos 4x}{4} + \frac{3 \sin 4x}{16} + C$$

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

$$U = 2x$$

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

$$\frac{dU}{dx} = 2$$

$$\frac{dV}{dx} = e^{3x}$$

$$\int \frac{2x}{3} e^{3x} - \frac{2}{3} \int \frac{1}{3} e^{3x}$$

$$= \int \frac{2x}{3} e^{3x} - \frac{1}{3} e^{3x}$$