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MATHEMATICS

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Q1=[15/35]

Q2=[9/33]

Q3=[10/32]

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Question One

i. Determinant of A

$$0 \times \begin{vmatrix} 0 & 3 \\ 8 & 2 \end{vmatrix} - 2 \times \begin{vmatrix} 2 & 3 \\ 1 & 3 \end{vmatrix} + 0 \times \begin{vmatrix} 2 & 0 \\ 1 & 8 \end{vmatrix}$$

$$= 0 - 2 \times 3 + 0$$

$$A = -6 \quad [4/4]$$

ii. Determinant of C

Not do able [1/1]

iii. Determinant of D

$$\begin{aligned} 2 \times 8 &= 16 & 16 - -12 &= 28 \\ -3 \times 4 &= -12 & & \\ & & = 28 & [2/2] \end{aligned}$$

iv. ~~AB~~ AB

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

$$AB \begin{bmatrix} 9 & 9 & 22 \\ 22 & 49 & 20 \\ 4 & 10 & 0 \end{bmatrix} \quad [4/4]$$

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

$$\begin{aligned} 2 \times 3 + 0 \times 2 + 3 \times 1 \\ 1 \times 3 + 8 \times 2 + 3 \times 1 \\ 0 \times 3 + 2 \times 2 + 0 \times 1 \end{aligned}$$

~~$$\begin{bmatrix} 9 & 9 & 22 \\ 22 & 49 & 20 \\ 4 & 10 & 0 \end{bmatrix}$$~~

v. BC

$$\begin{bmatrix} 3 & 0 & 2 \\ 2 & 5 & 0 \\ 1 & 3 & 6 \end{bmatrix} \begin{bmatrix} 1 & 4 \\ 2 & -5 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} 8 & 19 & 20 \\ 3 & -22 & 14 \end{bmatrix} \times$$

$$3(1) + 2(2) + 1(1) = 8$$

$$0(1) + 5(2) + 3(3) = 19$$

$$2(1) + 0(2) + 6(3) = 20$$

$$3(4) + 2(-5) + 1(1) = 3$$

$$0(4) + 5(-5) + 3(1) = -22$$

$$2(4) + 0(-5) + 6(1) = 14$$

vi. DC

NOT DO ABLE

[1/1]

vii. AD

NOT DO ABLE

[1/1]

b. Find the inverse of

$$A = \begin{bmatrix} 2 & 4 & 1 \\ 1 & 4 & 7 \\ 0 & 5 & 2 \end{bmatrix}$$

$$2 \times \begin{bmatrix} 4 & 7 \\ 5 & 2 \end{bmatrix} - 1 \times \begin{bmatrix} 4 & 1 \\ 5 & 2 \end{bmatrix} + 0 \times \begin{bmatrix} 4 & 1 \\ 4 & 7 \end{bmatrix}$$

$$2 \times (-27) - 3 + 0$$

$$-54 - 3$$

$$A^{-1} = -57 \quad [2/2]$$

3

C) Use Cramer's Rule

$$\begin{vmatrix} 3 & -2 & 1 \\ 3 & -3 & 0 \\ 2 & 1 & -3 \end{vmatrix}$$

$$= 18$$

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

$$= -2$$

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

$$= -8$$



$$\begin{vmatrix} 3 & -2 & 2 \\ 3 & -3 & 1 \\ 2 & 1 & -5 \end{vmatrix}$$

$$= 26$$

$$-\frac{1}{9}, \frac{4}{9}, \frac{13}{9}$$

Question Two

Complex numbers

$$Z_1 = 2 + 5j, \quad Z_2 = 3 + 2j, \quad Z_3 = 4 + 3j$$

i. $|2 + 5j| + |3 + 2j|$

$$|2 + 3| + |5j + 2j|$$

$$5 + 7j \quad [1/1]$$

ii. $3|3 + 2j| + 2|4 + 3j|$

$$|9 + 6j| + |8 + 6j|$$

$$|9 + 8| + |6j + 6j|$$

$$17 + 12j \quad [3/3]$$

4

$$\text{iii) } z_1^2 + z_2$$

$$(2+5j)^2 + (3+2j)$$

$$4 + 10j + 10j + 25j^2$$

[1/3]

$$4 + 20j + 24$$

$$(2+5j)(2+5j)$$

$$(28 + 20j + 3 + 2j)$$

$$\cancel{(4 + 10j + 10j + 25j^2)} + (3 + 2j)$$

$$31 + 22j$$

$$\text{iv) } z_1 z_2$$

$$(2+5j)(3+2j)$$

$$6 + 4j + 15j + 10j^2$$

[1/3]

$$6 + 19j + 10j^2 \quad |-1|$$

$$6 + 19j + 9$$

$$15 + 19j$$

$$\text{v) } \frac{z_1}{z_2}$$

$$\frac{2+5j}{3+2j} \left(\frac{3-2j}{3-2j} \right)$$

[2/5]

$$\frac{6 + 4j + 15j + 10j^2}{9 + 4j^2}$$

$$\frac{-4 + 19j}{5} = \frac{-4}{5} + \frac{19j}{5}$$

5

$$5x^2 - 8x + 5 = 0$$

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{+8 \pm \sqrt{8^2 - 4(5)(5)}}{2(5)}$$

$$x = \frac{+8 \pm \sqrt{+64 - 100}}{10}$$

[1/10]

$$x = \frac{8 \pm \sqrt{-36}}{10}$$

$$\sqrt{1.4^2 + 0.2^2} = 1.41$$

$$= 1.4 \quad = 0.2$$

$$\frac{0.2}{1.4} = 0.13$$

$$1.41 \angle 8.13$$

c) De Moivre's Theorem

$$(3 + 4j)^4$$

$$\sqrt{81^2 + 256^2} = 268.51$$

$$81 + 256j$$

$$\frac{256}{81} = 3.14$$

$$268.51 \angle 72.44$$



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$$r = \sqrt{13} \text{ cm}$$

Question 3

i. $\int x(x^2 + 3x) dx$

$$x^3 + 3x^2 dx$$

$$\frac{x^4}{4} + x^3$$

$$\frac{x^4}{4} + \cancel{\frac{3x^3}{4}} + x^3 + C \quad [3/4]$$

ii. $\int (x+2)(2x+1) - \sin 4x dx$

$$2x^2 + x + 4x + 2 - \sin 4x dx$$

$$2x^2 + 5x + 2 - \sin 4x dx$$

$$\int 2x^2 dx + \int 5x dx + \int 2 dx - \int \sin 4x dx$$

$$\frac{2x^3}{3} + \frac{5x^2}{2} + 2x + \frac{\cos 4x}{4} + C \quad [4/4]$$

iii. $\int_0^2 (3x^2 + 2x - 5) dx$

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$$b) \int 6x(3x^2+4)^5 dx$$

$$6x \int x(3x^2+4)^5 dx$$

$$\frac{6x^7}{7} - \frac{3x^3}{3} \frac{(3x^2+4)^6}{6} + C$$

$$c) \int x \sin x dx$$

$$u = x \quad [3/10]$$

$$dv = \sin(x)$$

$$du = dx$$

$$dv = -\cos(x)$$

$$v + du + C$$

$$\sin(x) +$$

$$\cos(x) + \sin(x) + C$$