

Ashleigh Rosser 1304378
maths friday afternoons Exam 2. 11/12/2020.

Question 1 - matrices

$$i) AB = \begin{pmatrix} -20 & -20 & -1 \\ 25 & -50 & 15 \\ -15 & 20 & 6 \end{pmatrix} \quad -10 + \quad ?$$

$$ii) BA = \begin{pmatrix} -50 & 25 & 25 \\ -20 & -10 & 40 \\ 19 & 0 & -4 \end{pmatrix}$$

$$iii) AC = \begin{pmatrix} 45 & 15 \\ -50 & 0 \\ 100 & 175 \end{pmatrix}$$

iv) $CA =$ cant multiply. not the same matrices

$$v) |A| = -125$$

$$vi) |B| =$$

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iii) $\int_2^5 (x+2)^3 + x - 1 \, dx.$

Sum rule

$$\int_2^5 (x+2)^3 \, dx + \int_2^5 x \, dx - \int_2^5 1 \, dx$$

$$\int_2^5 (x+2)^3 \, dx \quad \underline{\underline{\frac{2145}{4}}}$$

$$\int_2^5 x \, dx = \frac{21}{2}$$

$$\int_2^5 1 \, dx = 3 \quad = \frac{2145}{4} + \frac{21}{2} - 3 = \frac{2175}{4}$$

b) $\int x \sin 4x \, dx$

$$u = x \quad v = \sin 4x$$

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

$$\int -\frac{1}{4} \cos(4x) \, dx = -\frac{1}{16} \sin(4x)$$

$$= -\frac{1}{4} x \cos(4x) - \left(-\frac{1}{16} \sin(4x)\right)$$

$$= -\frac{1}{4} x \cos(4x) + \frac{1}{16} \sin(4x)$$

$$= -\frac{1}{4} x \cos(4x) + \frac{1}{16} \sin(4x) + C$$

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Question 3.

a) $\int (x^8 + 2x^2)(3x^2 + x) dx$

$$\int 3x^{10} + x^9 + 6x^4 + 2x^3 dx$$

$$\int 3x^{10} dx = \frac{3x^{11}}{11}$$

$$\int x^9 dx = \frac{x^{10}}{10}$$

$$\int 6x^4 dx = \frac{6x^5}{5}$$

$$\int 2x^3 dx = \frac{x^4}{2}$$

$$= \frac{3x^{11}}{11} + \frac{x^{10}}{10} + \frac{6x^5}{5} + \frac{x^4}{2} + C$$

b) $\int (e^x + 1)(e^x - 1) dx$

Conjugate of $e^x + 1$: $\frac{e^{2x} - 1}{e^x - 1}$

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

$$\int e^{2x} - 1 dx \quad \text{sum rule.}$$

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

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

$$\int 1 dx = x \quad = \frac{1}{2} e^{2x} - x = \frac{1}{2} e^{2x} - x + C.$$

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Question 2 - complex numbers

$$z_1 = 2 + 5j \quad z_2 = 1 - 3j \quad z_3 = -5 - 2j$$

a) i)

$$z_1 + z_3 = (2 + 5j) + (-5 - 2j) \\ = -3 + 3j$$

$$\text{ii) } z_1 - z_3 = (2 + 5j) - (-5 - 2j) \\ = 7 + 7j$$

$$\text{iii) } \frac{z_1}{z_2} = \frac{(2 + 5j)}{(1 - 3j)} = \frac{(2 + 5j)}{(1 - 3j)} \times \frac{(1 + 3j)}{(1 + 3j)} \\ = \frac{2 + 6j - 5j - 15j^2}{1 + 3j - 3j - 9j^2} \\ = \frac{2 + j - 15j^2}{1 + 9j^2}$$

conjugate

$$\text{iv) } (z_3)^2 - \bar{z}_1 =$$

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vii) $A + B = \begin{pmatrix} -3 & 3 & 3 \\ -3 & 6 & 7 \\ 3 & -2 & 5 \end{pmatrix}$

viii) $AB + D =$ cant multiply - not the same matrices

b) $Y = \begin{pmatrix} 2 & 2x & -2 \\ 5 & x & 1 \\ 2 & (x+2) & 1 \end{pmatrix}$ solve for x if $Y=5$.

c) Cramers rule simultaneous equations.

$$3x - y + 4z = 21.$$

$$5x + 3y - 2 = 15$$

$$2x + 4y + 3z = 10.$$

$$\begin{pmatrix} 3 & 1 & 4 \\ 5 & 3 & 1 \\ 2 & 4 & 3 \end{pmatrix} \begin{matrix} x \\ y \\ z \end{matrix} = \begin{pmatrix} 21 \\ 15 \\ 10 \end{pmatrix}$$

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b) Polar form

$$5x^2 = -3x - 12.$$

$$5x^2 + 3x + 12 = 0.$$

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

$$a=5 \quad b=3 \quad c=12.$$

$$D = b^2 - 4ac.$$

$$D = 3^2 - 4 \times 5 \times 12 = -231.$$

$$x = \frac{-3 - \sqrt{-231}}{2 \times 5} = -\frac{3}{10} \text{ and } -\frac{\sqrt{231}}{10}$$

$$x^2 = \frac{-3 \pm \sqrt{-231}}{2 \times 5} = -\frac{3}{10} \pm \frac{\sqrt{231}}{10}.$$

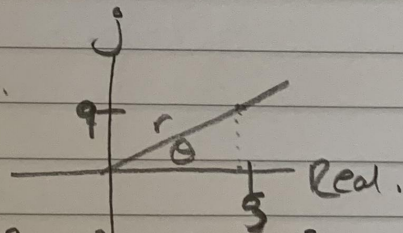
$$x = -\frac{3}{10} - \frac{\sqrt{231}}{10}$$

$$x = -\frac{3}{10} + \frac{\sqrt{231}}{10}.$$

c) de Moivre's theorem (

$$i) (5 - 9j)^5 = 65900 + 95076j.$$

$$r^n (\cos n\theta + j \sin n\theta)$$



$$r^2 = 9^2 + 5^2.$$

$$r^2 = 106. \quad r = 10.29$$

$$\tan \theta = \frac{9}{5} = 60.94^\circ$$

$$(10.29)^5 (\cos 5 \times 60.94^\circ + j \sin 5 \times 60.94^\circ)$$

$$115365.74 ($$