

Maths Test 2

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Q1)

$$(i) \quad AB = \begin{pmatrix} -10 + -10 + 0 & 16 + 30 - 6 & 2 - 10 + 9 \\ -25 + 0 + 0 & -40 + 0 + 10 & 0 + 0 + 15 \\ -15 + 0 + 0 & 24 + 0 - 4 & 0 + 0 + 6 \end{pmatrix}$$

$$AB = \begin{pmatrix} -20 & -20 & 1 \\ -25 & -50 & 15 \\ -15 & 20 & 6 \end{pmatrix}$$

ii) BA

$$BA = \begin{pmatrix} -10 - 40 + 0 & 25 + 0 + 0 & -15 + 40 + 0 \\ 4 - 30 + 6 & -10 + 0 + 0 & 6 + 30 + 4 \\ 0 + 10 + 9 & 0 + 0 + 0 & 0 - 10 + 6 \end{pmatrix}$$

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

iii)

$$AC = \begin{pmatrix} 24 + 15 + 6 & 10 - 10 + 15 \\ -60 + 0 + 10 & -25 + 0 + 25 \\ 36 + 0 + 4 & 15 + 0 + 10 \end{pmatrix}$$

$$AC = \begin{pmatrix} 45 & 15 \\ -50 & 0 \\ 40 & 25 \end{pmatrix}$$

iv) Cannot be done.

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(v)

$$|A| = 2(0-0) + 5(-10-15) + 3(0+0)$$

$$|A| = 0 + 5(-25) + 0$$

$$|A| = -125$$

vi)

$$|B| = -5(18+4) - 8(6+0) + 0$$

$$|B| = -5(22) - 8(6)$$

$$|B| = -110 - 48$$

$$|B| = -158$$

(vii)

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

(viii)

b)

$$|y| = 2(1x - (x+2) - 2x(5-2) - 2(5x+10) - 2x)$$

$$|y| = 2x - 2x - 4 - 10x + 4x - 10x - 20 + 4x = 5$$

$$-12x - 24 = 5$$

$$\cancel{-12x} + 24$$

$$-12x = 5 + 24$$

$$-12x = 29$$

$$x = \frac{29}{-12}$$

$$x = -2.42$$

c)

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

$$|A| = 3(9-4) - 1(15-2) + 4(20-6)$$

$$|A| = 3(5) - 1(13) + 4(14)$$

$$|A| = 15 - 13 + 56$$

$$|A| = 58$$

$$A_1 = \begin{pmatrix} 21 & 1 & 4 \\ 15 & 3 & 1 \\ 10 & 4 & 3 \end{pmatrix}$$

$$|A_1| = 21(9-4) - 1(45-10) + 4(60-30)$$

$$|A_1| = 21(5) - 1(35) + 4(30)$$

$$|A_1| = 105 - 35 + 120$$

$$|A_1| = 190$$

$$A_2 = \begin{pmatrix} 3 & 21 & 4 \\ 5 & 15 & 1 \\ 2 & 10 & 3 \end{pmatrix}$$

$$|A_2| = 3(45-10) - 21(15-2) + 4(50-3)$$

$$|A_2| = 3(35) - 21(13) + 4(20)$$

$$|A_2| = 105 - 273 + 80$$

$$|A_2| = -88$$

$$\{A_3\} = \begin{pmatrix} 3 & 1 & 21 \\ 5 & 3 & 15 \\ 2 & 4 & 10 \end{pmatrix}$$

$$|A_3| = 3(30 - 60) - 1(50 - 30) + 21(20 - 6)$$

$$|A_3| = 3(-30) - 1(20) + 21(14)$$

$$|A_3| = -90 - 20 + 294$$

$$|A_3| = 184$$

$$x = \frac{5190}{58}$$

$$y = \frac{-88}{58}$$

$$z = \frac{184}{58}$$

$$x = 3.28$$

$$y = -1.52$$

$$z = 3.17$$

Question 2 Complex numbers

a)

i) $(2+5j) + (-5-2j)$

$$-3+3j$$

ii) $(2+5j) - (-5-2j)$

$$= 7+7j$$

iii) $\frac{2+5j}{1-3j} \times \frac{1+3j}{1+3j}$

$$\frac{(2+5j) \times (1+3j)}{(1-3j)(1+3j)}$$

$$\frac{2+6j+5j+15j^2}{1+3j-3j-9j^2}$$

$$\frac{2+11j-15}{1+9}$$

$$\frac{-13+11j}{10}$$

$$\frac{-13}{10} + \frac{11}{10}j$$

$$\begin{aligned} \text{iv) } & (-5-2j)(-5-2j) - (2+5j) \\ & (25+10j+10j+4j) - (2+5j) \\ & (25+24j) - (2+5j) \\ & \boxed{23+19j} \end{aligned}$$

b)

$$\begin{aligned} 5x^2 &= -3x - 12 \\ 5x^2 + 3x + 12 &= 0 \end{aligned}$$

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(5)(12)}}{2(5)}$$

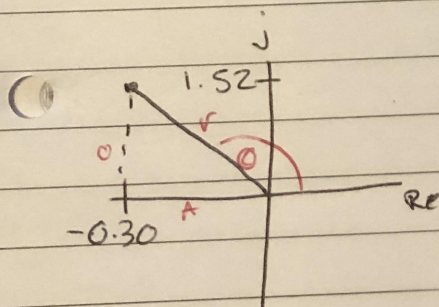
$$x = \frac{-3 \pm \sqrt{9 - 240}}{10}$$

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

$$x = \frac{-3 \pm 15.20j}{10}$$

$$x = \frac{-3 + 15.20j}{10} \quad x = \frac{-3 - 15.20j}{10}$$

$$x = -0.30 + 1.52j \quad x = -0.30 - 1.52j$$



$$r^2 = 0.30^2 + 1.52^2$$

$$r = \sqrt{0.09 + 2.31}$$

$$r = \sqrt{2.22}$$

$$\boxed{r = 1.49}$$

$$\tan \theta = \frac{1.52}{-0.30}$$

$$\theta = \tan^{-1} \left(\frac{1.52}{-0.30} \right)$$

$$\theta = \boxed{78.84^\circ}$$

$$\theta = 180^\circ - 78.84^\circ$$

$$\boxed{\theta = 101.16^\circ}$$

$$PF = \boxed{1.49(\cos 101.16^\circ + j \sin 101.16^\circ)}$$

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c)

ii) $(5-9j)^5$

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

$$r = \sqrt{25 + 81}$$

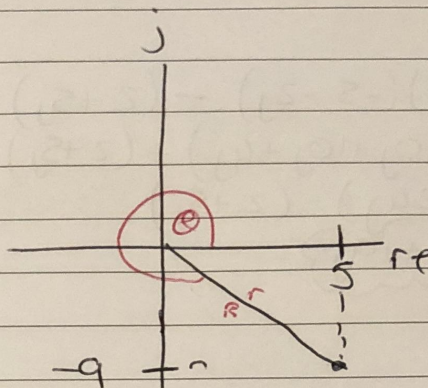
$$r = \sqrt{106}$$

$$r = 10.30$$

$$\tan \theta = \frac{9}{5}$$

$$\theta = \tan^{-1}\left(\frac{9}{5}\right)$$

$$\theta = 60.95^\circ$$



$$\theta = 180 + 60.95^\circ$$

$$\theta = 240.95^\circ$$

$$(10.30)^5 (\cos 5 \times 240.95^\circ + j \sin 5 \times 240.95^\circ)$$

$$115927.41 (\cos 1204.75 + j \sin 1204.75)$$

$$115927.41 (-0.57 + 0.82j)$$

$$RF = -66078.62 + 95060.48j$$

Question 3

a)

i) $\int (x^8 + 2x^2)(3x^2 + x) dx$
 $\int (3x^{10} + x^2 + 6x^4 + 2x^3) dx$
 $\frac{3x^{11}}{11} + \frac{x^3}{3} + \frac{6x^5}{5} + \frac{2x^4}{4}$

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