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Module : M4 x 00341 Metamerics

Q. Complex numbers

$$z_1 + z_2$$

$$(7 + 5j) + (3 - 7j)$$

ii) $z_1 + z_2 = (10 - 2j)$

$$z_1 - z_3 = (7 + 5j) - (-2 + 6j)$$

$$z_1 - z_3 = (9 - 1j)$$

iii) $\underline{z_1} \quad \underline{7 + 5j} \times \underline{3 + 7j}$

$$\underline{z_2} \quad \underline{3 - 7j} \times \underline{3 + 7j}$$

$$= \underline{21 + 44j + 15j + 35j^2}$$

$$4 + 21j + 21j - 44j^2$$

$$= \underline{21 + 64j + 28}$$

$$\begin{array}{r} 4 + 64j \\ 58 \quad 58 \end{array}$$

iv) $\underline{z_1} - \underline{z_2}$

$$\begin{array}{l|l} 7 - 5j & + \quad -2 - 6j \\ \hline (5 - 11j) & \end{array} \quad \begin{array}{l} \text{work out} \\ 7 - 2 = 5 \\ 5 + 6 = 11 \end{array}$$

$$b) (z_1)^2 - z_2 - z_3$$

$$(1+5j)(1+5j) - (3-7j) - (2+6j)$$

$$11 + 10j + 25j^2 - 3 - 7j - 2 - 6j$$

44

$$44 - 4j$$

$$b) 12x^2 + 5x - 13 = 0$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(12)(-13)}}{2(12)}$$

$$x = \frac{-5 \pm \sqrt{241}}{24}$$

$$x = \frac{-5 \pm \sqrt{549}}{24}$$

$$x = \frac{-5 \pm \frac{24 \cdot 4.7j}{24}}{24}$$

$$x = \frac{-5}{24} + \frac{2 \cdot 4 \cdot 4.7j}{24}$$

$$x = -0.21 + 1.02j$$

$$x = \frac{-5}{24} - \frac{24 \cdot 4.7j}{24}$$

$$x = -0.21 - 1.02j$$

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$$C = \sqrt{0.21^2 + 1.02^2}$$

$$C = 1.04$$

$$\tan^{-1} \frac{1.02}{0.21} = 78.37$$

$$180 - 78.37$$

$$\textcircled{D} 101.63^\circ$$

$$1.04 (\cos 101.63^\circ + j \sin 101.63^\circ)$$

$$C = \sqrt{0.21^2 + 1.02^2}$$

$$C = 1.04$$

$$\tan^{-1} \frac{1.02}{0.21} = 78.37$$

$$180 + 78.37$$

$$\textcircled{D} 258.37$$

$$1.04 (\cos 258.37^\circ + j \sin 258.37^\circ)$$

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

$$C = \sqrt{4^2 + 4^2}$$

$$C = \sqrt{4^2}$$

$$C = 4.45$$

$$\theta = \frac{4}{4}$$

$$\theta = 66.01$$

$$DWT = (4.45)^4 [\cos 4 \times 66.01^\circ + j \sin 4 \times 66.01^\circ]$$

$$4413.37 [\cos 246.28^\circ + j \sin 246.28^\circ]$$

$$= -37864.64 - 8818.95j$$

$$(-5 - 2j)^2$$

$$C = \sqrt{5^2 + 2^2}$$

$$C = \sqrt{21}$$

$$C = 4.58$$

$$\theta = \frac{2}{5}$$

$$= 21.80$$

$$180 - 21.80$$

$$\theta = 158.2^\circ$$

$$DWT = (4.58)^5 [\cos 5 \times 158.2^\circ + j \sin 154.2^\circ]$$

$$2019.24 [\cos 791^\circ + j \sin 791^\circ]$$

$$656.10 + 1405.41j$$

$$1701214 \quad \frac{6}{4}$$

$$\begin{aligned} & (-5 - 2j)^5 \\ \text{iii) } & C = \sqrt{5^2 + 2^2} \\ & C = \sqrt{29} \\ & C = 4.58 \end{aligned}$$

$$\theta = \frac{\pi}{5}$$

$$\begin{aligned} & = 21.80 \\ 180 - 21.80 \\ \theta & = 158.2^\circ \end{aligned}$$

$$\begin{aligned} D_{\text{out}} &= (4.58)^5 [\cos 5 \times 158.2^\circ + j \sin 158.2^\circ] \\ &= 2015.24 [\cos 791^\circ + j \sin 791^\circ] \\ &= 656.10 + 1405.45j \end{aligned}$$

$$j4 = j2 \times j2$$

$$\begin{aligned} \text{e) } & (5 + j)(1 - 6j)(3 - 2j) \\ & (5 - 30j + 1j - 6j^2)(3 - 2j) \\ & (11 - 29j)(3 - 2j) \end{aligned}$$

$$\begin{aligned} & = 11 \cdot 11j - 29j + 29j^2 \cdot 3 \\ & = 18 - 40j \end{aligned}$$

$$\begin{aligned} C &= \sqrt{18^2 + 40^2} \\ C &= 43.86 \end{aligned}$$

$$\theta = 105.77^\circ$$

$$\theta = 245.77^\circ$$

$$43.86 [\cos 245.77^\circ + j \sin 245.77^\circ]$$

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 $\frac{7}{2}$

3)

a

$$AB = \begin{pmatrix} 46 & 15 & 30 \\ -8 & -21 & -2 \\ 6 & 0 & 5 \end{pmatrix}$$

ii)

$$BA = \begin{pmatrix} 18 & 14 & 10 \\ 16 & 13 & 10 \\ 38 & 50 & 5 \end{pmatrix}$$

iii)

$$AC = \begin{pmatrix} 58 & 40 \\ 27 & 24 \\ 13 & 10 \end{pmatrix}$$

iv) $CA = \text{cannot calculate}$

$$v) A = 7 \begin{vmatrix} 4 & -7 \\ 1 & 0 \end{vmatrix} - 6 \begin{vmatrix} 2 & -7 \\ 2 & 0 \end{vmatrix} + 5 \begin{vmatrix} 2 & -7 \\ 2 & 1 \end{vmatrix}$$

$$= 7(0 - 7) - 6(0 + 14) + 5(14 - 27)$$

$$vi) |A| = 45$$

$$vii) |B| = 2 \begin{vmatrix} 0 & 1 \\ 9 & 2 \end{vmatrix} - 0 \begin{vmatrix} 2 & 1 \\ 4 & 2 \end{vmatrix} + 2 \begin{vmatrix} 2 & 0 \\ 4 & 3 \end{vmatrix}$$

$$= 2(0 - 4) - 0(4 + 4) + 2(6 - 0)$$

$$B = 4$$

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viii)

$$A+B = \begin{pmatrix} 9 & 6 & 2 \\ 4 & 8 & -6 \\ 6 & 4 & 2 \end{pmatrix}$$

viii) $A+B$ cannot calculate

$$b) \quad 14x^2 + 2x + 1 = 0$$

$$14x^2 + 2x = 11$$

$$14x^2 + 2x - 11 = 0$$

$$x = \frac{-2 \pm \sqrt{4 - 4(14)(-11)}}{2(14)}$$

$$x = \frac{4 \pm 616}{28}$$

$$\frac{-2 \pm \sqrt{612}}{28}$$

$$= \frac{-2 \pm 24.74}{28}$$

$$\begin{array}{l|l} \frac{-2 + 24.74}{28} & \frac{-2 - 24.74}{28} \\ \hline x = 0.81 & x = -0.96 \end{array}$$

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$$2x + 3y + 2z = 14$$

$$\begin{pmatrix} 2 & 3 & 2 \\ 1 & 2 & 5 \\ 3 & 1 & -2 \end{pmatrix} = \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 14 \\ 4 \\ 14 \end{pmatrix}$$

$$2 \left(\begin{array}{cc|c} 2 & 5 & 1 \\ 1 & -2 & 3 \end{array} \right) + 3 \left(\begin{array}{cc|c} 1 & 5 & 1 \\ 3 & -2 & 2 \end{array} \right) + 2 \left(\begin{array}{cc|c} 1 & 2 & 1 \\ 3 & 1 & 1 \end{array} \right)$$

A =

$$\begin{pmatrix} 14 & 3 & 2 \\ 4 & 2 & 5 \\ 14 & 1 & 2 \end{pmatrix}$$

$$14 \left(\begin{array}{cc|c} 2 & 5 & 1 \\ 1 & -2 & 3 \end{array} \right) + 3 \left(\begin{array}{cc|c} 1 & 5 & 1 \\ 3 & -2 & 2 \end{array} \right) + 2 \left(\begin{array}{cc|c} 1 & 2 & 1 \\ 3 & 1 & 1 \end{array} \right)$$

Ax

$$A \rightarrow \begin{pmatrix} 2 & 14 & 2 \\ 1 & 4 & 5 \\ 3 & 14 & 2 \end{pmatrix}$$

$$2 \left(\begin{array}{cc|c} 14 & 5 & 1 \\ 14 & 2 & 3 \end{array} \right) - 14 \left(\begin{array}{cc|c} 1 & 5 & 1 \\ 3 & 2 & 2 \end{array} \right) + 2 \left(\begin{array}{cc|c} 1 & 4 & 1 \\ 3 & 14 & 1 \end{array} \right)$$