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Student number: 1903653

Course: mathematics

Module code: M4X00391

Date: 11th of May

Start time: 13:00

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Question one

ai) $z_1 + z_3$
 $= (7+5j) + (-2+6j)$
 $= 7+5j-2+6j$
 $= 5+11j$

ii) $z_1 - z_3$
 $= (7+5j) - (-2+6j)$
 $= 7+5j+2-6j$
 $= 9-j$

iii) z_1/z_2
 $= \frac{7+5j}{3-7j}$
 $= \frac{7+5j}{3-7j} \times \frac{3+7j}{3+7j} = \frac{(7+5j)(3+7j)}{(3-7j)(3+7j)}$
 $= \frac{21+49j+15j+35j^2}{9+21j-21j-49j^2}$
 $= \frac{21+64j+35(-1)}{9-49(-1)}$
 $= \frac{21+64j-35}{9+49}$
 $= \frac{-14+64j}{58}$
 $= \frac{-14}{58} + \frac{64}{58}j$

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$$\text{civ) } \bar{z}_1 - \bar{z}_2 = (7-5j) - (-2-6j) = (7-5j) - (-2-6j) \\ = 7-5j+2+6j = 9+j$$

$$\text{v) } -z_2 - z_3 = -(2-7j) - (-2+6j) \\ = -2+7j+2-6j = 1+j$$

$$\text{b) } 12z^2 + 5z = -13 \\ 12z^2 + 5z + 13 = 0$$

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

$$= \frac{-5 \pm \sqrt{5^2 - 4 \times 12 \times 13}}{2 \times 12}$$

$$= \frac{-5 \pm \sqrt{25 - 624}}{24}$$

$$= \frac{-5 \pm \sqrt{-599}}{24}$$

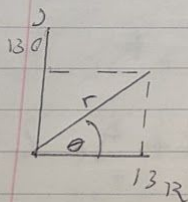
$$= \frac{-5 + 599j}{24}$$

$$= \frac{-5 - 599j}{24}$$

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d) j^4
 $= \sqrt{-1}^4$
 $= 1$

e) $\bar{z}_1 z_2 z_3$
 $= (5-2j)(1-6j)(3-2j)$
 $= 5-30j-2j-12j^2(3-2j)$
 $= 5-32j-12(-1)(3-2j)$
 $= 5-32j+12(3-2j)$
 $= (17-32j)(3-2j)$
 $= 51-96j-34j+64j^2$
 $= 51-130j+64(-1)$
 $= 51-130j-64$
 $= -13-130j$



$$r^2 = -13^2 + (-130)^2$$

$$= 169 + 16900$$

$$r = \sqrt{17069}$$

$$= 130.65$$

$$\tan \theta = \frac{-130}{-13}$$

$$\theta = \tan^{-1} \left(\frac{-130}{-13} \right)$$

$$= 84.29^\circ$$

Polar form = $130.65(\cos 84.29 + j \sin 84.29)$

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Question 2

ai) $\int (6x^2 - 6x)(3x^2 - x) dx$

$$= \int 3x^4 + x^3 - 18x^3 + 6x^2 dx$$

$$= \int 3x^4 - 17x^3 + 6x^2 dx$$

$$\frac{3x^5}{5} - \frac{17x^4}{4} + \frac{6x^3}{3} + C$$

ii) $\int (x^2 + 3x)^2 + e^{0.5x} - \sin \sin 2x dx$

$$= \int (x^2 + 3x)(x^2 + 3x) + e^{0.5x} - \sin \sin 2x dx$$

$$= \int x^4 + 3x^3 + 3x^3 + 9x^2 + e^{0.5x} - \sin \sin 2x dx$$

$$= \int x^4 + 6x^3 + 9x^2 + e^{0.5x} - \sin \sin 2x dx$$

$$= \frac{x^5}{5} + \frac{6x^4}{4} + \frac{9x^3}{3} + \frac{1}{0.5} e^{0.5x} + \frac{1}{2} \cos 2x + C$$

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$$\begin{aligned}\text{iii } & \int_0^3 (2x^2 + 3)^3 dx \\&= \int_0^3 (2x^2 + 3) (2x^2 + 3) (2x^2 + 3) dx \\&= \int_0^3 (4x^4 + 6x^2 + 6x^2 + 9) (2x^2 + 3) dx \\&= \int_0^3 (4x^4 + 12x^2 + 9) (2x^2 + 3) dx \\&= \int_0^3 (8x^6 + 12x^4 + 18x^2 + 27 + 36x^2 + 24x^4) dx \\&= \int_0^3 (8x^6 + 36x^4 + 54x^2 + 27) dx \\&= \left[\frac{8x^7}{7} + \frac{36x^5}{5} + \frac{54x^3}{3} + 27x \right]_0^3 \\&= \left[\frac{8(3)^7}{7} + \frac{36(3)^5}{5} + \frac{54(3)^3}{3} + 27(3) \right] - [0] \\&= [2499.43 + 1749.6 + 486 + 81] - [0] \\&= \del{4816.03} 4816.03\end{aligned}$$