

Samuel Johns Maths Exam

1804234

Maths-M4X00391

11/05/2020

Time Of Exam: 13:00

Questions done were Q1 (Complex Numbers) and Q2 (Integration)

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i. a. $z_1 + z_3 = 7+5j + -2+6j$

$$7-2+5j+6j = 5+11j$$

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

$$7-2+5j-6j = 9-j$$

iii $\frac{z_1}{z_2} = \frac{7+5j}{-3-7j} \times \frac{3+7j}{3+7j}$

~~$$\frac{21+35j^2 - 9 - 49j^2}{21+35(1) - 9 - 49j^2} = \frac{14j}{14j}$$~~

~~$$21+35(1) - 9 - 49j^2 =$$~~

~~$$\frac{21+35j^2 - 9 - 49j^2}{21+35j^2 - 9 - 49j^2} = \frac{21+64j+35j^2}{-9-21j-21j-49j^2}$$~~

~~$$\frac{14j}{14j}$$~~

$$= \frac{21+64j+35j^2}{-9-49j^2}$$

$$\frac{-14}{58} + \frac{64j}{58}$$

iv $\overline{z_1 + z_2} = 7+5j - -3-7j$

$$\therefore 7+5j - -3-7j$$

$$\therefore 4-12j$$

v $(z_1)^2 - z_2 - z_3 = (7+5j)^2 - 3-7j - -2+6j$

~~$$44+16j-3-7j-2+6j$$~~

~~$$= 4+13j$$~~

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$$b. 12x^2 + 5x = 13 \quad \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$V. (7+5j)^2 - 3 - 7j - 2 + 6j$$

$$(7+5j)(7+5j)$$

$$= 49 + 35j + 35j + 25j^2 - 3 - 7j - 2 + 6j$$

$$44 + 71j$$

$$b. 12x^2 + 5x = 13 \quad \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\therefore \frac{-5 \pm \sqrt{5^2 - 4(12)(13)}}{2 \times 12} \quad \therefore = 4(12)(13) = -624$$

$$\therefore \frac{-5 \pm \sqrt{5^2 - 624}}{24} \quad \therefore (5)^2 - 624 = -599$$

$$\therefore \frac{-5 \pm \sqrt{-599}}{24} \quad \therefore \sqrt{599} = 24.47j$$

$$\frac{-5 \pm 24.47j}{24} \quad \therefore \frac{-5}{24} = 0.208 \quad \frac{24.47}{24} = 1.0196$$

$$0.208 + 1.020 = 1.228$$

$$0.208 - 1.02 = 0.812$$

$$\text{Polar}(-0.208, 1.02) \approx r = 1.04$$

$$\angle \tan^{-1} \frac{1.02}{-0.21} = -80.07 \quad r(\cos \theta + j \sin \theta)$$

$$r(\cos 80 + j \sin 80)$$

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c.

$$i. (4+9j)^4 \quad r = \sqrt{x^2 + y^2} = \sqrt{4^2 + 9^2} = 9.85$$

$$\tan \theta = \frac{y}{x}$$

$$\theta = \tan^{-1} \frac{9}{4} = 66.04$$

DMT

$$(4+9j)^4 [\cos(4 \times 66.04) + j \sin(4 \times 66.04)]$$

$$9409 (\cos 264.16 + j \sin 264.16)$$

$$= -957.37 - 9360.17j$$

$$ii. (-5-2j)^5 \quad r = \sqrt{x^2 + y^2} = \sqrt{5^2 + 2^2} = 5.39$$

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

$$\theta = \tan^{-1} \frac{-2}{-5} = 21.8$$

DMT

$$(-5-2j)^5 [\cos(-5 \times 21.8) + j \sin(-5 \times 21.8)]$$

$$4528 (\cos -109) + j (\sin -109)$$

$$= -1474.17 - 4281.3j$$

$$d. j^4 = 1$$

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e. $\bar{z} z z z$

$$(5-2j) \times (1-6j) \times (3-2j)$$

$$~~15-18j~~$$

$$(5-30j+15-10j-2j+12j^2-6j+4j^2)$$

$$~~24~~ - 5 - 30j + 15 - 10j - 2j + 12(-1) - 6j + 4(-1)$$

$$~~36-48j~~ - 85 - 82j$$

$$\text{Pol}(85, -82) = 118.11 \quad r = 118.11^\circ$$

$$\tan \theta = \frac{82}{85}$$

$$\theta = \tan^{-1} \frac{82}{85} = 43.97^\circ$$

2.a

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

$$\therefore \frac{x^2 - 6x}{3} \cdot \frac{3x^2 - x}{2} = \frac{3x^4 - x^3 - 18x^3 - 6x^2}{6}$$

$$\therefore \frac{3x^5}{5} - \frac{x^4}{4} - \frac{18x^4}{4} - \frac{6x^3}{3} + C$$

$$\frac{dy}{dx} = \frac{3x^5}{5} - \frac{x^4}{4} - \frac{18x^4}{4} - \frac{2x^3}{1} + C$$

$$11 \int (x^2 + 3x)^2 + e^{0.5x} - \sin 2x dx$$

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

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

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$$x^4 + 3x^3 + 3x^2 + 4x + e^{0.5x} - \sin 2x \, dx$$

$$\frac{x^5}{5} + \frac{3x^4}{4} + \frac{3x^3}{4} + \frac{4x^2}{3} + e^{0.5x} - \sin 2x \, dx$$

$$\frac{dy}{dx} = \frac{x^5}{5} + \frac{3x^4}{4} + \frac{3x^3}{4} + \frac{4x^2}{3} + \frac{1}{0.5} e^{0.5x} - \sin 2x \, dx$$

$$\frac{1}{\sin 2x}$$

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

$$iv \int_0^3 (2x^2 + 3x)^3$$

$$(2x^2 + 3x)(2x^2 + 3x)(2x^2 + 3x)$$

$$4x^4 + 6x^3 + 4x^4 + 6x^3 + 6x^3 + 9x^2 + 6x^3 + 9x^2 + 4x^2$$

$$8x^6 + 36x^4 + 54x^3 + 27 \, dx$$

$$\frac{8x^7}{7} + \frac{36x^5}{5} + \frac{54x^3}{3} + 27x \, dx$$

$$\frac{8(3)^7}{7} + \frac{36(3)^5}{5} + \frac{54(3)^3}{3} + 27(3) = 4816.03 - 0 = 4816.03$$

$$\frac{8(0)^7}{7} + \frac{36(0)^5}{5} + \frac{54(0)^3}{3} + 27(0) = 0$$

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$$\text{iv} \int_2^5 x^3 + 2x^{\frac{2}{3}} - x + 5 dx$$

$$\frac{x^4}{4} + \frac{2x^{\frac{3}{3}}}{\frac{3}{3}} - \frac{x^2}{2} + 5x dx$$

$$\frac{(5)^4}{4} + \frac{2(5)^3}{3} - \frac{(5)^2}{2} + 5(5) dx$$

$$= 2512.08 - 32.8 = 214.28$$

$$\therefore \frac{(2)^4}{4} + \frac{2(2)^3}{3} - \frac{(2)^2}{2} + 5(2) dx = 32.8$$

$$\text{b. i} \int 3x \sin 5x dx$$

$$\frac{3x}{5} \cos 5x$$

$$- \frac{3x}{5} \cos 5x + C$$

$$\text{ii} \int x \cos \frac{x}{2} dx$$

$$\frac{x}{\frac{1}{2}} \sin \frac{x}{2} + C$$