Question 1 — Complex Numbers **(8 marks)**

Consider the equation $z^3 = -27i$.

(a) Express $-27i$ in exact polar form. (2 marks)

(b) Hence determine, in exact polar form, all three solutions to $z^3 = -27i$. (3 marks)

(c) One of the solutions found in part (b) is purely imaginary. State this solution in Cartesian form, and verify that it satisfies the original equation. (3 marks)

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Question 2 — Integration Techniques **(6 marks)**

(a) Express $\frac{5x+1}{(x-1)(x+2)}$ in the form $\frac{A}{x-1}+\frac{B}{x+2}$, stating the values of the constants A and B. (3 marks)

(b) Hence determine $\int \frac{5x+1}{(x-1)(x+2)}\,dx$. (3 marks)

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Question 3 — Vectors in Three Dimensions **(8 marks)**

Relative to an origin O, the points A(2, 0, 1), B(5, 4, 1) and C(6, −3, 3) are given.

(a) Determine the vectors AB (from A to B) and AC (from A to C), each in component form. (2 marks)

(b) Hence show that angle BAC = 90°. (2 marks)

(c) Determine a vector equation for the line passing through A and B. (2 marks)

(d) Determine whether the point D(11, 12, 1) lies on the line found in part (c). Justify your answer. (2 marks)

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