Exercise 1

Paper 1 style · No calculator

1 7 marks AHL 2.12 ●●○ Typical

Let $P(x) = 2x^3 + ax^2 + bx - 9$, where $a, b \in \mathbb{R}$. The polynomial $x - 3$ is a factor of $P(x)$, and when $P(x)$ is divided by $x + 1$ the remainder is -12.

(a) Find the value of a and the value of b. **[4]**

(b) Hence show that the equation $P(x) = 0$ has exactly one real root. **[3]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$P(3) = 0$: $54 + 9a + 3b - 9 = 0$ **M1**

$P(-1) = -12$: $-2 + a - b - 9 = -12$ **M1**

$3a + b = -15$ and $a - b = -1$ **A1**

$a = -4,\ b = -3$ **A1**

Total 4 marks

MARKSCHEME (b)

$P(x) = (x - 3)\left(2x^2 + 2x + 3\right)$ **M1A1**

$\Delta = 4 - 24 = -20 < 0$: no real root for the quadratic, so $x = 3$ is the only real root **R1**

Total 3 marks