Exercise 3

Paper 2 style · Graphic display calculator

3 6 marks AHL 2.12 ●●○ Typical

Consider the equation $x^4 - 3x^3 - 5x^2 + 9x + 4 = 0$, with roots α, β, γ and δ.

(a) Find the four roots. **[2]**

(b) Write down the value of $\alpha\beta\gamma\delta$. **[1]**

(c) Find the value of $\alpha^2 + \beta^2 + \gamma^2 + \delta^2$. **[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)

$-1.82,\ -0.384,\ 1.59,\ 3.61$ **A2**

Total 2 marks

Note A1 for two or three correct roots.

MARKSCHEME (b)

$\alpha\beta\gamma\delta = 4$ **A1**

Total 1 mark

MARKSCHEME (c)

$\sum\alpha = 3,\ \sum\alpha\beta = -5$ **(A1)**

$3^2 - 2 \times (-5)$ **(M1)**

$= 19$ **A1**

Total 3 marks