Marked example 3

Paper 2 style · Graphic display calculator

3 6 marks AHL 2.12 ●●○ Typical

Consider the equation $x^4 - 2x^3 - 7x^2 + 8x + 5 = 0$, 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]**

MARKSCHEME (a)

$-2.25,\ -0.466,\ 1.47,\ 3.25$ **A2**

Total 2 marks

Note A1 for two or three correct roots.

MARKSCHEME (b)

$\alpha\beta\gamma\delta = \frac{(-1)^4 \times 5}{1} = 5$ **A1**

Total 1 mark

MARKSCHEME (c)

$\sum\alpha = 2,\ \sum\alpha\beta = -7$ **(A1)**

$2^2 - 2 \times (-7)$ **(M1)**

$= 18$ **A1**

Total 3 marks

Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software.
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