Exercise 3

Paper 2 style · Graphic display calculator

3 8 marks AHL 1.14 ●●○ Typical

Consider the equation $z^3 = -11 - 2\mathrm{i}$.

(a) Show that $1 + 2\mathrm{i}$ is a root of the equation. **[2]**

(b) Find the other two roots, giving your answers in the form $a + b\mathrm{i}$. **[4]**

(c) The three roots form a triangle in the complex plane. Find its area. **[2]**

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)

$(1+2\mathrm{i})^3 = 1 + 6\mathrm{i} + 12\mathrm{i}^2 + 8\mathrm{i}^3$ **M1**

$= 1 + 6\mathrm{i} - 12 - 8\mathrm{i} = -11 - 2\mathrm{i}$ **A1**

Total 2 marks

MARKSCHEME (b)

multiply by $\mathrm{e}^{\pm \mathrm{i}2\pi/3}$ **M1**

$(1+2\mathrm{i})\left(-\frac{1}{2} + \frac{\sqrt{3}}{2}\mathrm{i}\right)$ **(A1)**

$-2.23 - 0.134\mathrm{i},\ 1.23 - 1.87\mathrm{i}$ **A1A1**

Total 4 marks

MARKSCHEME (c)

equilateral, circumradius $|1+2\mathrm{i}| = \sqrt{5}$: $3 \times \frac{1}{2}(\sqrt{5})^2 \sin\frac{2\pi}{3}$ **(M1)**

$= 6.50$ **A1**

Total 2 marks