Exercise 2

Paper 1 style · No calculator

2 7 marks AHL 1.13 ●●● Demanding

Let $u = 1 + \mathrm{i}$ and $v = 1 + \sqrt{3}\,\mathrm{i}$.

(a) Find uv in the form $a + b\mathrm{i}$. **[2]**

(b) Write u and v in the form $r\mathrm{e}^{\mathrm{i}\theta}$. Hence write uv in the same form. **[3]**

(c) Hence find the exact value of $\cos\dfrac{7\pi}{12}$. **[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)

$1 + \sqrt{3}\,\mathrm{i} + \mathrm{i} - \sqrt{3}$ **(M1)**

$= (1 - \sqrt{3}) + (1 + \sqrt{3})\mathrm{i}$ **A1**

Total 2 marks

MARKSCHEME (b)

$u = \sqrt{2}\,\mathrm{e}^{\mathrm{i}\pi/4},\ v = 2\mathrm{e}^{\mathrm{i}\pi/3}$ **A1A1**

$uv = 2\sqrt{2}\,\mathrm{e}^{\mathrm{i}7\pi/12}$ **A1**

Total 3 marks

MARKSCHEME (c)

$2\sqrt{2}\cos\frac{7\pi}{12} = 1 - \sqrt{3}$ **M1**

$\cos\frac{7\pi}{12} = \dfrac{1 - \sqrt{3}}{2\sqrt{2}} = \dfrac{\sqrt{2} - \sqrt{6}}{4}$ **A1**

Total 2 marks