# Cartesian/polar forms

6 questions | 13 marks

Equivalent correct methods earn the corresponding marks.

**1.** Convert $1+i$ to polar form. [2 marks]

$r=\sqrt{1+1}=\sqrt{2}$ and the equal positive coordinates give $\theta=\frac{\pi}{4}$.

**Answer:** $\sqrt{2}\operatorname{cis}(\frac{\pi}{4})$.

**2.** Convert $-2-2i$ to polar form with $-\pi<\theta\leq\pi$. [2 marks]

The modulus is $\sqrt{8}=2\sqrt{2}$. Quadrant III has principal angle $-\frac{3\pi}{4}$.

**Answer:** $2\sqrt{2}\operatorname{cis}(-\frac{3\pi}{4})$.

**3.** Convert $6\operatorname{cis}(\frac{\pi}{6})$ to Cartesian form. [2 marks]

Multiply 6 by $\cos(\frac{\pi}{6})=\frac{\sqrt{3}}{2}$ and $\sin(\frac{\pi}{6})=\frac{1}{2}$.

**Answer:** $3\sqrt{3}+3i$.

**4.** A signal is represented by $5\operatorname{cis}\pi$. State its real and imaginary components. [2 marks]

$5\cos\pi=-5$ and $5\sin\pi=0$.

**Answer:** Real component $-5$; imaginary component $0$.

**5.** A student writes $-1+i=\sqrt{2}\operatorname{cis}(-\frac{\pi}{4})$. Explain and correct the error. [3 marks]

The given angle produces a positive real part and a negative imaginary part, opposite to those required.

**Answer:** The angle is in the wrong quadrant; use $\sqrt{2}\operatorname{cis}(\frac{3\pi}{4})$.

**6.** Why is an argument of $z=0$ undefined? [2 marks]

Every value of $\theta$ gives $0\operatorname{cis}\theta=0$, so no direction is distinguished.

**Answer:** Zero has no direction from the origin.