IB Math Minds

# Complex Numbers
# Problem Set 1

**1.** For each complex number $z$ given below, find the modulus, $|z|$, and the principal argument, $\arg z$. [ ***no*** *calculator* ]

(a) $z = \dfrac{1-\mathrm{i}}{1+\mathrm{i}}$ (b) $z = \dfrac{-1-7\mathrm{i}}{4+3\mathrm{i}}$

**2.** Find all complex solutions to the equation $z^4 + 81 = 0$ and express them in Cartesian form; that is, in the form $z = a + \mathrm{i}b$. [ ***no*** *calculator* ]

**3.** (a) Using de Moivre's theorem, find identities for $\sin 4\theta$ and $\cos 4\theta$ expressed only in terms of $\sin\theta$ and $\cos\theta$.

(b) Hence, show that $\tan 4\theta = \dfrac{4\tan\theta - 4\tan^3\theta}{1 - 6\tan^2\theta + 4\tan^4\theta}$, [ ***no*** *calculator* ]