Indian Institute of Technology Bombay
MA 001 Preparatory Mathematics I

Quiz 1

Date: August 30, 2004 | Maximum Marks: 16
Duration: 30 Minutes | Weightage : 8 %

Note: Write the answers in the space provided on the question paper. The supplement sheet provided to you is for rough work. It should be submitted alongwith this question-cum-answer paper. Please ensure that you write your name and roll number below as well as on the supplement sheet.

Name: **Roll No.:**

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1. Represent each of the following complex numbers in the polar form.

   (i) $\cos\frac{\pi}{4} - \frac{i}{\sqrt{2}}\sin\frac{\pi}{2}$, (ii) $\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)^5 \left(\cos\frac{\pi}{5} + i\sin\frac{\pi}{5}\right)^3$.

   Answer: (i) (ii)

   [4 points]

2. Determine the principal value of the argument for each of the following complex numbers.

   (i) $\left(\frac{1+i}{\sqrt{2}}\right)^{17}$, (ii) $2004\left(\cos\frac{17\pi}{3} + i\sin\frac{17\pi}{3}\right)$.

   Answer: (i) (ii)

   [4 points]

3. Let ω be a primitive 30^{th} root of unity. Determine the values of k, where $0 \le k \le 29$, for which ω^k is a 6th root of unity. Further determine the values of ℓ, where $0 \le \ell \le 29$, for which ω^ℓ is a primitive 6th root of unity.

Answer: $k =$ $\ell =$

[4 points]

4. State whether the following statements are True or False by circling T or F. As usual, for a nonzero complex number z, we denote by $\arg z$ an argument of z and by $\text{Arg}(z)$ the principal argument of z.

(i) $\text{Arg}(z_1 z_2) = \text{Arg}(z_1) + \text{Arg}(z_2)$ for any nonzero complex numbers z_1, z_2. (T / F)

(ii) $\arg z + \arg \overline{z}$ is an integer multiple of 2π for any $z \in \mathbb{C}$ with $|z| = 1$. (T / F)

(iii) If $n \in \mathbb{N}$ and ω is an n^{th} root of unity, then every nth root of unity is of the form ω^k for some $k \in \mathbb{Z}$ with $0 \le k \le n-1$. (T / F)

(iv) The total number of all primitive 12^{th} root of unity is 4. (T / F)

[4 points]