25/03/2012 E.C

Bule Hora University
College of Natural and Computational Science
Department of Mathematics
Mathematics for Natural Science Group Assignment (5 %)

Jot down necessary steps neatly and legibly !!

1 By induction on n , derive De Moivre's formula : $(\cos\theta + i\sin\theta)^n = \cos(n\theta) + i\sin(n\theta)$ and use De Moiver's formula to derive formula for $\cos 3\theta$, $\sin 3\theta$, $\cos 4\theta$, $\sin 4\theta$ in terms of $\cos\theta$ and $\sin\theta$ (**0.75 pt**)

2 Let $z, w \in \mathbb{C}$. Show that

a. $\mathrm{Re}(z \pm w) = \mathrm{Re}(z) \pm \mathrm{Re}(w)$

b. $\mathrm{Im}(z \pm w) = \mathrm{Im}(z) \pm \mathrm{Im}(w)$

Give examples to show that neither $\mathrm{Re}(zw) = \mathrm{Re}(z)\,\mathrm{Re}(w)$ nor $\mathrm{Im}(zw) = \mathrm{Im}(z)\mathrm{Im}(w)$ hold in general. (**1 pt**)

3 If z_1 , z_2 are complex numbers , then prove that

$|z_1 + z_2|^2 + |z_1 - z_2|^2 = 2(|z_1|^2 + |z_2|^2)$ (**0.75 pt**)

4 **200** College freshman were interviewed. (**0.25 pts each**) **89** were registered for a Maths class , **80** were registered for an English class , **60** were registered for both Maths and English.

a. How many registered only for a Maths class?

b. How many registered only for an English class?

c. How many registered for neither Maths class nor Englihs class?

d. How many registered for Maths class or English class?

5 **Using Principle of Mathematical Induction , prove that** (**0.5 pts each**)

a. For any natural number n , $2903^n - 803^n - 464^n + 261^n$ is divisible by 1897.

b. $\sin\theta + \sin(2\theta) + \sin(3\theta) + \cdots + \sin(n\theta) = \frac{\cot\left(\frac{\theta}{2}\right)}{2} - \frac{\cos\left(\left(n+\frac{1}{2}\right)\theta\right)}{2\sin\left(\frac{\theta}{2}\right)}, \ \forall n \in N$

6 Using formal proof , show that the following argument is valid or not.

If today is Tuesday , then I have a test in Maths or Economics. If my Economics teacher is sick , then I will not have a test in Economics. Today is Tuesday and my Economics teacher is sick. Therefore , I have a test in Maths. (**0.5 pt**)

Submission Date : 6/04/2012 E.C