

RHODES UNIVERSITY
DEPARTMENT of MATHEMATICS (Pure & Applied)
CLASS TEST No. 1 : MARCH 2010

M2.1 (TRANSFORMATION GEOMETRY)

AVAILABLE MARKS : 56
FULL MARKS : 50
DURATION : 1 HOUR

NB : All questions may be attempted.

Question 1. TRUE or FALSE ?

- (a) The mapping $(x, y) \mapsto (x, \cos y)$ is a transformation.
- (b) Any collineation has an inverse.
- (c) The product of 2010 halfturns is a translation.
- (d) Every involution is a halfturn.

[2,2,2,2]

Question 2.

- (a) Define the terms *transformation*, *group of transformations*, *involution*, and *collineation*.
- (b) Prove the following statements :
 - $\sigma_M \sigma_A = \tau_{A,B}$ where M is the midpoint of A and B .
 - Every isometry preserves betweenness and segments.

[4,8,8]

Question 3. PROVE or DISPROVE :

- (a) The set of all involutions forms a group.
- (b) Translations and halfturns are isometries.

[8,8]

Question 4. Consider the points

$$A = (1, 3), \quad B = (4, 4).$$

- (a) Write the equations for each of the following transformations :
- the translation $\tau_{A,B}$;
 - the halfturns σ_A and σ_B ;
 - the reflection $\sigma_{\mathcal{L}}$, where \mathcal{L} is the line with equation $x - y + 1 = 0$.
- (b) Is transformation $\alpha = \sigma_B \sigma_A$ a collineation? Justify your answer.
- (c) Find the image of the line \mathcal{M} with equation $x - 3y + 1 = 0$ under α .
- (d) Find
- the image of the point B under the translation $\tau_{A,B}$.
 - the preimage of the point B under the transformation α .

[4,2,4,2]
