



**MTH101 (Symmetry)**

**Mid Semester Examination** / February 19, 2022

20 marks / 60 minutes

**Instructions**

1. Write your name and roll number on the top of **every page**.
2. Write all arguments precisely and do not leave anything to the evaluator's imagination.
3. **Mysterious or unsupported answers will not receive credit.** A correct answer, unsupported by calculations or explanation will receive no credit; an incorrect answer supported by substantially correct calculations and explanations *might* still receive partial credit.
4. Stop writing at 10:00 AM, and submit your answers by 10:09 AM.

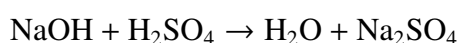
1. Take a triangle whose two sides have equal length, but the third side is different. Write the composition table of symmetries of this triangle. [2]
2. Take a square and draw two diagonals on it, one with the red color and the other with blue color. Now consider two scenarios.  
*Scenario 1:* Flip the square first by the red diagonal and then by the blue diagonal.  
*Scenario 2:* Flip the square first by the blue diagonal and then by the red diagonal.  
 Argue, *either using permutations or matrices*, to determine if the final configuration of the square is the same in the two scenarios. [4]
3. Perform the following matrix multiplication of  $3 \times 3$  matrices, using row operations. [3]

$$S_{1,2}M_2(2)L_{1,2}(-1)S_{2,3}.$$

4. Verify socks-shoe property,  $(AB)^{-1} = B^{-1}A^{-1}$ , for the following matrices. Remember to use **only** row operations to compute inverses. [4]

$$A = \begin{pmatrix} 1 & 2 \\ 2 & 5 \end{pmatrix}, \quad B = \begin{pmatrix} 2 & 1 \\ 7 & 3 \end{pmatrix}$$

5. Write the matrix that is to be used in balancing the following chemical reaction. Is this matrix a row echelon matrix? [2+1]



6. For  $2 \times 2$  matrices  $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ , define a number  $t(A)$  as follows:  $t(A) = a + d$  (which is simply the sum of diagonal entries). Determine, if the assignment of matrix  $A$  to the number  $t(A)$  satisfies row linearity. [4]