

GT-02 Solved Problem

Class multiplication rules for D_4

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Problem 1: What is the number of irreducible representations of the D-4 group. Find their dimensions and construct the character table for the group. You may use the notation and information given below.

⊗ **Notation for group elements**

- Anticlockwise rotation about z - axis by angle $\pi/2 \rightarrow 4_z$.
- Anticlockwise rotation about z - axis by angle $\pi \rightarrow 4_z^2$.
- Anticlockwise rotation about z - axis by angle $3\pi/2 \rightarrow 4_z^3$.
- Reflection in a plane perpendicular to X - axis $\rightarrow m_x$
- Reflection in a plane perpendicular to Y - axis $\rightarrow m_y$
- Reflection in plane containing Z - axis and diagonal 13 $\rightarrow m_{13}$
- Reflection in plane containing Z - axis and diagonal 24 $\rightarrow m_{24}$

The classes are given to be

$$\begin{aligned} C_1 &= \{e\}. \\ C_2 &= \{4_z^2\} & C_3 &= \{4_z, 4_z^3\} \\ C_4 &= \{m_x, m_y\} & C_5 &= \{m_{13}, m_{24}\} \end{aligned}$$

Class multiplication rules:

$$\begin{aligned} C_2^2 &= C_1 & C_2 C_3 &= C_3 & C_2 C_4 &= C_4 & C_2 C_5 &= C_5 \\ C_3^2 &= 2C_1 + C_2 & C_3 C_4 &= 2C_5 & C_3 C_5 &= 2C_4 \\ C_4^2 &= 2C_1 + 2C_2 & C_4 C_5 &= 2C_3 \\ C_5^2 &= 2C_1 + 2C_2 \end{aligned}$$

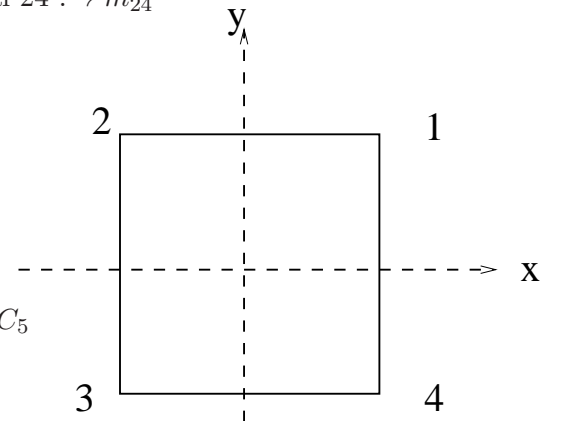


Fig. 1

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