

Height: 1.70m

Weight: 65kg
 Age: 25 years
 Date: 15/05/2024
 Time: 10:00h

1.1

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

1.2



$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

1.3



1.4

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

1.5

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

Thursday, 12th November 2014

11.00 - 12.00

12.00 - 1.00

1.00 - 2.00

2.00 - 3.00

Time	Location	Activity	Notes
11.00 - 12.00	11.00 - 12.00	11.00 - 12.00	11.00 - 12.00
12.00 - 1.00	12.00 - 1.00	12.00 - 1.00	12.00 - 1.00
1.00 - 2.00	1.00 - 2.00	1.00 - 2.00	1.00 - 2.00
2.00 - 3.00	2.00 - 3.00	2.00 - 3.00	2.00 - 3.00

3.00 - 4.00

4.00 - 5.00

5.00 - 6.00

6.00 - 7.00

7.00 - 8.00

8.00 - 9.00

9.00 - 10.00

10.00 - 11.00

11.00 - 12.00

12.00 - 1.00

1.00 - 2.00

2.00 - 3.00

3.00 - 4.00

4.00 - 5.00

5.00 - 6.00

6.00 - 7.00

7.00 - 8.00

8.00 - 9.00

9.00 - 10.00

10.00 - 11.00

11.00 - 12.00

Chapter 1: Introduction to the Theory of Groups

1.1. Definition of a Group

A group is a set G equipped with a binary operation $\cdot$ satisfying the following properties:

(1) Closure: For all $a, b \in G$, $a \cdot b \in G$.

(2) Associativity: For all $a, b, c \in G$, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$.

(3) Identity: There exists an element $e \in G$ such that $e \cdot a = a \cdot e = a$ for all $a \in G$.

(4) Inverse: For each $a \in G$, there exists an element $a^{-1} \in G$ such that $a \cdot a^{-1} = a^{-1} \cdot a = e$.

Example 1.1: The set of integers $\mathbb{Z}$ under addition forms a group.

Example 1.2: The set of non-zero real numbers $\mathbb{R}^*$ under multiplication forms a group.

Example 1.3: The set of $n \times n$ invertible matrices over a field F forms a group under matrix multiplication.

Example 1.4: The set of all permutations of a finite set S forms a group under composition.

1.2. Subgroups and Cosets

Definition 1.1: A subgroup H of a group G is a subset of G that is itself a group under the same operation.

Proposition 1.1: Let H be a subgroup of G . Then H is closed under the group operation and contains the identity element e .

Definition 1.2: The left coset of H in G with respect to $a \in G$ is the set $aH = \{a \cdot h \mid h \in H\}$.

Proposition 1.2: Let H be a subgroup of G . Then the left cosets of H partition G .

Definition 1.3: The index of H in G is the number of distinct left cosets of H in G .

Proposition 1.3: Let H be a subgroup of G . Then $|G| = [G:H] \cdot |H|$, where $|G|$ and $|H|$ denote the orders of G and H respectively.

Corollary 1.1: Lagrange's Theorem: The order of any subgroup H of a finite group G divides the order of G .

