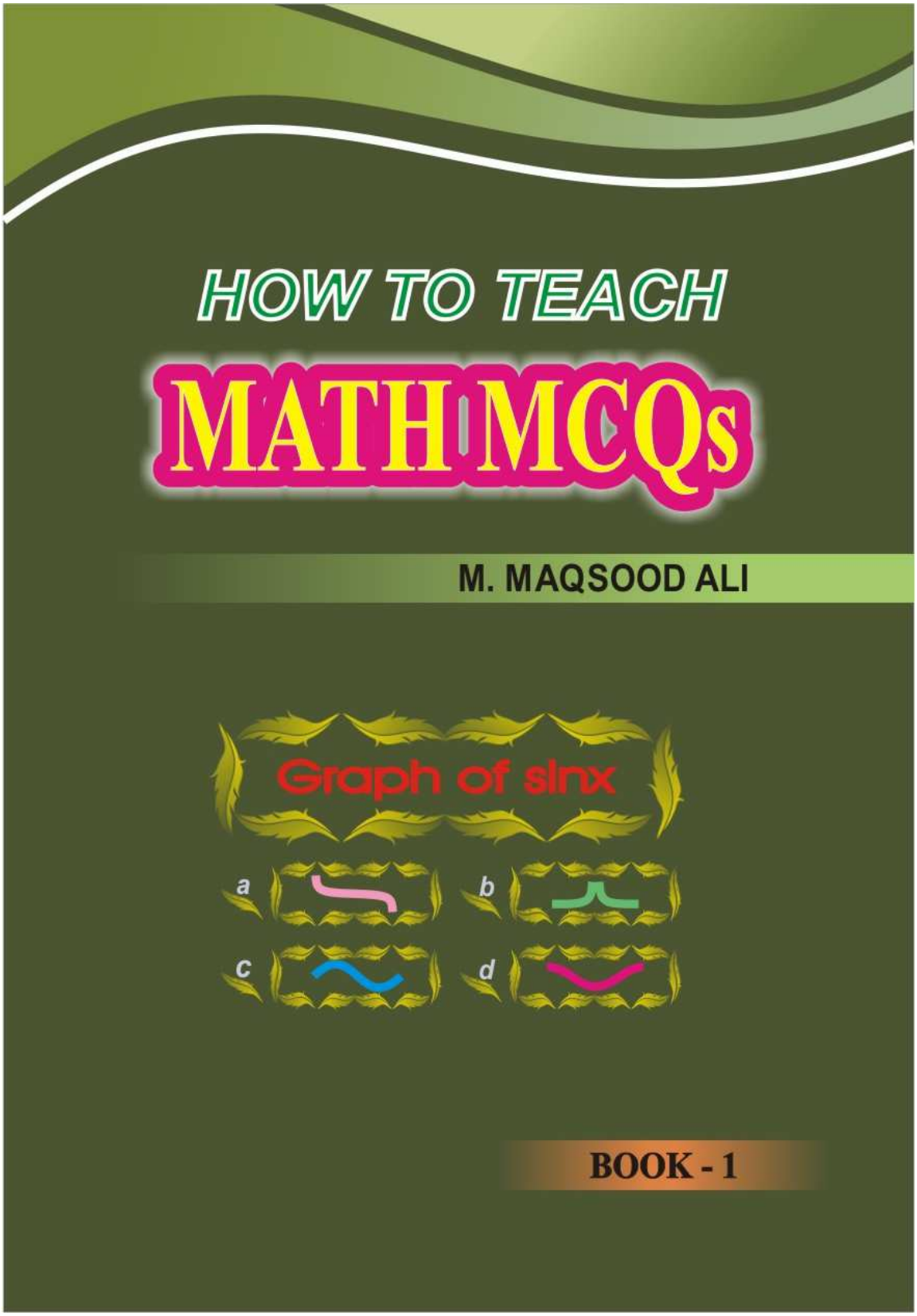
HOW TO TEACH
MATH MCQs
M. MAQSOOD ALI
Graph of sinx
a
b
c
d
BOOK - 1

## Chapter 6

# GROUPS

## GROUPOID

A non-empty set S with a binary operation $*$ is said to be a groupoid if S is closed under *, that is

$$a * b = c \in S \qquad \forall\ a, b \in S$$

### MCQ-1:

$(\mathbb{Z}, *)$ is a groupoid. The binary operation is defined as

$$a * b = ? \ , \qquad \forall a, b \in Z$$

(a) $a + b\pi$ (b) $5a - \frac{1}{2} b$ (c) $a + \sqrt{b}$ (d) $2a - 5b$

### Solution:

$\mathbb{Z}$ is the set of integers.

For option (a): $\pi \notin \mathbb{Z} \Rightarrow a + b\pi \notin \mathbb{Z}$

For option (b): $5a - \frac{1}{2}b \notin \mathbb{Z}$ , $\forall\ a, b \in \mathbb{Z}$

if $a = 2$ and $b = 3$

$5a - \frac{1}{2}b = 5(2) - \frac{3}{2} = \frac{7}{2} \notin \mathbb{Z}$

For option (c): $\sqrt{b} \notin \mathbb{Z}$ , $\forall\ b \in \mathbb{Z}$

if $b = 5$ and $a = 6$

$a + \sqrt{b} = 6 + \sqrt{5} \notin \mathbb{Z}$

For option(d): $2a - 5b \in \mathbb{Z}$ , $\forall\ a, b \in \mathbb{Z}$

The answer is (d).

## IDENTITY ELEMENT

$e$ is the identity element of $S$ with respect to binary operation $*$, if

$$e * a = a = a * e \quad , \qquad \forall a \in S$$

where $S$ is a non-empty set.

**MCQ-2:**

A binary operation $*$ be defined on $\mathbb{R}$ by

$$a * b = {}^{ab}/_{8} \ , \quad \forall a, b \in \mathbb{R}$$

Which is the identity element of $\mathbb{R}$ w.r.t. *?

(a) $a/8$ (b) $1/8$ (c) $8$ (d) $-8$

**Solution:**

$e$ is identity element

$$e * b = b$$

$$eb \ / \ 8 = b$$

$$e = 8$$

The answer is (c).

## INVERSE

Let $S$ be a non-empty set with binary operation *having an identity element $e$. An element $b \in S$ is the inverse of $a \in S$ with respect to * , if

$$a * b = e = b * a$$

### MCQ-3:

$*$ is defined on $\mathbb{Z}$ as

$$a * b = ab \quad , \quad \forall\, a, b \in \mathbb{Z}$$

The identity element of $(\mathbb{Z}, *)$ is 1. what is the inverse of 9 in $\mathbb{Z}$ ?

(a) 1/3 (b) 1/9 (c) $-9$ (d) 2/9

### Solution:

$b$ is the inverse of 9.

$$9 * b = e$$
$$9b = 1$$
$$b = 1/9$$

The answer is (b).

## EXERCISE

(1) $(\mathbb{N}, *)$ is a groupoid. The binary operation * is defined as

$$a * b = ? \quad , \quad \forall\, a, b \in \mathbb{N}$$

(a) $a - b$ (b) $a \div b$ (c) $5b + a$ (d) $a + b - ab$

(2) $(\mathbb{Z}, *)$ is a groupoid. The binary operation * is defined as

$$a * b = ? \quad , \quad \forall\, a, b \in \mathbb{Z}$$

(a) $a - b$ (b) $a - 6b$ (c) $a + \frac{b}{2}$ (d) None

(3) A binary operation * is defined on $\mathbb{E}$ (set of even natural numbers) as

$$a * b = ? \quad , \quad \forall\, a, b \in \mathbb{E}$$

$(\mathbb{E}, *)$ is a groupoid.

(a) $\frac{3}{2}ab$ (b) $a - 2b$ (c) $\frac{b}{a}$ (d) $a + 2b + 3$

(4) A binary operation * is defined on $\mathbb{Q}$ as

$$a * b = ? \quad , \quad \forall\, a, b \in \mathbb{Q}$$

$\mathbb{Q}$ is closed under *.

(a) $e^{ab}$ (b) $a + \sqrt{2}\, b$ (c) $6a + b\pi$ (d) $\frac{3}{5}a - \frac{b}{2}$

(5) A binary operation * is defined on $\mathbb{N}$ as

$$a * b = ? \quad , \quad \forall\, a, b \in \mathbb{N}$$

$\mathbb{N}$ is closed under *.

(a) $a - 2$ (b) $\frac{2a + 6}{2}$ (c) $10a - b$ (d) $\frac{5}{2}a + b$

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(a) $1$ (b) $\frac{8}{a}$ (c) $8$ (d) $-8$

(13) What is the identity element of ($\mathbb{R}$ ,*), if * is defined on $\mathbb{R}$ as

$$a * b = 2b + ab \quad , \quad \forall\, a, b \in \mathbb{R}$$

(a) $0$ (b) $1$ (c) $\frac{-a}{2+a}$ (d) None

(14) What is the identity element of ($\mathbb{Z}$ , *) in $\mathbb{Z}$, if * is defined on $\mathbb{Z}$ as

$$a * b = 5ab \quad , \quad \forall\, a, b \in \mathbb{Z}$$

(a) $0$ (b) $1$ (c) $\frac{1}{5}$ (d) None

(15) * is defined in $\mathbb{R}$ as

$$a * b = 6ab \quad , \quad \forall a, b \in \mathbb{R}$$

The identity element of ($\mathbb{R}$ , *) is $1/6$. What is the inverse of $2/3$?

(a) $\frac{1}{9}$ (b) $\frac{3}{2}$ (c) $\frac{1}{24}$ (d) None

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