



# BUDDHA SERIES

(Unit Wise Solved Question & Answers)

Course – B.Sc.Maths2<sup>nd</sup> year3<sup>rd</sup> Semester

College – Buddha Degree College

(DDU Code-859)

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Subject: Algebra

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## Unit-1

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1. Which condition is sufficient for a non-empty subset  $H$  of  $G$  to be a subgroup?

- A)  $a, b \in H \Rightarrow ab \in H$
- B)  $a \in H \Rightarrow a^{-1} \in H$
- C)  $H$  contains identity
- D) All of the above

**Answer: D**

2. The set  $\{e\}$ , where  $e$  is the identity, is:

- A) Not a subgroup
- B) Subgroup of every group
- C) Only subgroup of trivial group
- D) Not closed

**Answer: B**

3. The intersection of two subgroups of a group  $G$  is:

- A) Always a subgroup

- B) May or may not be a subgroup
- C) Not a subgroup
- D) Equal to identity

**Answer: A**

4. **Which of the following is NOT a subgroup of  $(\mathbb{Z}, +)$ ?**

- A)  $2\mathbb{Z}$  B)  $\mathbb{Z}^+$  (positive integers) C)  $\mathbb{Z}$  D)  $5\mathbb{Z}$

**Answer: B**

5. **If  $H$  is a subgroup of  $G$ , and  $g \in G$ , then  $gHg^{-1}$  is:**

- A) A subgroup
- B) A normal subgroup
- C) A left coset
- D) None of the above

**Answer: A**

6. **A subgroup  $H$  of  $G$  is called proper if:**

- A)  $H = G$
- B)  $H \subseteq G$
- C)  $H \neq G$  and  $H \neq \{e\}$
- D)  $H$  is normal

**Answer: C**

7. **Which of the following is a necessary and sufficient condition for  $H$  to be a subgroup of  $G$ ?**

- A)  $H$  is closed and contains  $e$
- B) For all  $a, b \in H$ ,  $ab^{-1} \in H$
- C)  $H$  is closed under inverses
- D)  $H$  has at least 3 elements

**Answer: B**

8. **The set of all  $n \times n$  invertible matrices forms a:**

- A) Group under addition
- B) Subgroup of matrix ring
- C) Group under multiplication
- D) Subring

**Answer: C**

9. **If a group  $G$  has only one subgroup, then  $G$  is:**

- A) Cyclic
- B) Trivial
- C) Infinite
- D) Non-abelian

**Answer: B**

10. **Which of the following is always a subgroup of a group  $G$ ?**

- A)  $Z(G)$ , the center of  $G$
- B) The set of all elements of finite order
- C) The set of all generators
- D)  $G - \{e\}$

**Answer: A**

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11. **If  $a \in G$ , then  $\langle a \rangle$  is:**

- A) The set of generators of  $G$
- B) The identity
- C) The cyclic subgroup generated by  $a$
- D) All elements of  $G$

**Answer: C**

12. **Which of the following elements is a generator of  $\mathbb{Z}_7$  ?**

- A) 1 B) 2 C) 3 D) All of these

**Answer: D**

13. Number of generators of  $Z_8$  :

A) 2 B) 4 C) 6 D) 8

Answer: B (1, 3, 5, 7)

14. Element 'a' is a generator of G if:

A)  $a^2 = e$

B)  $\langle a \rangle = G$

C) a is in  $Z(G)$

D) a commutes with all elements

Answer: B

15. If  $\langle a \rangle$  is of order n, then a is a generator if:

A)  $a^n = e$

B)  $a^k \neq e$  for  $0 < k < n$

Answer: B

16. Which of the following has exactly 4 generators?

A)  $Z_4$  B)  $Z_5$  C)  $Z_6$  D)  $Z_8$

Answer: D

17. A generator of a cyclic group of order 9 can be:

A) An element of order 9

Answer: A

18. In a cyclic group of prime order p, every non-identity element is:

A) An involution

B) A subgroup

C) A generator

D) Normal

Answer: C

19. If a generates G, then the inverse of a is:

A) Not in G

B) Also a generator

Answer: B

20. Number of generators of  $Z_{12}$  :

A) 4 B) 6 C) 5 D) 2

Answer: A (1, 5, 7, 11)

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21. A group generated by a single element is called:

A) Finite group

B) Trivial group

C) Cyclic group

D) Abelian group

Answer: C

22. Every cyclic group is:

A) Abelian

Answer: A

23. A cyclic group of order n has:

A)  $\phi(n)$  generators

Answer: A

24. Subgroups of cyclic groups are:

A) Cyclic

Answer: A

25. Every subgroup of a cyclic group is:

A) Not cyclic

B) Cyclic

Answer: B

26. Which is NOT a cyclic group?

- A)  $(\mathbb{Z}, +)$  B)  $(\mathbb{Z}_7, +)$  C)  $(\mathbb{Z}_4, \times)$  D)  $(\mathbb{Z}_6, +)$

Answer: C

27. The cyclic group  $\langle a \rangle = \{e, a, a^2, \dots, a^{n-1}\}$  implies:

- A) Order of  $a$  is  $n$

Answer: A

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28. Order of an element  $a$  in  $G$  is:

- A) Minimum  $n$  such that  $a^n = e$

Answer: A

29. Order of an element divides:

- A) The group order

Answer: A

30. If the order of  $a$  is 8, the order of  $a^3$  is:

- A) 8 B) 3 C) 2 D)  $8/\gcd(8,3)=8$

Answer: D

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