

**DEPARTMENT OF MATHEMATICS**  
**BARNAGAR COLLEGE, SORBHOG**

Home Assignment for the Paper: **MAT1101004CC/MC: Fundamental Mathematics**

**Last Date of Submission: 19-09-2026**

1. Let  $p$  be the statement “Maria learns discrete mathematics” and  $q$  be the statement “Maria will find a good job.” Express the statement  $p \rightarrow q$  as a statement in English.
2. What is the truth value of  $\forall x P(x)$ , where  $P(x)$  is the statement “ $x^2 < 10$ ” and the domain consists of the positive integers not exceeding 4?
3. What are the contrapositive, the converse and the inverse of the conditional statement “The home team wins whenever it is raining.”
4. Construct the truth table of the compound statement “ $(p \vee \neg q) \rightarrow (p \wedge q)$ ”.
5. Translate the following English sentence into a logical expression:  
“You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old.”
6. Write the direct proof of the theorem “If  $n$  is an odd integer, then  $n^2$  is odd.”
7. Write the direct proof that “if  $m$  and  $n$  are both perfect squares, then  $mn$  is also a perfect square.”
8. Prove that if  $n$  is an integer and  $3n + 2$  is odd, then  $n$  is odd.
9. Prove that if  $n = ab$ , where  $a$  and  $b$  are positive integers, then  $a \leq \sqrt{n}$  or  $b \leq \sqrt{n}$ .
10. Prove that the sum of two rational numbers is rational.
11. Prove that if  $n$  is an integer and  $n^2$  is odd, then  $n$  is odd.
12. Show that at least four of any 22 days must fall on the same day of the week.
13. Prove that  $\sqrt{2}$  is irrational by giving a proof by contradiction.
14. Give a proof by contradiction of the theorem “If  $3n + 2$  is odd, then  $n$  is odd.”
15. Show that the statement “Every positive integer is the sum of the squares of two integers” is false.

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