
Exercise 5.1 **Write each symbolic sentence in two ways:**
(i) without any symbol, apart from f .
(ii) with symbols only, using quantifiers.

1. i The value of f at the origin is rational.
   ii $\exists r \in Q, f(0) = r.$
2. i The value of function f at each point is its corresponding point.
   ii $\forall x \in R, f(x) = x.$
3. i The function f is constant.
   ii $\exists y \in R, \forall x \in R, f(x) = y.$
4. i The value of function f, for all integers, is zero.
   ii $\forall x \in Z, f(x) = 0.$
5. i The zeros of f include all integers.
   ii $\forall x \in Z, f^{-1}(0) = x.$
6. i Both integers and natural numbers have the same image under f.
   ii $\forall x \in Z, \forall y \in N f(x) = f(y).$
7. i The rational numbers have no rational value under f.
   ii $\nexists x \in Q, f(x) \in Q$

Exercise 5.3 **Write each symbolic sentence without symbols, apart from f .**

1. The zeros of f include all even integers.
2. The function f is identically zero for negative values of the argument.
3. The composition of the function f with itself is the Identity function.
4. The function f is non-zero at the closed interval of zero to one.
5. The value of function f is not rational for any natural number.