

Student Name: \_\_\_\_\_

Class: \_\_\_\_\_

Due Date: \_\_\_\_\_

**Introduction to Relations and Functions**

**Definition:** A relation is a set of ordered pairs, where each pair consists of an input (or independent variable) and an output (or dependent variable). A function is a special type of relation where each input corresponds to exactly one output.

- One-to-one relations: where each input corresponds to exactly one output
- Many-to-one relations: where multiple inputs correspond to the same output
- One-to-many relations: where one input corresponds to multiple outputs

**Complete these concept checks:**

1. Determine whether the following relation is a function or not:  $\{(2, 3), (4, 5), (6, 7)\}$

2. Find the domain and range of the function  $f(x) = x^2 + 2x - 3$

**Linear Functions:** where the output is directly proportional to the input

**Quadratic Functions:** where the output is proportional to the square of the input

- Examples of linear functions:  $f(x) = 2x + 1$ ,  $f(x) = x - 3$
- Examples of quadratic functions:  $f(x) = x^2 + 2x - 3$ ,  $f(x) = x^2 - 4x + 3$

**Complete these concept checks:**

1. Evaluate the function  $f(x) = 2x + 1$  at  $x = 4$

2. Graph the function  $f(x) = x^2 - 4x + 3$

## Domain and Range

**Domain:** the set of all possible input values

**Range:** the set of all possible output values

- Examples of domain and range:  $f(x) = x^2 + 2x - 3$ , domain: all real numbers, range: all real numbers greater than or equal to -3

**Complete these concept checks:**

1. Find the domain and range of the function  $f(x) = x^2 + 2x - 3$

2. Graph the function  $f(x) = x^2 - 4x + 3$  and identify the x and y intercepts

## Function Notation

**Function Notation:** a way of representing functions using symbols and equations

**Examples:**  $f(x) = 2x + 1$ ,  $f(x) = x^2 + 2x - 3$

- Evaluating functions:  $f(4) = 2(4) + 1 = 9$

**Complete these concept checks:**

1. Evaluate the function  $f(x) = 2x + 1$  at  $x = 4$

2. Find the value of  $x$  in the equation  $f(x) = 2x + 1 = 5$

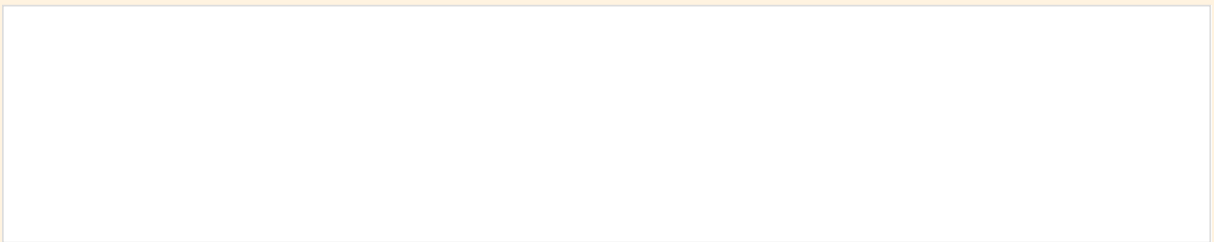
**Graphical Representation:** functions can be represented graphically using x and y axes

**Examples:** graphing  $f(x) = x^2 + 2x - 3$ , graphing  $f(x) = x^2 - 4x + 3$

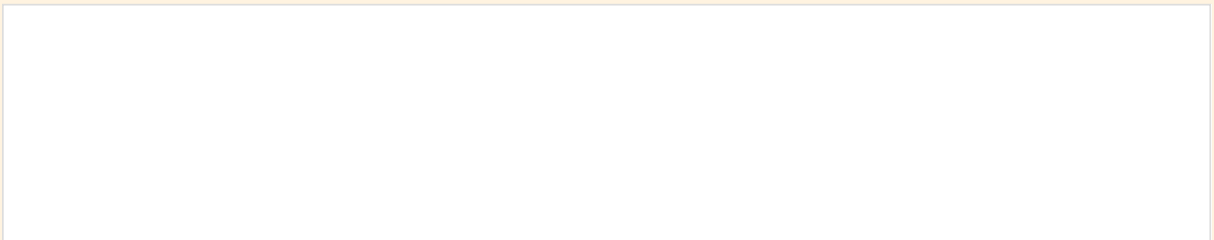
- Identifying x and y intercepts:  $f(x) = x^2 - 4x + 3$ , x-intercepts:  $x = 2$ ,  $x = 3$ , y-intercept:  $y = 3$

**Complete these concept checks:**

1. Graph the function  $f(x) = x^2 - 4x + 3$



2. Identify the x and y intercepts of the function  $f(x) = x^2 + 2x - 3$



**Real-World Applications:** relations and functions have numerous applications in real-world problems

**Examples:** physics, engineering, economics, computer science

- A book costs Rs. 100. If a 10% discount is offered, how much will you pay for the book?

**Complete these concept checks:**

1. A company produces  $x$  units of a product at a cost of Rs. 100 per unit. The revenue is given by the function  $R(x) = 200x - 2x^2$ . Find the revenue when  $x = 10$

2. A car travels from Delhi to Mumbai at an average speed of 60 km/h. How long will it take to cover a distance of 1200 km?

**Choose ONE of these topics for detailed research:**

1. Create a relation between the number of hours studied and the grade achieved on a test. Determine whether the relation is a function or not
2. Find the domain and range of the function  $f(x) = x^2 + 2x - 3$ . Graph the function and identify the x and y intercepts
3. Evaluate the function  $f(x) = 2x + 1$  at different values of x. Create a table to show the input and output values
4. Solve the equation  $f(x) = 2x + 1 = 5$ . Find the value of x
5. A company produces x units of a product at a cost of Rs. 100 per unit. The revenue is given by the function  $R(x) = 200x - 2x^2$ . Find the revenue when  $x = 10$

## Extension Questions

### Choose any combination:

1. Find the inverse of the function  $f(x) = x^2 + 2x - 3$
2. Solve the equation  $f(x) = x^2 - 4x + 3 = 0$
3. Graph the function  $f(x) = x^2 - 4x + 3$  and identify the x and y intercepts
4. A car travels from Delhi to Mumbai at an average speed of 60 km/h. How long will it take to cover a distance of 1200 km?
5. The temperature of a city is given by the function  $T(t) = 2t + 10$ , where t is the time in hours. Find the temperature at 3 pm



## Answer Key

**Answer Key:** provided for reference only. Students should attempt to solve the questions on their own before checking the answers

1. The relation is a function
2. Domain: all real numbers, Range: all real numbers greater than or equal to -3
3.  $f(4) = 2(4) + 1 = 9$
4. The graph is a parabola with x-intercepts at  $x = 2$  and  $x = 3$ , and y-intercept at  $y = 3$
5. You will pay Rs. 90 for the book