Introduction

Welcome to the world of relations and functions! In this worksheet, we will explore the fundamental concepts of relations and functions, and how they are used to model real-world phenomena. By the end of this worksheet, you will be able to distinguish between relations and functions, identify the domain and range of a function, and apply function notation to solve problems.

Section 1: Relations and Functions

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.

Activity 1: Identifying Relations and Functions

Directions: Determine whether each of the following relations is a function or not.

1. $\{(2, 3), (4, 5), (6, 7)\}$
2. $\{(1, 2), (2, 3), (3, 4), (4, 5)\}$
3. $\{(x, y) \mid x^2 + y^2 = 4\}$

Section 2: Domain and Range

The domain of a function is the set of all possible input values, and the range is the set of all possible output values.

Activity 2: Finding Domain and Range

Directions: Find the domain and range of each of the following functions.

1. f(x) = x^2
2. f(x) = 2x + 3
3. f(x) = 1/x

Section 3: Function Notation

Function notation is a way of representing functions using symbols and equations.

Activity 3: Applying Function Notation

Directions: Evaluate each of the following functions at the given input values.

1. f(x) = 2x + 3; find f(2)
2. f(x) = x^2; find f(-3)
3. f(x) = 1/x; find f(4)

Section 4: Real-World Applications

Relations and functions are used to model real-world phenomena, such as population growth, financial transactions, and scientific experiments.

Activity 4: Modeling Real-World Phenomena

Directions: Use functions to model each of the following real-world phenomena.

1. The cost of producing x units of a product is given by the function C(x) = 2x + 10. Find the cost of producing 5 units.
2. The height of a ball thrown upwards at an initial velocity of 20 m/s is given by the function h(t) = 20t - 4.9t^2. Find the height of the ball after 2 seconds.
3. The population of a city is growing at a rate given by the function P(t) = 2t^2 + 10t + 100. Find the population after 5 years.

Conclusion

In this worksheet, we have explored the fundamental concepts of relations and functions, and how they are used to model real-world phenomena. We have also applied function notation to solve problems and modeled real-world phenomena using functions. Remember to practice and review the concepts regularly to reinforce your understanding.

Additional Practice

For additional practice, try the following questions:

1. Find the domain and range of the function f(x) = x^3.
2. Evaluate the function f(x) = 2x + 3 at x = -2.
3. Use a function to model the cost of producing x units of a product, where the cost is given by C(x) = 3x + 15.

Answer Key

Activity 1:

1. Not a function
2. Function
3. Not a function

Activity 2:

1. Domain: all real numbers; Range: all non-negative real numbers
2. Domain: all real numbers; Range: all real numbers
3. Domain: all real numbers except 0; Range: all real numbers except 0

Activity 3:

1. f(2) = 7
2. f(-3) = 9
3. f(4) = 1/4

Activity 4:

1. C(5) = 20
2. h(2) = 20(2) - 4.9(2)^2 = 40 - 19.6 = 20.4
3. P(5) = 2(5)^2 + 10(5) + 100 = 50 + 50 + 100 = 200