Domain Of A Function Practice Problems

Q.1 **Find the Domain of the following functions:**

(1) $y = 1 - \log_{10}x$; (2) $y = \log_{10}(x + 3)$;

(3) $y = \sqrt{5 - 2x}$; (4) $y = \sqrt{-px}\ (p > 0)$;

(5) $y = \frac{1}{x^2 - 1}$; (6) $y = \frac{1}{x^2 + 1}$;

(7) $y = \frac{1}{x^3 - x}$; (8) $y = \frac{2x}{x^2 - 3x + 2}$;

(9) $y = 1 - \sqrt{1 - x^2}$; (10) $y = \frac{1}{\sqrt{x^2 - 4x}}$;

(11) $y = \sqrt{x^2 - 4x + 3}$; (12) $y = \frac{x}{\sqrt{x^2 - 3x + 2}}$;

Domain of a function practice problems are essential for mastering the understanding of functions in mathematics. The domain of a function refers to the complete set of possible values of the independent variable (commonly x) that will not lead to any ambiguities or undefined situations. Understanding the domain is crucial for graphing functions, solving equations, and analyzing mathematical behavior. This article will explore the concept of the domain, provide practice problems, and offer solutions and explanations for each problem to aid in understanding.

Understanding the Domain of a Function

The domain of a function can be defined as the set of all input values (x-values) for which the function is defined. In other words, it includes all the values that can be plugged into the function without causing any mathematical issues such as division by zero or taking the square root of a negative number.

Common Types of Functions and Their Domains

1. Polynomial Functions: The domain of polynomial functions (e.g., $f(x) = x^2 + 3x - 5$) is all real numbers. There are no restrictions because polynomials can take any real number as input.

2. Rational Functions: The domain of a rational function (e.g., $f(x) = \frac{1}{x - 2}$) excludes any values that make the denominator zero. For the above function, $x = 2$ is not in the domain.

3. Radical Functions: The domain of radical functions (e.g., $f(x) = \sqrt{x - 3}$) requires the expression inside the square root to be non-negative. Therefore, $x - 3 \geq 0$ leads to $x \geq 3$.

4. Logarithmic Functions: The domain of logarithmic functions (e.g., $f(x) = \log(x)$) includes only positive numbers, since the logarithm of zero or a negative number is undefined. Thus, $x > 0$.

5. Trigonometric Functions: The domains of trigonometric functions vary. For example, the sine and cosine functions have a domain of all real numbers, while the tangent function has a domain

excluding odd multiples of $\frac{\pi}{2}$.

Practice Problems on Domain of Functions

Now that we understand the concept of the domain, let’s practice with some problems. Try to determine the domain of each function listed below.

Problem Set:

1. Find the domain of the function $f(x) = \frac{3}{x^2 - 4}$.

2. Determine the domain of $g(x) = \sqrt{2x + 6}$.

3. What is the domain of $h(x) = \log(x - 5)$?

4. Find the domain of the function $j(x) = \frac{x + 1}{x^2 + x - 2}$.

5. Determine the domain for $k(x) = \frac{1}{\sqrt{x - 3}}$.

6. What is the domain of the function $m(x) = \sin(x) + \frac{1}{x - 1}$?

Solutions to Practice Problems

Now, let’s go over the solutions for each problem.

Problem 1: $f(x) = \frac{3}{x^2 - 4}$

To find the domain, we need to identify when the denominator is equal to zero:

$$
x^2 - 4 = 0 \implies x^2 = 4 \implies x = \pm 2
$$

Thus, the function is undefined at $x = 2$ and $x = -2$. Therefore, the domain is:

$$
\text{Domain: } (-\infty, -2) \cup (-2, 2) \cup (2, \infty)
$$

Problem 2: $g(x) = \sqrt{2x + 6}$

For the square root function, the expression inside the square root must be non-negative:

$$
2x + 6 \geq 0 \implies 2x \geq -6 \implies x \geq -3
$$

Thus, the domain is:

$$
\text{Domain: } [-3, \infty)
$$

Problem 3: $h(x) = \log(x - 5)$

The logarithm is defined only for positive arguments:

$$
x - 5 > 0 \implies x > 5
$$

Thus, the domain is:

$$
\text{Domain: } (5, \infty)
$$

Problem 4: $j(x) = \frac{x + 1}{x^2 + x - 2}$

First, factor the denominator:

$$
x^2 + x - 2 = (x - 1)(x + 2)
$$

Set the factors to zero to find the undefined points:

$$
x - 1 = 0 \implies x = 1 \quad \text{and} \quad x + 2 = 0 \implies x = -2
$$

Thus, the domain is:

$$
\text{Domain: } (-\infty, -2) \cup (-2, 1) \cup (1, \infty)
$$

Problem 5: $k(x) = \frac{1}{\sqrt{x - 3}}$

For this function, the square root must be positive:

$$
x - 3 > 0 \implies x > 3
$$

Thus, the domain is:

$$
\text{Domain: } (3, \infty)
$$

Problem 6: $m(x) = \sin(x) + \frac{1}{x - 1}$

The sine function has no restrictions on its domain, but the rational part requires:

$$
x - 1 \neq 0 \implies x \neq 1
$$

Thus, the domain is:

$$
\text{Domain: } (-\infty, 1) \cup (1, \infty)
$$

Conclusion

Understanding the domain of a function is a fundamental aspect of algebra and calculus. It aids in avoiding undefined operations and contributes to graphing and interpreting functions accurately. Practicing domain problems, as shown in this article, helps students to develop a clearer understanding of how to identify the domain in various types of functions. By working through these examples, learners can become proficient in determining domains, an essential skill for advanced mathematics.

Whether dealing with polynomials, rational functions, or logarithmic expressions, being able to assess the domain will empower students to tackle more complex mathematical concepts with confidence.

Frequently Asked Questions

What is the domain of the function f(x) = 1/(x - 3)?

The domain is all real numbers except $x = 3$, so it can be written as $(-\infty, 3) \cup (3, \infty)$.

How do you determine the domain of the function f(x) = √(x + 4)?

The expression inside the square root must be non-negative, so $x + 4 \geq 0$, which gives the domain as $x \geq -4$ or $[-4, \infty)$.

For the function f(x) = log(x - 2), what is the domain?

The argument of the logarithm must be positive, so $x - 2 > 0$. Therefore, the domain is $x > 2$ or $(2, \infty)$.

What is the domain of the function f(x) = 3x/(x^2 - 4)?

To find the domain, set the denominator not equal to zero: $x^2 - 4 \neq 0$. This gives $x \neq \pm 2$, so the domain is $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$.

Determine the domain of the function f(x) = 1/(x^2 + 1).

Since x^2 + 1 is always positive for all real x, the domain is all real numbers, or (-∞, ∞).

What is the domain of the piecewise function f(x) = { x^2 for x < 0; 2 for x = 0; 1/(x - 1) for x > 0 }?

The domain is all real numbers except x = 1, so it can be written as (-∞, 1) ∪ (1, ∞).

How do you find the domain of the function f(x) = tan(x)?

The function tan(x) is undefined at x = (π/2) + kπ for any integer k. Therefore, the domain is all real numbers except those points.

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In the Domain Name System (DNS) hierarchy, a second-level domain (SLD or 2LD) is a domain that is directly below a top-level domain (TLD). For example, in example.com, example is the …

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