

Domain of Rational Functions

Algebra Worksheet · Grade 9–11

Name: _____

Date: _____

Learning Objectives

- Identify rational functions as ratios of two polynomials where the denominator is not zero
- Find values of x that make the denominator equal to zero
- Express the domain of a rational function using set notation and words

Problems

1. Find the domain of the rational function below. Write your answer in words.

$$f(x) = \frac{5}{x-3}$$

2. Find the domain of the rational function below. Write your answer in words.

$$f(x) = \frac{4x}{x+7}$$

3. Find the domain of the rational function below. Write your answer using set notation.

$$g(x) = \frac{2x+1}{x-5}$$

4. Find the domain of the rational function below. Write your answer in words.

$$h(x) = \frac{3}{x^2-9}$$

5. Find the domain of the rational function below. Write your answer in set notation.

$$f(x) = \frac{4}{x^2+1}$$

6. Find the domain of the rational function below. Write your answer in set notation.

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$$p(x) = \frac{3x}{x^2 - 10x - 24}$$

7. Find the domain of the rational function below. Write your answer in words.

$$f(x) = \frac{2}{(x-1)^2}$$

8. Find the domain of the rational function below. Write your answer in set notation.

$$f(x) = \frac{x^2 + 3x}{x^2 - 16}$$

9. Find the domain of the rational function below. Write your answer in set notation.

$$f(x) = \frac{5x - 2}{x^2 + 3x - 18}$$

10. Find the domain of the rational function below. Then explain in one sentence why the excluded values cannot be in the domain.

$$f(x) = \frac{x^2 - 4}{x^3 - 4x^2 - 7x + 10}$$

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Domain of Rational Functions — Answer Key

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Answer Key

1. Answer: All real numbers except $x = 3$

- Set the denominator equal to zero: $x - 3 = 0$
 - Solve for x : $x = 3$
 - The domain is all real numbers except $x = 3$
-

2. Answer: All real numbers except $x = -7$

- Set the denominator equal to zero: $x + 7 = 0$
 - Solve for x : $x = -7$
 - The domain is all real numbers except $x = -7$
-

3. Answer: $\{ x \in \blacksquare \mid x \neq 5 \}$

- Set the denominator equal to zero: $x - 5 = 0$
 - Solve: $x = 5$
 - Write in set notation: $\{ x \in \blacksquare \mid x \neq 5 \}$
-

4. Answer: All real numbers except $x = 3$ and $x = -3$

- Set the denominator equal to zero: $x^2 - 9 = 0$
 - Factor as a difference of two squares: $(x - 3)(x + 3) = 0$
 - Apply the zero product property: $x = 3$ or $x = -3$
 - The domain is all real numbers except $x = \pm 3$
-

5. Answer: $\{ x \in \blacksquare \}$ (all real numbers)

- Set the denominator equal to zero: $x^2 + 1 = 0$
 - Solve: $x^2 = -1$
 - There is no real solution since a square cannot be negative
 - The denominator is never zero, so the domain is all real numbers
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6. Answer: $\{ x \in \blacksquare \mid x \neq 12 \text{ and } x \neq -2 \}$

- Set the denominator equal to zero: $x^2 - 10x - 24 = 0$
 - Factor the trinomial: $(x - 12)(x + 2) = 0$
 - Apply zero product property: $x = 12$ or $x = -2$
 - Domain: $\{ x \in \blacksquare \mid x \neq 12 \text{ and } x \neq -2 \}$
-

7. Answer: All real numbers except $x = 1$

- Set the denominator equal to zero: $(x - 1)^2 = 0$
 - Take the square root of both sides: $x - 1 = 0$
 - Solve: $x = 1$
 - The domain is all real numbers except $x = 1$
-

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8. Answer: $\{ x \in \mathbb{R} \mid x \neq 4 \text{ and } x \neq -4 \}$

- Set the denominator equal to zero: $x^2 - 16 = 0$
 - Factor as difference of two squares: $(x - 4)(x + 4) = 0$
 - Apply zero product property: $x = 4$ or $x = -4$
 - Domain: $\{ x \in \mathbb{R} \mid x \neq \pm 4 \}$
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9. Answer: $\{ x \in \mathbb{R} \mid x \neq 3 \text{ and } x \neq -6 \}$

- Set the denominator equal to zero: $x^2 + 3x - 18 = 0$
 - Factor the trinomial: $(x + 6)(x - 3) = 0$
 - Apply zero product property: $x = -6$ or $x = 3$
 - Domain: $\{ x \in \mathbb{R} \mid x \neq 3 \text{ and } x \neq -6 \}$
-

10. Answer: All real numbers except $x = 1$, $x = -2$, and $x = 5$

- Set the denominator equal to zero: $x^3 - 4x^2 - 7x + 10 = 0$
 - Test $x = 1$: $1 - 4 - 7 + 10 = 0$, so $(x - 1)$ is a factor
 - Divide: $x^3 - 4x^2 - 7x + 10 = (x - 1)(x^2 - 3x - 10)$
 - Factor the quadratic: $(x - 1)(x - 5)(x + 2) = 0$
 - Zeros: $x = 1$, $x = 5$, $x = -2$
 - Domain: all real numbers except $x = 1$, $x = 5$, and $x = -2$
 - These values make the denominator zero, which makes the function undefined
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