

Adding and Subtracting Rational Functions

Given a rational expression, identify the excluded values by finding the zeroes of the denominator.

1. $\frac{x-1}{x^2+3x-4}$ $(x+4)(x-1)$ $x \neq -4, 1$

2. $\frac{4}{x(x+17)}$ $x \neq 0, -17$

Write the given expression as an equivalent rational expression that has the given denominator.

3. Expression: $\frac{x-7}{x+8}$
 Denominator: $x^3 + 8x^2$
 $x^2(x+8)$

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

Simplify the given expression:

6. $\frac{x-8-1(x+8)}{(x+1)(x+8)}$ $= \frac{-1}{x+1}, x \neq -1, -8$

7. $\frac{6x^2+5x+1}{3x^2+4x+1} = \frac{(6x^2+2x)(3x+1)+1(3x+1)}{(3x^2+3x)(x+1)+1(x+1)}$ 8. $\frac{x^2-1}{x^2+1} = \frac{(x^2+1)(x^2-1)}{x^2+1}$

$$= \frac{(3x+1)(2x+1)}{(3x+1)(x+1)}$$

$$= \frac{2x+1}{x+1}$$

$x \neq -\frac{1}{3}, -1$

x^2-1 or -1 $x \neq$
 $(x+1)(x-1)$

Find the LCD for each set of rational expressions

11. $\frac{4(x+3)}{x^2+5x+6}$ and $\frac{8(x+3)}{10x+20}$
 $(x+2)(x+3)$ $2(x+2)$

12. $\frac{-11}{x^2-3x-28}$ and $\frac{2}{x^2-2x-24}$
 $(x-7)(x+4)$ $(x+4)(x-6)$

LCD: $2(x+2)$

$(x-7)(x+4)(x-6)$

Add or subtract the given expressions, simplifying each result and noting the combined excluded values

15. $\frac{x(1)}{x(1+x)} + \frac{(1-x)(1+x)}{(x)(1+x)}$

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

$x \neq 0, -1$

20. $\frac{1(x-2)}{x^2+3x-4} + \frac{-1(x+4)}{x^2-3x+2}$

$(x-2)(x+4)(x-1) \quad (x-2)(x-1)(x+4)$

$$\frac{x-2 - (x-4)}{(x-2)(x-1)(x+4)} = \frac{-6}{(x-2)(x-1)(x+4)}$$

$x \neq 2, 1, -4$

26. An auto race consists of 8 laps. A driver completes the first 3 laps at an average speed of 185 miles per hour and the remaining laps at an average speed of 200 miles per hour. Let d represent the length of one lap. Find the time in terms of d that it takes the driver to complete the race.

$\frac{3d}{185} + \frac{5d}{200} = t$

$$\frac{600d + 925d}{3700} = \frac{1525d}{3700} = \frac{61d}{148}$$

29. Match each expression with the correct excluded value(s).

a. $\frac{3x+5}{x+2}$

c. no excluded values

b. $\frac{1+x}{x^2-1}$

d. $x \neq 0, -2$

c. $\frac{3x^4-12}{x^2+4}$

b. $x \neq 1, -1$

d. $\frac{3x+6}{x^2(x+2)}$

a. $x \neq -2$

31. Communicate Mathematical Ideas Write a rational expression with excluded values at $x = 0$ and $x = 17$.

$$\frac{x+1}{x(x-17)}$$

16. $\frac{x+4}{x^2-4} + \frac{-2x-2}{x^2-4}$
 $(x+2)(x-2) \quad (x+2)(x-2)$

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

$\frac{-1}{x+2}, x \neq -2, 2$

21. $\frac{3}{x^2-4} + \frac{(-x+5)(x-2)}{x+2(x-2)}$
 $(x+2)(x-2)$

$$\frac{3 - x^2 + 2x - 5x + 10}{(x+2)(x-2)}$$

$$\frac{13 - x^2 - 3x}{(x+2)(x-2)}$$

$\frac{-x^2 - 3x + 13}{(x+2)(x-2)}, x \neq \pm 2$

Review

State the domain and range of each function

1. $f(x) = -2\sqrt{x-3}$

D: $[3, \infty)$

R: $(-\infty, 0]$

2. $f(x) = \sqrt{3x+9} - 5$

D: $[-3, \infty)$

R: $[-5, \infty)$

Graph the following function

3. $g(x) = 2\sqrt[3]{x-2}$

