

Agenda:







Topic 1 Example 1 Add or Subtract Rational Expressions With Common Denominators

Determine each sum or difference. Express each answer in simplest form. Identify all non-permissible values.

a)
$$\frac{2a}{b} - \frac{a-1}{b}$$

$$= \frac{2a - (a-1)}{b}$$
don't forget
bracket

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$$= \frac{2x + 8}{x + 4}$$
factor

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factor

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

$$= \frac{a+1}{b}$$
; $b \neq 0$

$$= 2$$
; $x \neq -4$

a)
$$\frac{2}{m-2} + \frac{-7}{m-2}$$
 b) $\frac{4x}{x+5} - \frac{-2x}{x+5}$



Try:

Determine each sum or difference. Express each answer in simplest form. Identify all non-permissible values.

$$\frac{2w^2 - w}{(w-3)(w+1)} + \frac{3 - 2w}{(w-3)(w+1)} - \frac{8}{(w-3)(w+1)}$$

Example 2

Add or Subtract Rational Expressions With Unlike Denominators

Simplify. Express each answer in simplest form.

$$a) \ \frac{2x}{xy} + \frac{4}{x^2} - 3$$

1 ^s find LCD = x^2y , then multiply each numerator by the missing term.

$$= \frac{2x(x)}{xy(x)} + \frac{4(y)}{x^2(y)} - \frac{3(x^2y)}{1(x^2y)}$$
$$= \frac{2x^2 + 4y - 3x^2y}{x^2y}$$

b) $\frac{1-\frac{1}{x}}{x-\frac{1}{x}} \stackrel{\text{this is a complex}}{\Rightarrow} \frac{1-\frac{1}{x}}{\frac{1}{x}} \quad \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{bmatrix}$

Find LCD in the Complex Fraction \boldsymbol{x}

then multiply LCD by every term.

$$= \frac{(x)1 - \frac{1}{x}(x)}{(x)x - \frac{1}{x}(x)}$$
This simplifies
a complex
fraction.

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

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

Try: Simplify. What are the non-permissible values.

a)
$$\frac{4}{p^2 - 1} + \frac{3}{p + 1}$$
 b) $\frac{2 - \frac{4}{n}}{n - \frac{4}{n}}$

c)
$$\frac{5}{2x-8} - \frac{3}{x-4}$$
 d) $\frac{-1}{c+1} + \frac{3c+1}{c^2 - 2c - 15}$



Topic 2

Example 1 Solve a Rational Equation

Solve the following equation. What values are non-permissible.

$$\frac{2}{a^2 - 4} + \frac{10}{6a + 12} = \frac{1}{a - 2}$$



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1 - Factor denominator to find LCD

$$= \frac{2}{(a-2)(a+2)} + \frac{10}{6(a+2)} = \frac{1}{a-2}$$

LCD = 6(a-2)(a+2)

From the factors, the nonpermissible values are:

2 ndTo clear fractions multiply each term by the LCD, then cancel out like terms

$$x \neq -2, 2$$

$$= \left[\frac{2}{(a-2)(a+2)} \left[\frac{2}{(a-2)(a+2)} \right] + \left[\frac{10}{6(a+2)} \right] = \left[\frac{6(a-2)(a+2)}{a-2} \left[\frac{1}{a-2} \right] \right]$$

3 r Solve equation

$$12 + 10a - 20 = 6a + 12$$

 $4a = 20$
 $a = 5$ Check your answer:

Check:

Substitute a = 5 into the original equation.

Left Side

Right Side

$\frac{2}{a^2 - 4} + \frac{10}{6a + 12}$		$\frac{1}{a-2}$
$=\frac{2}{(5)^2-4}+\frac{10}{6(5)+12}$		$=$ $\frac{1}{(5)-2}$
$=$ $\frac{2}{21}$ + $\frac{10}{42}$		$= \frac{1}{3}$
$= \frac{1}{3}$	\checkmark	

Try: Solve the following equation. What values are non-permissible.

$$\frac{9}{x-3} - \frac{4}{x-6} = \frac{18}{x^2 - 9x + 18}$$



Example 2 Solve a Rational Equation With an Extraneous Root

Solve the following equation. What values are non-permissible.

$$\frac{2x}{x+3} + \frac{x}{x-3} = \frac{18}{x^2 - 9}$$



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$$\frac{2x}{x+3} + \frac{x}{x-3} = \frac{18}{x^2-9}$$
1 => Find RESTRICTION , $x \neq 3,-3$ Then find LCD = $(x+3)(x-3)$
2 == multiply each rational expression by LCD (this eliminates denominator)

$$(x+3)(x-3)\left(\frac{2x}{x+3}\right) + \binom{(x+3)(x-3)}{(x-3)}\left(\frac{x}{x-3}\right) = \binom{(x+3)(x-3)}{(x+3)(x-3)}\left(\frac{18}{x^2-9}\right) \swarrow \text{ factor}$$

$$(x+3)(x-3)$$

$$2x(x-3) + x(x+3) = 18 \quad (exp and)$$

$$2x^2 - 6x + x^2 + 3x = 18 \quad (collect like terms)$$

$$3x^2 - 3x - 18 = 0 \quad (factor)$$

$$3(x^2 - x - 6) = 0$$

$$3(x-3)(x+2) = 0$$

$$x = 3, x = -2$$

$$x = -2, \qquad x = 3 \text{ is extraneous}$$
Solution
$$x = 3 \text{ is extraneous}$$





Try: Solve the following equation. What values are non-permissible.

$$\frac{3x}{x+2} - \frac{5}{x-3} = \frac{-25}{x^2 - x - 6}$$



Example 3 Use a Rational Equation to Solve a Problem

Two brothers share in cutting their lawn. Tim can cut the lawn in 40 min. Jim can cut the same lawn in 50 min. How long will it take to cut the lawn if they work together?

1 sMake a Table

	Time to cut lawn (min)	Fraction of work in 1 min	Fraction of work done int minutes
Tim	40	$\frac{1}{40}$	$\frac{t}{40}$
Jim	50	$\frac{1}{50}$	$\frac{t}{50}$
Together	t	$\frac{1}{t}$	1



From the table, the equation for Tim and Jim to cut the lawn together is:



Find the LCD = 200, now multiply each term by LCD

$$5 = 200 \left(\frac{t}{40}\right)^{4} \frac{200}{t} \left(\frac{t}{50}\right)^{200} = (1)$$

$$5t + 4t = 200$$

$$9t = 200$$

$$t = \frac{200}{9} \text{ or } 22.2 \text{ min.}$$

Don't forget to do a Check !

Try: Mary takes 4 h to paint a room. It takes Sue 3 h to paint the same area. How long

will the paint job take if they together?

Example 4

Use a Rational Equation to Solve a Problem

A bike race goes from Victoria to Chemainus and back. The total distance was 140 km. Conditions were excellent on the way from Victoria to Chemainus. However, bad weather caused the winner's average speed to decrease by 6 km/h on the return trip. The total time for the trip was 8.5 h. What was the winning rider's average speed on the way to Chemainus?

- Use the formula distance = rate x time, or time = $\frac{dist.}{rate}$
- Let x represent the average speed, in km/h, on the trip from Victoria to Chemainus.

Make a Table

	Distance (km)	Rate (km/h)	Time (h)
Trip to Chemainus	70	x	$\frac{70}{x}$
Return from Chemainus	70	<i>x</i> - 6	$\frac{70}{x-6}$
		Total	$8\frac{1}{2} \text{ or } \frac{17}{2}$

$$\frac{70}{x} + \frac{70}{x-6} = \frac{17}{2}$$
Victoria to
Chemainus to
Victoria



$$\frac{70}{x} + \frac{70}{x-6} = \frac{17}{2}$$

Find LCD = 2(x)(x-6), then multiply each term by LCD

$${}^{2(x)(x-6)}\left(\frac{70}{x}\right) + {}^{2(x)(x-6)}\left(\frac{70}{x-6}\right) = {}^{2(x)(x-6)}\left(\frac{17}{2}\right)$$

$$2(x-7)(70) + 2(x)(70) = (x)(x-6)(17)$$

140x - 840 + 140x = 17x² - 102x
0 = 17x² - 382x + 840

Use Quadratic Program on Calculator.



x = 20 km/h or x = 2.471 km/h This answer will not

This answer will not work because you will get a negative answer.



Simon Whitfield won a Gold medal in the 2000 Summer Olympics in Triathlon. He swam 1.5 km, biked 40 km and ran 10 km. He ran at an average speed of \hat{x} , biked at an average speed of 2x, and swam at an average speed of $\frac{x}{4}$, where is in km per hours.

- a) Determine an expression for the total time taken to complete the race.
- b) Simon can swim at 5km/hr. How long will it take him to

complete the race?