



Simplify the rational expression below.

$$\frac{1}{a-3} + \frac{1}{a^2-9} - \frac{1}{a^2-2a-3}$$

$$\frac{1}{a-3} + \frac{1}{(a-3)(a+3)} - \frac{1}{(a-3)(a+1)}$$

$$\frac{1(a+3)(a+1)}{(a-3)(a+3)(a+1)} + \frac{1(a+1)}{(a-3)(a+3)(a+1)} - \frac{1(a+3)}{(a-3)(a+3)(a+1)}$$

$$\frac{a^2 + 4a + 3 + a + 1 - a - 3}{(a-3)(a+3)(a+1)}$$

$$\frac{a^2 + 4a + 1}{(a-3)(a+3)(a+1)}$$

Pre-Calculus 110
Unit 5: Rational Expressions and Equations

May 2th, 2019: Day #8

1. Assignments - Due Wednesday
2. Test on Friday

Curriculum Outcomes

AN4: Determine equivalent forms of rational expressions (limited to numerators and denominators that are monomials, binomials or trinomials).

AN5: Perform operations on rational expressions (limited to numerators and denominators that are monomials, binomials or trinomials).

AN6: Solve problems that involve rational equations (limited to numerators and denominators that are monomials, binomials or trinomials).

Working Example 3: Sharing a Task

Andrea and Phary are sharing a bag of popcorn at the movies.

- By himself, Phary can eat the whole bag of popcorn in 20 min.
- Andrea takes 25 min to eat the whole bag.

If they both eat popcorn at their usual rates, how quickly will they eat the popcorn?

Solution

Let x represent the time, in minutes, it takes Andrea and Phary together to eat the popcorn. Organize the information in a table.

	Time to Eat Popcorn (min)	Fraction of Popcorn Eaten in 1 min	Fraction of Popcorn Eaten in x min
Andrea (A)	25	$\frac{1}{25}$	$\frac{x}{25}$
Phary (P)	20	$\frac{1}{20}$	$\frac{x}{20}$
Together	x	$\frac{1}{x}$	$x\left(\frac{1}{x}\right) = 1$

(fraction A eats) + (fraction P eats) = total

$$\frac{x}{25} + \frac{x}{20} = 1$$

The answer should lie somewhere between half of Andrea's time and half of Phary's time. Is this the case? Explain your answer.

$$\frac{x}{25} + \frac{x}{20} = 1$$

$$\frac{4x}{100} + \frac{5x}{100} = \frac{100}{100}$$

$$4x + 5x = 100$$

$$9x = 100$$

$$x = \frac{100}{9} = 11.1 \text{ mins}$$

Example 3

Use a Rational Equation to Solve a Problem

Two friends share a paper route. Sheena can deliver the papers in 40 min. Jeff can cover the same route in 50 min. How long, to the nearest minute, does the paper route take if they work together?

	Time to Deliver Papers(min)	Fraction of Work Done in 1 minute	Fraction of Work Done in T minutes
Sheena	40	$\frac{1}{40}$	$\frac{t}{40}$
Jeff	50	$\frac{1}{50}$	$\frac{t}{50}$
Together			$\frac{t}{40} + \frac{t}{50} = 1$

$$\frac{t}{40} + \frac{t}{50} = 1$$

$$\frac{5t}{200} + \frac{4t}{200} = \frac{200}{200}$$

$$5t + 4t = 200$$

$$\frac{9t}{9} = \frac{200}{9}$$

$$t = 22.2 \text{ mins}$$

Working Example 4: Create and Solve a Rational Model

A group of friends go on a 3-h bike ride together. They ride 15 km with the wind at their backs, and then 15 km straight into the wind. The wind adds or subtracts 3 km/h from their speed. What is the average speed of the group of friends with no wind?

Solution

Let x represent the average biking speed with no wind, in kilometres per hour. Then the average speed with the wind at their backs is $(x + 3)$ km/h, and the average speed riding into the wind is $(x - 3)$ km/h.

	Distance, d (km)	Speed, s (km/h)	Time, t $t = \frac{d}{s}$
With wind	15	$x + 3$	$\frac{15}{x + 3}$
Against wind	15	$x - 3$	$\frac{15}{x - 3}$
Total			3

(time biking with wind) + (time biking against wind) = (total time)

$$\frac{15}{x + 3} + \frac{15}{x - 3} = 3$$

Use the quadratic equation to solve for x .

$a = \text{_____}, b = \text{_____}, c = \text{_____}$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Does either solution for x match any of the non-permissible values?
Do both solutions for x make sense in the context of the problem?

Therefore, the average biking speed with no wind is _____ km/h.

$$\frac{15}{x+3} + \frac{15}{x-3} = \frac{3}{1}$$

$$\frac{15(x-3)}{(x+3)(x-3)} + \frac{15(x+3)}{(x+3)(x-3)} = \frac{3(x+3)(x-3)}{(x+3)(x-3)}$$

$$15(x-3) + 15(x+3) = 3(x+3)(x-3)$$

$$15x - \cancel{45} + 15x + \cancel{45} = 3x^2 - 27$$

$$0 = 3x^2 - 30x - 27$$

$$0 = x^2 - 10x - 9$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

$$x = \frac{10 \pm \sqrt{136}}{2} = 10.8 \text{ or } -.83$$

Example 4

Use a Rational Equation to Solve a Problem

The Northern Manitoba Trapper's Festival, held in The Pas, originated in 1916. A championship dog race has always been a significant part of the festivities. In the early days, the race was non-stop from The Pas to Flin Flon and back.



In one particular race, the total distance was 140 mi. Conditions were excellent on the way to Flin Flon. However, bad weather caused the winner's average speed to decrease by 6 mph on the return trip. The total time for the trip was $8\frac{1}{2}$ h. What was the winning dog team's average speed on the way to Flin Flon?

	D	v	t
to Flin Flon	70	x	$\frac{70}{x}$
return	70	x-6	$\frac{70}{x-6}$
			$8\frac{1}{2}$



$$x = 20 \text{ Km/hr.}$$

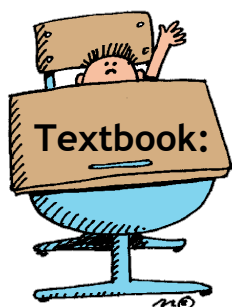
$$\frac{70}{x} + \frac{70}{x-6} = 8.5$$

$$70(x-6) + 70x = 8.5(x)(x-6)$$

$$70x - 420 + 70x = 8.5x^2 - 51x$$

$$0 = 8.5x^2 - 191x + 420$$

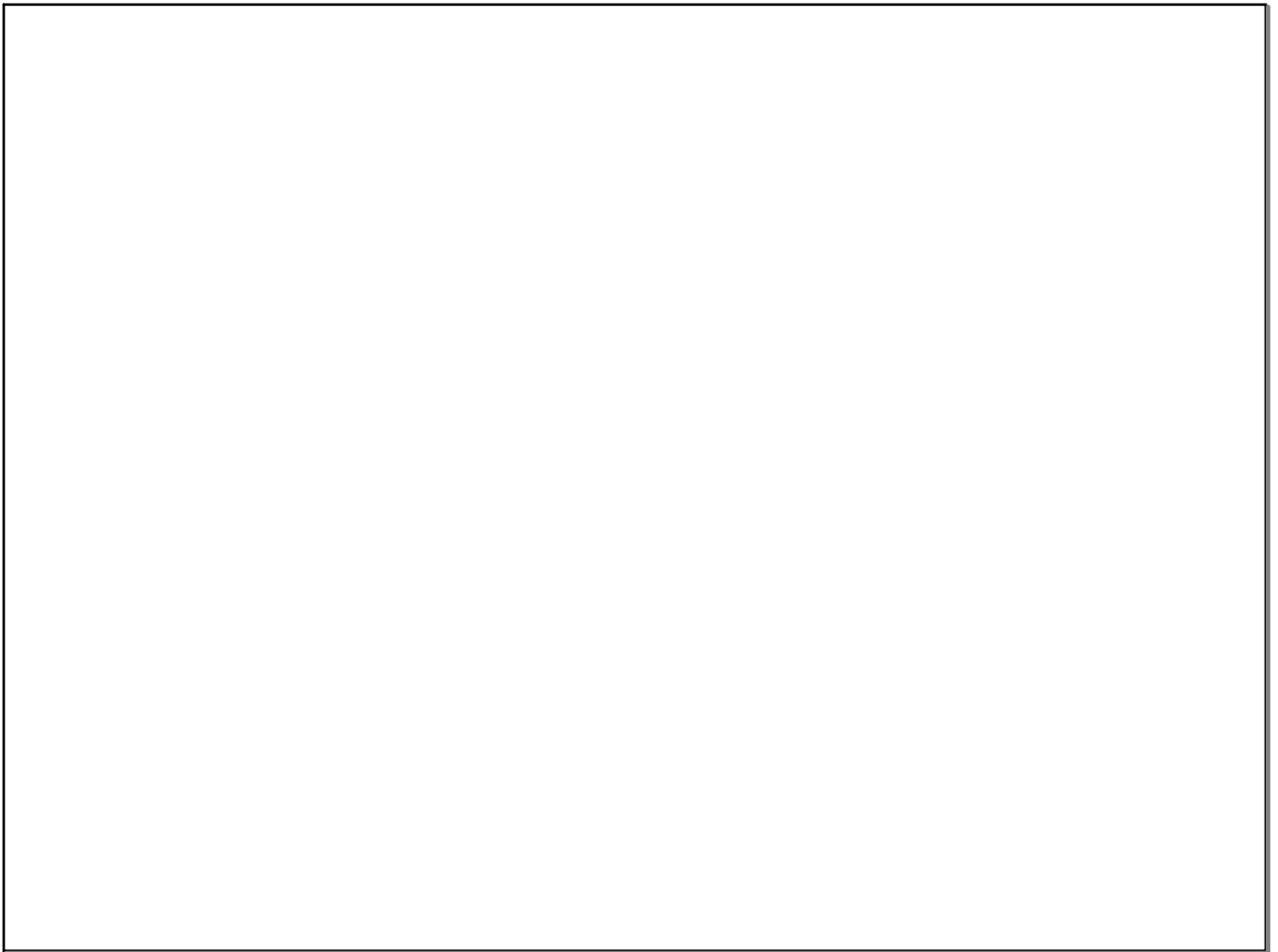
$$x = 20 \text{ or } 2.47$$



Minimum Preparation:

 p. 348-351

1ac, 2ac, 3ac, 4, 6a, 8, 9, 12, 14, 16, 18, 22



Attachments

Standard Form Demor.GSP

Warm ups.notebook