

9.3 Solving Rational Equations

2 Types of Rational Equations	How to Solve
<p>Proportion (Ratio = Ratio)</p>	<ol style="list-style-type: none"> <u>cross</u> - <u>multiply</u> <u>Solve</u> <u>check</u> ! Denominators cannot = <u>0</u>
<p>can use this same method ↓</p> <p>NOT a Proportion (Not simply Ratio = Ratio)</p>	<ol style="list-style-type: none"> <u>Factor</u> every DENOMINATOR (not the numerators!) Find the <u>LCD</u> (What is each denominator <u>missing</u> that the other denominators have?) <u>multiply</u> numerator and denominator by what's missing to get LCD. <ul style="list-style-type: none"> (Technically we're multiplying both sides of the equation by the LCD, so the denominators cancel out and can be dropped) <u>simplify</u> each numerator (Distribute/FOIL) <u>Solve</u>: normal (undo PEMDAS), factor, quadratic formula <u>check</u> ! Denominators cannot = <u>0</u>

Ex1: $\frac{3}{x+1} = \frac{9}{4x+5}$

$$3(4x+5) = 9(x+1)$$

$$12x+15 = 9x+9$$

$$-9x \quad -9x$$

$$3x+15 = 9$$

$$\frac{3x}{3} = \frac{-6}{3}$$

$$x = -2$$

Quick Check:

Ex3: $\frac{-4}{x+3} = \frac{5}{x-3}$

$$-4(x-3) = 5(x+3)$$

$$-4x+12 = 5x+15$$

$$+4x \quad +4x$$

$$12 = 9x+15$$

$$-3 = \frac{9x}{9}$$

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

Ex2: $\frac{1}{2x+5} = \frac{x}{11x+8}$

$$1(11x+8) = x(2x+5)$$

$$11x+8 = 2x^2+5x$$

$$-11x \quad -8$$

$$0 = 2x^2 - 6x - 8$$

$$0 = 2(x^2 - 3x - 4)$$

$$0 = 2(x-4)(x+1)$$

$$x = 4 \quad x = -1$$

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Ex4: $\frac{4 \cdot 5}{4 \cdot x} + \frac{7}{4} = \frac{-9}{x}$

$$20 + 7x = -36$$

$$\frac{7x}{7} = \frac{-56}{7}$$

$$x = -8$$

Ex5: $\frac{6}{x-3} = \frac{8x^2}{x^2-9} + \frac{-4x}{x+3}$

$$6x + 18 = 8x^2 - 4x^2 + 12x - 6x - 18$$

$$0 = 4x^2 + 6x - 18$$

$$0 = 2(2x^2 + 3x - 9)$$

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

$$3 = \frac{6}{2} \times \frac{-3}{2}$$

No! makes 3rd den = 0 ← $x = -3, x = 3/2$

Quick Check:

Ex6: $\frac{x(x-5)}{1} + \frac{-8}{x-5} = \frac{3}{x}$

$$x^2 - 5x - 8x = 3x - 15$$

$$x^2 - 16x + 15 = 0$$

$$(x-15)(x-1) = 0$$

$$x = 15, x = 1$$

Word Problem: From 1995 through 2003, the annual sales S (in billions of dollars) of entertainment software can be modeled by $S(t) = \frac{848t^2 + 3220}{115t^2 + 1000}$, $0 \leq t \leq 8$ where t is the number of years since 1995. For which year were the total sales of entertainment software about \$5.3 billion?

$$\frac{5.3}{1} = \frac{848t^2 + 3220}{115t^2 + 1000}$$

$$1(848t^2 + 3220) = 5.3(115t^2 + 1000)$$

$$848t^2 + 3220 = 609.5t^2 + 5300$$

$$238.5t^2 + 3220 = 5300$$

$$\frac{238.5t^2}{238.5} = \frac{2080}{238.5}$$

$$\sqrt{t^2} = \sqrt{8.72}$$

$$t = \pm 2.95$$

2.95 years

$$1995 + 3 = 1998$$

Additional Resources:

- Textbook Ch 8.6 pg.589
- <https://www.khanacademy.org/math/algebra2/rational-expressions-equations-and-functions/solving-rational-equations/v/equations-with-two-rational-expressions-2>