

3.11 Solve Rational Expressions



Example 1**Use the cross products property**

Solve $\frac{5}{x-1} = \frac{x}{4}$. Check your solution.

Solution

$$\frac{5}{x-1} = \frac{x}{4}$$

$$20 = \underline{x^2 - x}$$

$$0 = \underline{x^2 - x - 20}$$

$$0 = (\underline{x - 5})(\underline{x + 4})$$

$$\underline{x - 5} = 0 \quad \text{or} \quad \underline{x + 4} = 0$$

$$x = \underline{5} \quad \text{or} \quad x = \underline{-4}$$

Write original equation.

Cross products property

Subtract **20** from each side.

Factor polynomial.

Zero-product property

Solve for x .



The solutions are 5 and -4.

CHECK If $x = \underline{5}$:

$$\frac{5}{\boxed{5} - 1} \stackrel{?}{=} \frac{\boxed{5}}{4}$$
$$\underline{\frac{5}{4}} = \underline{\frac{5}{4}} \quad \checkmark$$

If $x = \underline{-4}$:

$$\frac{5}{\boxed{-4} - 1} \stackrel{?}{=} \frac{\boxed{-4}}{4}$$
$$\underline{-1} = \underline{-1} \quad \checkmark$$

We are going to skip the examples for now, so



Example 2**Multiply by the LCD**

$$\text{Solve } \frac{x}{x+6} - \frac{1}{2} = \frac{4}{x+6}$$

**Multiply everything
by the LCD!**

Solution

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

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

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

$$\underline{2x - x - 6} = \underline{8}$$

$$\underline{x - 6} = \underline{8}$$

$$x = \underline{14}$$

The solution is 14.



Example 3**Factor to find the LCD**

$$\text{Solve } \frac{3}{x+2} - 1 = \frac{-5}{x^2 - 3x - 10}.$$

Write each denominator in factored form. The LCD is

$(x+2)(x-5)$.

$$\frac{3}{x+2} - 1 = \frac{-5}{(x+2)(x-5)}$$

$$\frac{3 \cdot \boxed{(x+2)(x-5)}}{x+2} - 1 \cdot \boxed{(x+2)(x-5)}$$

$$= \frac{-5 \cdot \boxed{(x+2)(x-5)}}{(x+2)(x-5)}$$

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

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



$$\underline{3x - 15} - (\underline{x^2 - 3x - 10}) = \underline{-5}$$

$$\underline{-x^2 + 6x - 5} = \underline{-5}$$

$$\underline{-x^2 + 6x} = 0$$

$$\underline{-x}(\underline{x - 6}) = 0$$

$$\underline{-x} = 0 \quad \text{or} \quad \underline{x - 6} = 0$$

$$x = \underline{0} \quad \text{or} \quad x = \underline{6}$$

The solutions are 0 and 6.



We are going outside to do these example problems in chalk in teams of TWO or THREE.

Bring pages 191 – 194 (where problems are written & you can use examples) with you.

1. $\frac{-2}{x+9} = \frac{x}{7}$

2. $\frac{6}{x-4} = \frac{3}{x}$

Everyone MUST participate.

3. Solve $\frac{3}{x-3} - \frac{1}{x+3} = \frac{14}{x^2-9}$. Check your solution(s).

4. Solve $\frac{1}{x+6} + 2 = \frac{x^2-38}{x^2+2x-24}$.

Your homework is in the TEXTBOOK.

p. 178 2 – 14 even

It is due *tomorrow*.



$$1. \frac{-2}{x+9} = \frac{x}{7}$$

$$(-2)(7) = x(x+9)$$

$$-14 = x^2 + 9x$$

$$0 = x^2 + 9x + 14$$

$$0 = (x+2)(x+7)$$

$$x+2=0 \quad x+7=0$$

$$x=-2 \quad x=-7$$



$$2. \frac{6}{x-4} = \frac{3}{x}$$

$$6x = 3(x - 4)$$

$$6x = 3x - 12$$

$$3x = -12$$

$$x = -4$$



3. Solve $\frac{3}{x-3} - \frac{1}{x+3} = \frac{14}{x^2-9}$. Check your solution(s).

$$\frac{3}{\cancel{(x-3)}} \cdot \cancel{(x-3)}(x+3) - \frac{1}{\cancel{(x-3)}} \cdot \cancel{(x-3)}(x+3) = \frac{14}{\cancel{(x-3)}\cancel{(x+3)}} \cdot \cancel{(x-3)}\cancel{(x+3)}$$

$$3(x+3) - 1(x-3) = 14$$

$$3x + 9 - x + 3 = 14$$

$$2x + 12 = 14$$

$$2x = 2$$

$$x = 1$$



4. Solve $\frac{1}{x+6} + 2 = \frac{x^2 - 38}{x^2 + 2x - 24}$.

$$\frac{1}{\cancel{(x+6)}} \bullet \cancel{(x+6)}(x-4) + 2 \bullet (x+6)(x-4) = \frac{x^2 - 38}{\cancel{(x+6)}\cancel{(x-4)}} \bullet \cancel{(x+6)}\cancel{(x-4)}$$

$$x - 4 + 2(x^2 - 4x + 6x - 24) = x^2 - 38$$

$$x - 4 + 2x^2 - 8x + 12x - 48 - x^2 + 38 = 0$$

$$x^2 + 5x - 14 = 0$$

$$(x - 2)(x + 7) = 0$$

$$x - 2 = 0 \quad x + 7 = 0$$

$$x = 2$$

$$x = -7$$

