

Warm Up

Simplify each expression. Assume all variables are nonzero.

$$1. x^5 \cdot x^2$$

x^7

$$3. \frac{x^6}{x^2} x^4$$

$$2. y^3 \cdot y^3 y^0$$

$$4. \frac{y^2}{y^5} \frac{1}{y^3}$$



Factor each expression.

$$5. x^2 - 2x - 8$$

$$6. x^2 - 5x x(x-5)$$

$$x^2 + 2x - 4x - 8 \quad (x-4)(x+2)$$

$$x(x+2) - 4(x+2)$$

$$7. x^5 - 9x^3 \quad x^3(x^2 - 9) \Rightarrow x^3(x-3)(x+3)$$

A **rational expression** is a quotient of two polynomials. Other examples of rational expressions include the following:

$$\frac{x^2 - 4}{x + 2}$$

$$\frac{10}{x^2 - 6}$$

$$\frac{x + 3}{x - 7}$$

Steps to simplify:

- **Factor** numerator & denominator
- State **excluded values**
 - > Set each factor in the denominator equal to zero and solve.
- **Simplify** by canceling out like factors on top and bottom.

Simplifying Rational Expressions

Simplify. Identify any x-values for which the expression is undefined.

$$\frac{10x^8}{6x^4} = \frac{5x^4}{3}$$

$$6x^4 = 0$$

$$x = 0$$

$$x \neq 0$$

$$\frac{\cancel{xxxx} \circledast \cancel{xxxx}}{\cancel{xxxx}}$$

Simplify. Identify any x -values for which the expression is undefined.

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

$$x+3=0$$

$$x-1=0$$

$$\frac{\cancel{x+2}}{x+3}$$

$$x \neq -3, 1$$

You Try Simplify. Identify any x -values for which the expression is undefined.

A)

$$\frac{16x^{11}}{8x^2} = 2x^9$$

$$x \neq 0$$

B)

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

$$x \neq -\frac{4}{3}, 1$$

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

$$-12 \quad (3x+4)(x-1)$$

4 · 3

$$(3x^2+4x)(-3x-4)$$

$$x(3x+4) - 1(3x+4)$$

$$\rightarrow (3x+4)(x-1)$$

Multiplying and Dividing Rational Expressions

Example 1:

$$\frac{\cancel{n+9}}{\cancel{n+4}} \cdot \frac{\cancel{(n+6)}\cancel{(n+4)}}{\cancel{n^2+10n+24}} = \boxed{n+6}$$

The diagram shows the simplification of the rational expression $\frac{n+9}{n+4} \cdot \frac{n^2+10n+24}{n+9}$. The numerator $n+9$ and denominator $n+9$ are crossed out with red lines. The denominator $n+4$ is crossed out with a blue line. The quadratic $n^2+10n+24$ is factored into $(n+6)(n+4)$ in red, and the $(n+4)$ factor is crossed out with a blue line. The final simplified result $n+6$ is enclosed in a blue box.

Restrictions on x: $n \neq -4, -9$

Example 2:

$$\frac{\cancel{3x^2} \cdot \cancel{(x-4)(x+4)}}{\cancel{3x^3 + 12x^2} \cdot \cancel{x^2 - 16}} = \frac{x-4}{3}$$

$$\cancel{3x^2(x+4)}$$

$$\boxed{\frac{x-4}{3}}$$

$$3x^2 = 0$$

$$x = 0$$

$$x+4 = 0 \quad x = -4$$

$$3 \neq 0$$

Restrictions on x:

$$\boxed{x \neq -4, 0}$$

Example 3:

~~$(n-9)(n+1)$~~ Keep-Change-Flip

$$\frac{n^2 - 8n - 9}{n-7} \times \frac{n-9}{n-4} \rightarrow \frac{n-4}{n-9}$$

$$\frac{(n+1)(n-4)}{n-7}$$

Restrictions on x: $n \neq 7, 9, 4$

Example 4:

$$\frac{\cancel{(n-4)}(n+4)}{n^2-16} \cdot \frac{n+4}{\cancel{(n-4)}(n-6)}$$

$$\frac{n^2-16}{n^2-10n+24}$$

$$\frac{n+4}{n+4}$$

$$= \frac{n+1}{n-6}$$

Restrictions on x:

$$n \neq 6, 4, -1, -4$$

Attachments

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