

9-1 Multiplying/Dividing Rational Expressions

To multiply rational expressions:

1. Find the excluded values (after factoring), which are values of the variable for which the expression is **undefined**.
2. Multiply the numerators to find the numerator of the product
3. Multiply the denominators to find the denominator
4. Simplify the product by reducing common factors.

Reduce the following expressions. List excluded/undefined values first.

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

$$x \neq 2, -3$$

$$\frac{x}{(x-2)}$$

$$\frac{x}{-2x} = -\frac{1}{2}$$

$$-\frac{1}{2}$$

$$-\frac{1}{2}$$

$$\frac{(x+5) \cdot 2x^2}{x(x+5)(x+1)}$$

$$x \neq -5, -1, 0$$

$$\frac{2x^2}{x+1}$$

Your Turn

Find the products and any excluded values. (undefined)

2. $\frac{x^2 - 9}{x^2 - 5x - 24} \cdot \frac{x - 8}{2x^2 - 18x}$

$$\frac{x^2 - 9}{x^2 - 5x - 24} \cdot \frac{x - 8}{2x^2 - 18x}$$

$$\frac{\cancel{(x+3)}(x-3)}{\cancel{(x-8)}(x+3)} \cdot \frac{\cancel{(x-8)}}{2x(x-9)}$$

3. $\frac{x}{x-9} \cdot \frac{3x-27}{x+1}$

$$\frac{x-3}{2x(x-9)}$$

$x \neq 8, -3, 9, 0$

Find the product and excluded/undefined) values.

6. $\frac{x^2 + 14x + 33}{4x} \cdot \frac{x^2 - 3x}{x + 3} \cdot \frac{8x - 56}{x^2 + 4x - 77}$

7. $\frac{9x^2}{x - 6} \cdot \frac{x^2 - 36}{3x - 6} \cdot \frac{3}{4x^2 + 24x}$

Steps for dividing polynomials

1. Find the excluded values (after factoring), which are values of the variable for which the expression is ***undefined***. *Look at both denominators and numerator of the divisor
2. Change to multiplication
3. Multiply the numerators to find the numerator of the product
4. Multiply the denominators to find the denominator
5. Simplify the product by reducing common factors.

To divide rational expressions, change the division problem to a multiplication problem by multiplying by the reciprocal. Then, follow the steps for multiplying rational expressions.

Example 2 Find the quotients and any excluded values.

(A) $\frac{(x+7)^2}{x^2} \div \frac{x^2+9x+14}{x^2+x-2}$

$$\frac{(x+7)^2}{x^2} \div \frac{x^2+9x+14}{x^2+x-2}$$

$$\frac{(x+7)^2}{x^2} \cdot \frac{(x+7)(x+2)}{(x-1)(x+2)}$$

$$\frac{(x+7)^2}{x^2} \cdot \frac{(x-1)(x+2)}{(x+7)(x+2)}$$

$$x \neq 0, 1, -2, -7$$

$$\frac{(x+7)(x-1)}{x^2}$$

Your Turn

Find the quotients and any excluded values.

4. $\frac{x+11}{4x} \div \frac{2x+6}{x^2+2x-3}$

5. $\frac{20}{x^2-7x} \div \frac{5x^2-40x}{x^2-15x+56}$

