

Day 16

9.4 Rational Expressions

A rational expression is in simplest form when the numerator (top) and the denominator (bottom) are polynomials that have NO common factors.

To simplify, factor out the GCF 1st, then factor (trinomial, difference of squares), and cancel or \div out common factors.

(ex) $\frac{x}{x-1}$ \leftarrow cannot be reduced (already in simplest form)

(ex) $\frac{x}{x^2}$ \leftarrow can reduce $\frac{x}{x \cdot x} = \frac{1}{x}$ \leftarrow simplest reduced form

(ex) $\frac{x^2+3}{x^2+9x+3}$ \leftarrow cannot be reduced any further
cannot cancel the " x^2 " or the "+3"

because of the addition signs

(ex) $\frac{2x-6}{3x-9} = \frac{2(x-3)}{3(x-3)} = \frac{2}{3}$

can cancel like binomials

(ex) $\frac{\frac{1}{x}}{\frac{x+1}{1}} = \frac{1}{x} \cdot \frac{1}{x+1} = \frac{1}{x(x+1)}$
 \uparrow Flip
 \uparrow mult.

If there are no plus or minus signs, you can reduce fractions and use rules of exponents to simplify.

$$\textcircled{\text{ex}} \quad \frac{-27x^3y^5}{9x^4y^1} = \frac{-3y^4}{x^1} = \left(\frac{-3y^4}{x} \right)$$

If there are plus and minus signs, factor and only cancel exact binomials or trinomials.

$$\textcircled{\text{ex}} \quad \frac{-6-3x}{x^2-6x+8} = \frac{-3(2+x)}{(x-4)(x-2)} = \left(\frac{-3(x+2)}{(x-4)(x-2)} \right)$$

State any restrictions on x . \rightarrow $x \neq 4, 2$
(any x -value that would make the denominator zero)

$$\textcircled{\text{ex}} \quad \frac{2x^2-3x-2}{x^2-5x+6} = \frac{(x-2)(2x+1)}{(x-2)(x-3)} = \left(\frac{2x+1}{x-3} \right)$$

Find restrictions before you cancel!

$$x \neq 2, 3$$

Multiply:

Factor 1st, then cancel anything on top with like factors on the bottom.
then any top = top
bottom = bottom.

ex

$$\frac{a^2 - 4}{a^2 - 1} \cdot \frac{a + 1}{a^2 + 2a}$$

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

$$\frac{a+1}{a(a+2)}$$

both were difference of 2 squares

$$\begin{aligned} a-1 &= 0 \\ +1 &+1 \\ a &= 1 \end{aligned}$$

$$\begin{aligned} a+1 &= 0 \\ -1 &-1 \\ a &= -1 \end{aligned}$$

$$\begin{aligned} a+2 &= 0 \\ -2 &-2 \\ a &= -2 \end{aligned}$$

Factor 1st

before canceling,

Find restrictions

$$a \neq 1, -1, 0, -2$$

$$= \frac{a-2}{a(a-1)}$$

Dividing: only difference is you multiply by the reciprocal (Flip only the 2nd Fraction!)

ex

$$\frac{a^2 + 2a - 15}{a^2 - 16} \div \frac{a+1}{3a-12}$$

$$\frac{(a+5)(a-3)}{(a+4)(a-4)} \cdot \frac{3(a-4)}{a+1}$$

restrictions: $a \neq -4, 4, -1$

$$= \frac{3(a+5)(a-3)}{(a+4)(a+1)}$$

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ex

$$\frac{x^2 - x - 2}{2x^2 - 5x + 2} \div \frac{x^2 - x - 12}{2x^2 + 5x - 3}$$

$$\frac{\cancel{(x-2)}(x+1)}{\cancel{(2x-1)}(\cancel{x-2})} \cdot \frac{\cancel{(2x-1)}(\cancel{x+3})}{(x-4)(\cancel{x+3})}$$

restrictions: $x \neq \frac{1}{2}, 2, 4, -3$

answer:

$$\frac{x+1}{x-4}$$

p. 511-512 (2-18 even, 19-21,
28, 30, 32)