

Name: _____

Date: _____

Learning Goal 6.1	Simplifying and applying operations to rational expressions, identifying any non-permissible values.
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Recall Multiplying and Dividing Fractions

Mult. then Simp.

$$= \frac{10}{280} \div 10$$

$$= \frac{1}{28}$$

$$\frac{5}{8} \times \frac{2}{35}$$

Simp. then Mult.

$$= \frac{1}{28}$$

$$\frac{7}{9} \div \frac{35}{6}$$

$$= \frac{1}{3} \times \frac{2}{5}$$

$$= \frac{2}{15}$$

Extend to rational expressions. Simplify and state the non-permissible values.

a. $\left(\frac{4x^2}{3xy}\right)\left(\frac{y^2}{8x}\right)$ NPV: $x \neq 0$
 $y \neq 0$

$$= \frac{x^2 y^2}{6x^2 y}$$

$$= \frac{y}{6}$$

b. $\frac{10ac^3}{3b^2} \div \frac{2b^5c^4}{15ab^2}$ NPV: $a \neq 0$
 $b \neq 0$
 $c \neq 0$

$$= \frac{25a^2 b^2 c^3}{b^7 c^4}$$

$$= 25a^2 b^{-5} c^{-1}$$

$$= \frac{25a^2}{b^5 c}$$

c. $\frac{x+3}{2} \times \frac{x+1}{4}$ NPV: none

$$= \frac{(x+3)(x+1)}{8}$$

$$= \frac{x^2 + 4x + 3}{8}$$

d. $\frac{x-3}{x^2-9} \div \frac{x}{x+3}$ NPV: $x+3 \neq 0$
 $x \neq -3$
 $x-3 \neq 0$
 $x \neq 3$
 $x \neq 0$

$$= \frac{(x-3)}{(x+3)(x-3)} \div \frac{x}{x+3}$$

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

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

e. $\frac{a^2 - a - 12}{a^2 - 9} \times \frac{a^2 - 4a + 3}{a^2 - 4a}$

$a^2 - a - 12 = a^2 - 4a + 3a - 12 = a(a-4) + 3(a-4) = (a-4)(a+3)$
 $a^2 - 9 = (a+3)(a-3)$
 $a^2 - 4a + 3 = (a-3)(a-1)$
 $a^2 - 4a = a(a-4)$

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

f. $\frac{x^2 - 4}{x^2 - 4x} \div \frac{x^2 + x - 6}{x^2 + x - 20}$

$x^2 - 4 = (x+2)(x-2)$
 $x^2 - 4x = x(x-4)$
 $x^2 + x - 6 = (x+3)(x-2)$
 $x^2 + x - 20 = (x+5)(x-4)$

NPV:

- $a+3 \neq 0$
- $a \neq -3$
- $a-3 \neq 0$
- $a \neq 3$
- $a \neq 0$
- $a-4 \neq 0$
- $a \neq 4$

$= \frac{(x+2)(x-2)}{x(x-4)} \div \frac{(x+3)(x-2)}{(x+5)(x-4)}$

- NPV: $x \neq 0$
 $x-4 \neq 0$
 $x \neq 4$
 $x+5 \neq 0$
 $x \neq -5$
 $x+3 \neq 0$
 $x \neq -3$
 $x-2 \neq 0$
 $x \neq 2$

$= \frac{(x+2)(x-2)}{x(x-4)} \times \frac{(x+5)(x-4)}{(x+3)(x-2)}$
 $= \frac{(x+2)(x+5)}{x(x+3)}$

Example Write a polynomial A so that the expression simplifies to -1.

$\frac{3n^2 + 2n - 8}{n^2 + 4n + 4} \times \frac{A}{3n^2 - n - 4} = -1$

Step 1:
Factor!

$3n^2 + 2n - 8 = 3n^2 + 6n - 4n - 8 = 3n(n+2) - 4(n+2) = (n+2)(3n-4)$

$n^2 + 4n + 4 = (n+2)(n+2)$

$3n^2 - n - 4 = 3n^2 + 3n - 4n - 4 = 3n(n+1) - 4(n+1) = (n+1)(3n-4)$

$\frac{(n+2)(3n-4)}{(n+2)(n+2)} \times \frac{A}{(n+1)(3n-4)} = -1$

$\frac{A}{(n+2)(n+1)} = -1$

$A = -(n+2)(n+1)$

CHECK $-\frac{(n+2)(n+1)}{(n+2)(n+1)} = \frac{-1}{1} = -1$