

Name: _____

Date: _____

Learning Goal 6.1

Simplifying and applying operations to rational expressions, identifying any non-permissible values.

Simplify and state the non-permissible values.

a. $\frac{d}{2\pi r} \times \frac{2\pi r h}{d-2}$ Non-Permissible Values:
 $= \frac{dh}{d-2}$ $r \neq 0$
 $d \neq 2$

b. $\frac{5n^4}{-2} \div \frac{(5n)^2}{6}$ Non-Permissible Values:
 $n \neq 0$
 $= \frac{5n^4}{-2} \times \frac{6}{(5n)^2}$
 $= \frac{5n^4}{-2} \times \frac{6}{25n^2}$
 $= \frac{n^4}{-2} \times \frac{6}{5n^2}$
 $= \frac{n^4}{-1} \times \frac{3}{5n^2}$
 $= \frac{n^2}{-1} \times \frac{3}{5}$
 $= -\frac{3n^2}{5}$

c. $\frac{y^2-9}{r^3-r} \times \frac{r^2-r}{y+3}$

d. $\frac{2}{b-3} \div \frac{4b}{b^2-9}$

Non-Permissible Values:

$$r \neq 0, \pm 1$$

$$y \neq -3$$

$$= \frac{(y+3)(y-3)}{r(r^2-1)} \times \frac{r(r-1)}{y+3}$$

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

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

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

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

$$= \frac{y-3}{r+1}$$

Non-Permissible Values:

$$b \neq 0, \pm 3$$

$$= \frac{2}{b-3} \times \frac{b^2-9}{4b}$$

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

$$= \frac{2}{1} \times \frac{(b+3)}{4b}$$

$$= \frac{1}{1} \times \frac{(b+3)}{2b}$$

$$= \frac{b+3}{2b}$$

$$e. \quad \frac{x^2 + 9x + 20}{2x^2 + 6x - 8} \times \frac{x^2 - 1}{3x + 15}$$

Non-Permissible Values:

$$x \neq -5, -4, 1$$

$$\begin{aligned} &= \frac{(x+4)(x+5)}{2(x+4)(x-1)} \\ &\quad \times \frac{(x+1)(x-1)}{3(x+5)} \\ &= \frac{(x+4)}{2(x+4)(x-1)} \\ &\quad \times \frac{(x+1)(x-1)}{3} \\ &= \frac{1}{2(x-1)} \times \frac{(x+1)(x-1)}{3} \\ &= \frac{1}{2} \times \frac{(x+1)}{3} \\ &= \frac{x+1}{6} \end{aligned}$$

$$f. \quad \frac{c^2 - 6c - 7}{c^2 - 49} \div \frac{c^2 + 8c + 7}{c^2 + 7c}$$

Non-Permissible Values:

$$c \neq \pm 7, -1, 0$$

$$\begin{aligned} &= \frac{c^2 - 6c - 7}{c^2 - 49} \times \frac{c^2 + 7c}{c^2 + 8c + 7} \\ &= \frac{(c-7)(c+1)}{(c+7)(c-7)} \times \frac{c(c+7)}{(c+7)(c+1)} \\ &= \frac{(c+1)}{(c+7)} \times \frac{c(c+7)}{(c+7)(c+1)} \\ &= \frac{(c+1)}{1} \times \frac{c}{(c+7)(c+1)} \\ &= \frac{1}{1} \times \frac{c}{(c+7)} \\ &= \frac{c}{c+7} \end{aligned}$$

$$g. \quad \frac{3x + 12}{3x^2 - 5x - 12} \div \frac{12}{3x + 4} \times \frac{2x - 6}{x + 4}$$

Non-Permissible Values:

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

$$\begin{aligned} &= \frac{3x + 12}{3x^2 - 5x - 12} \times \frac{3x + 4}{12} \times \frac{2x - 6}{x + 4} \\ &= \frac{3(x + 4)}{(x - 3)(3x + 4)} \times \frac{3x + 4}{12} \times \frac{2(x - 3)}{x + 4} \\ &= \frac{3}{(x - 3)(3x + 4)} \times \frac{3x + 4}{12} \times \frac{2(x - 3)}{1} \\ &= \frac{3}{(3x + 4)} \times \frac{3x + 4}{12} \times \frac{2}{1} \\ &= \frac{3}{1} \times \frac{1}{12} \times \frac{2}{1} \\ &= \frac{1}{1} \times \frac{1}{4} \times \frac{2}{1} \\ &= \frac{1}{1} \times \frac{1}{2} \times \frac{1}{1} \\ &= \frac{1}{2} \end{aligned}$$

$$h. \quad \frac{1 - 2/a}{1 - 4/a^2}$$

Non-Permissible Values:

$$a \neq \pm 2, 0$$

$$\begin{aligned} &= \frac{1 - 2/a}{a - 2} \quad \quad \quad 1 - 4/a^2 \\ &= \frac{a - 2}{a} \quad \quad \quad = \frac{a^2 - 4}{a^2} \\ &= \frac{(a + 2)(a - 2)}{a^2} \end{aligned}$$

$$\begin{aligned} \frac{1 - 2/a}{1 - 4/a^2} &= \frac{a - 2}{a} \div \frac{(a + 2)(a - 2)}{a^2} \\ &= \frac{a - 2}{a} \times \frac{a^2}{(a + 2)(a - 2)} \\ &= \frac{a - 2}{1} \times \frac{a}{(a + 2)(a - 2)} \\ &= \frac{1}{1} \times \frac{a}{(a + 2)} \\ &= \frac{a}{a + 2} \end{aligned}$$

Write a polynomial A so that the expression simplifies to $1/5$.

$$\frac{x^2 + 6x + 9}{5x^2 + 15x} \div \frac{3x^2 + 11x + 6}{A}$$

1. Simplify!

$$\begin{aligned} &= \frac{x^2 + 6x + 9}{5x^2 + 15x} \times \frac{A}{3x^2 + 11x + 6} \\ &= \frac{(x + 3)^2}{5x(x + 3)} \times \frac{A}{(x + 3)(3x + 2)} \\ &= \frac{(x + 3)}{5x(x + 3)} \times \frac{A}{(3x + 2)} \\ &= \frac{1}{5x} \times \frac{A}{(3x + 2)} \end{aligned}$$

2. Equate to $1/5$!

$$\begin{aligned} \left(\frac{1}{5x} \times \frac{A}{(3x + 2)} = \frac{1}{5}\right) \times 5 \\ \left(\frac{1}{x} \times \frac{A}{(3x + 2)} = 1\right) \times x \\ \left(\frac{A}{(3x + 2)} = x\right) \times (3x + 2) \\ A = x(3x + 2) \\ A = 3x^2 + 2x \end{aligned}$$