

Math 3201

### 4.3B Dividing Rational Expressions

Steps:

- Keep the first fraction the same and multiply by the reciprocal of the second fraction.
- Where possible, factor the numerators and denominators of both expressions.
- Cancel common factors.
- Determine the restrictions by calculating the non-permissible values.
- State the simplified answer along with restrictions.

**Example 1:**

Simplify the following and state restrictions.

Recall:

$$\frac{2}{3} \div \frac{4}{5}$$

$$= \frac{2}{3} \cdot \frac{5}{4}$$

$$= \frac{10}{12}$$

$$= \frac{5}{6}$$

(A)  $\frac{(4x^3+8x^2)}{45x} \div \frac{(2x^2-8)}{36x^4}$  Think:  $\frac{4x^3+8x^2}{45x}$

$$= \frac{(4x^3+8x^2)}{45x} \cdot \frac{36x^4}{(2x^2-8)}$$

Restrictions

$$= \frac{4x^2(x+2)}{45x} \cdot \frac{36x^4}{2(x^2-4)}$$

$$= \frac{4x \cancel{(x+2)}}{45 \cancel{x}} \cdot \frac{36x^4}{2 \cancel{(x+2)}(x-2)}$$

Restrictions

$$= \frac{144x^5}{90(x-2)}$$

$$= \frac{8x^5}{5(x-2)}, x \neq 0, -2, 2$$

$$(B) \frac{(25-x^2)}{(3x^2+6x)} \div \frac{(7x-35)}{(x^4-16)}$$

$$= \frac{(25-x^2)}{(3x^2+6x)} \cdot \frac{(x^4-16)}{(7x-35)}$$

$$= \frac{(5+x)(5-x)}{3x(x+2)} \cdot \frac{(x^2+4)(x^2-4)}{7(x-5)}$$

$$= \frac{\cancel{(5+x)}\cancel{(5-x)}}{3x\cancel{(x+2)}} \cdot \frac{(x^2+4)\cancel{(x+2)}(x-2)}{7\cancel{(x-5)}}$$

$$= \frac{-(5+x)(x^2+4)(x-2)}{21x}, x \neq 0, -2, 2, 5$$

$$\begin{aligned} x^2 + 4 &\neq 0 & (\neq 2) \\ x^2 &\neq -4 \\ \cancel{\sqrt{x^2}} &\neq \cancel{\sqrt{-4}} \end{aligned}$$

$$(C) \left( \frac{x-5}{3x^2-9x} \div \frac{5}{6x-18} \right)$$

$$= \frac{(x-5)}{(3x^2-9x)} \cdot \frac{(6x-18)}{5}$$

$$= \frac{(x-5)}{3x(x-3)} \cdot \frac{6(x-3)}{5}$$

$$= \frac{6(x-5)}{15x}$$

$$= \frac{2(x-5)}{5x}, x \neq 0, 3$$

$$\begin{aligned}
 \text{(D)} \quad \frac{\frac{x^3+3x^2}{x^2-x^3}}{\frac{3x^2+9x}{1-x^2}} &= \frac{x^3+3x^2}{x^2-x^3} \cdot \frac{3x^2+9x}{1-x^2} \\
 &= \frac{\cancel{x^2}(x+3)}{\cancel{x^2}(1-x)} \cdot \frac{(1+x)\cancel{(1-x)}}{3x\cancel{(x+3)}} \\
 &= \frac{(1+x)}{3x}, \quad x \neq 0, -1, 1, -3
 \end{aligned}$$

**Textbook Questions:** page 238 - 239 #1(b,d), 2(c,d), 3(b,c), 4(b,d), 5(b), 7, 15(a)