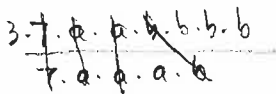


11-1 Simplifying Rational Expressions

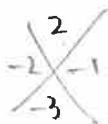
Simplify:

$$1. \frac{21a^2b^4}{7a^3b} = \boxed{\frac{3b^3}{a}}$$



$$2. \frac{2n-3}{6n-9} = \frac{(2n-3)}{3(2n-3)} = \boxed{\frac{1}{3}}$$

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



$$= \boxed{\frac{y-2}{3}}$$

$$4. \frac{2d^2-2d-12}{d^2+5d+6} = \frac{2(d^2-d-6)}{d^2+5d+6}$$

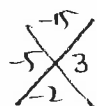


$$= \frac{2(d-3)(d+2)}{(d+3)(d+2)}$$



$$= \boxed{\frac{2(d-3)}{d+3}} \quad \text{or} \quad \frac{2d-6}{d+3}$$

$$5. \frac{e^2-2e-15}{25-e^2} = \frac{e^2-2e-15}{-1(e^2-25)} = \frac{(e-5)(e+3)}{-1(e+5)(e-5)} = \frac{e+3}{-(e+5)} = \boxed{\frac{-e+3}{e+5}}$$



11-2 Multiplying Rational Expressions

Multiply and simplify:

$$1. \frac{4a^3b}{3a^2b^2} \cdot \frac{9ab}{8} = \boxed{\frac{3a^2}{2}}$$

$$\frac{\cancel{2} \cdot \cancel{2} \cdot a \cdot \cancel{a} \cdot \cancel{a} \cdot b \cdot \cancel{3} \cdot 3 \cdot a \cdot \cancel{b}}{\cancel{3} \cdot \cancel{a} \cdot \cancel{a} \cdot \cancel{b} \cdot \cancel{2} \cdot \cancel{2} \cdot 2}$$

$$2. \frac{n+3}{3n} \cdot \frac{6n^2}{n^2+n-6} = \frac{(n+3) \cdot \cancel{2} \cdot \cancel{3} \cdot n}{\cancel{3} \cdot n \cdot (n+3)(n-2)}$$

$$\frac{\cancel{3} \cdot \cancel{-6}}{1 \cdot -2} = \boxed{\frac{2n}{n-2}}$$

$$3. \frac{4x+4}{5x+10} \cdot \frac{30x+60}{2x-2}$$

$$= \frac{4(x+1)}{5(x+2)} \cdot \frac{30(x+2)}{2(x-1)}$$

$$= \frac{2 \cdot 2 \cdot (x+1)}{\cancel{5} \cdot (x+2)} \cdot \frac{\cancel{2} \cdot 3 \cdot \cancel{5} \cdot (x+2)}{\cancel{2} \cdot (x-1)}$$

$$= \boxed{\frac{12(x+1)}{x-1}}$$

$$4. \frac{2y+9}{4y+12} \cdot (y^2+y-6)$$

$$= \frac{(2y+9)}{4(y+3)} \cdot \frac{(y+3)(y-2)}{1}$$

$$= \boxed{\frac{(2y+9)(y-2)}{4}}$$

$$\frac{\cancel{-6}}{\cancel{3} \cdot -2}$$

$$5. \frac{x^2-6x+8}{x^2-x-2} \cdot \frac{2x-4}{x-4} = \frac{(x-2)(x-4)}{(x-2)(x+1)} \cdot \frac{2(x-2)}{\cancel{(x-4)}} = \boxed{\frac{x-2}{x+1}}$$

$$\frac{\cancel{8}}{\cancel{-2} \cdot \cancel{-4}}$$

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



11-3 Dividing Rational Expressions

Divide and simplify:

$$1. \frac{8a^2b^3}{6ab^4} \div \frac{6ab}{9} = \frac{8a^2b^3}{6ab^4} \cdot \frac{9}{6ab}$$

$$= \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{a} \cdot \cancel{b} \cdot \cancel{b} \cdot \cancel{b} \cdot \cancel{b}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{a} \cdot \cancel{b} \cdot \cancel{b} \cdot \cancel{b} \cdot \cancel{b} \cdot \cancel{a} \cdot \cancel{b}}$$

$$= \boxed{\frac{2}{b^2}}$$

$$2. \frac{3t+12}{5t} \div \frac{t+4}{10t} = \frac{3t+12}{5t} \cdot \frac{10t}{t+4}$$

$$= \frac{3(\cancel{t}+4)}{\cancel{5} \cdot \cancel{t}} \cdot \frac{2 \cdot \cancel{5} \cdot \cancel{t}}{\cancel{t}+4}$$

$$= \boxed{6}$$

→

$$3. \frac{k^2+5k-6}{8k^3} \div \frac{24k^2}{k^2+6k}$$

$$= \frac{k^2+5k-6}{8k^3} \cdot \frac{24k^2}{k^2+6k}$$

$$= \frac{(k+6)(k-1)}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot k \cdot k \cdot k} \cdot \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 3 \cdot k \cdot k}{k(k+6)}$$

$$= \boxed{\frac{3(k-1)}{k^2}}$$

$$4. \frac{x^2+10x-11}{x^2+12x+11} \div (x-1)$$

$$= \frac{(x+11)(x-1)}{(x+11)(x+1)} \cdot \frac{1}{(x-1)}$$

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

$$5. \frac{2n^2-5n-3}{4n^2-12n-7} \div \frac{4n+5}{2n-7} = \frac{(2n+1)(n-3)}{(2n-7)(2n+1)} \cdot \frac{(2n-7)}{(4n+5)}$$

$$\begin{array}{r} -6 \\ -6 \\ -5 \end{array} \begin{array}{l} \diagdown \\ \diagup \\ \diagdown \end{array}$$

$$\begin{array}{r} 2n \quad 1 \\ n \quad \begin{array}{|c|c|} \hline 2n^2 & 1n \\ \hline -6n & -3 \\ \hline \end{array} \\ -3 \end{array}$$

$$= \boxed{\frac{n-3}{4n+5}}$$

$$\begin{array}{r} -28 \\ -14 \\ -12 \end{array} \begin{array}{l} \diagdown \\ \diagup \\ \diagdown \end{array}$$

$$\begin{array}{r} 2n \quad 1 \\ 2n \quad \begin{array}{|c|c|} \hline 4n^2 & 2n \\ \hline -14n & -7 \\ \hline \end{array} \\ -7 \end{array}$$

11-4 Adding & Subtracting Rational Expressions

Add or subtract and simplify:

$$1. \frac{9}{2y+4} - \frac{5}{2y+4} = \frac{4}{2y+4}$$

$$\frac{\cancel{2} \cdot 2}{\cancel{2}(y+2)} = \boxed{\frac{2}{y+2}}$$

(2)

$$2. \frac{4b \cdot 4}{4b \cdot 6b^2} + \frac{5 \cdot 3}{8b^3 \cdot 3} = \frac{16b}{24b^3} + \frac{15}{24b^3}$$

$$6b^2 = 2 \cdot 3 \cdot b \cdot b$$

$$8b^3 = 2 \cdot 2 \cdot 2 \cdot b \cdot b \cdot b$$

$$LCD = 2 \cdot 2 \cdot 2 \cdot 3 \cdot b \cdot b \cdot b$$

$$= 24b^3$$

$$= \boxed{\frac{16b + 15}{24b^3}}$$

(2)

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

$$\begin{array}{r} \cancel{3} \\ 3 \end{array} \begin{array}{r} \cancel{-3} \\ -3 \end{array}$$

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

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

(3)

$$4. \frac{(y+1)4}{(y+1)(y-1)} - \frac{3(y-1)}{(y+1)(y-1)}$$

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

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

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

$$= \boxed{\frac{y+7}{(y+1)(y-1)}} \quad \text{or} \quad \frac{y+7}{y^2-1}$$

(3)

11-5 Solving Rational Equations

Solve each equation. Be sure to check for extraneous solutions!

$$1. \frac{2}{p+3} = \frac{7}{2p}$$

$$2(2p) = 7(p+3)$$

$$4p = 7p + 21$$

$$\begin{array}{r} 4p \\ -7p \\ \hline -3p = 21 \\ \frac{-3p}{-3} = \frac{21}{-3} \\ \boxed{p = -7} \end{array}$$

Check:

$$\frac{2}{-7+3} = \frac{7}{2(-7)}$$

$$\frac{2}{-4} = \frac{7}{-14}$$

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

(3)

$$2. \frac{4}{p+3} = \frac{p-3}{4}$$

$$4(4) = (p+3)(p-3)$$

$$16 = p^2 - 9$$

$$25 = p^2$$

$$\pm\sqrt{25} = \sqrt{p^2}$$

$$\boxed{\pm 5 = p}$$

check $p = 5$

$$\frac{4}{5+3} = \frac{5-3}{4}$$

$$\frac{4}{8} = \frac{2}{4}$$

$$\frac{1}{2} = \frac{1}{2} \checkmark$$

check $p = -5$

$$\frac{4}{-5+3} = \frac{-5-3}{4}$$

$$\frac{4}{-2} = \frac{-8}{4}$$

$$-2 = -2 \checkmark$$

(3)

$$3. \frac{1}{p-5} = \frac{p}{p^2-25}$$

$$1(p^2-25) = p(p-5)$$

$$\begin{array}{r} p^2 - 25 \\ -p^2 \\ \hline -25 = -5p \\ \frac{-25}{-5} = \frac{-5p}{-5} \\ \cancel{5} \neq p \end{array}$$

check:

$$\frac{1}{5-5} = \frac{5}{5^2-25}$$

$$\frac{1}{0} \neq \frac{5}{0}$$

no solution

(4)