VANCOUVER COMMUNITY COLLEGE

Operations with Fractional Expressions

To multiply fractions:
$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

To divide fractions:
$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

To add/subtract fractions:
$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad}{bd} \pm \frac{cb}{db} = \frac{ad \pm bc}{bd}$$

Example 1: Multiply $\dfrac{x+1}{x+2} \cdot \dfrac{x+3}{x+4}$.

Solution:
$$\frac{x+1}{x+2} \cdot \frac{x+3}{x+4} = \frac{(x+1)(x+3)}{(x+2)(x+4)}$$
$$= \frac{x^2 + 4x + 3}{x^2 + 6x + 8}$$

Example 2: Divide $\dfrac{x+1}{x+2} \div \dfrac{x+3}{x+4}$.

Solution:
$$\frac{x+1}{x+2} \div \frac{x+3}{x+4} = \frac{x+1}{x+2} \cdot \frac{x+4}{x+3}$$
$$= \frac{x^2 + 5x + 4}{x^2 + 5x + 6}$$

Example 3: Add $\dfrac{x+1}{x+2} + \dfrac{x+3}{x+4}$.

Solution:
$$\frac{x+1}{x+2} + \frac{x+3}{x+4} = \frac{(x+1)(x+4)}{(x+2)(x+4)} + \frac{(x+3)(x+2)}{(x+4)(x+2)}$$
$$= \frac{x^2 + 5x + 4}{x^2 + 6x + 8} + \frac{x^2 + 5x + 6}{x^2 + 6x + 8}$$
$$= \frac{2x^2 + 10x + 10}{x^2 + 6x + 8}$$

Authored by Gordon Wong

EXERCISES

A. Simplify and expand:

1) $\dfrac{x+1}{x-1} \cdot \dfrac{x-2}{x+2}$

2) $\dfrac{x}{x-3} \cdot \dfrac{x+1}{x-2}$

3) $\dfrac{(x+1)(x-1)}{(x+2)(x+3)} \cdot \dfrac{x-2}{(x+1)(x-1)}$

10) $\dfrac{4}{x} + \dfrac{5}{x+3}$

4) $\dfrac{x+1}{x+2} \cdot \dfrac{x+2}{x+3} \cdot \dfrac{x+3}{x+4} \cdot \dfrac{x+4}{x+5}$

11) $\dfrac{x}{x+2} + \dfrac{3}{(x+2)(x-2)}$

5) $\dfrac{x}{x+1} \div \dfrac{x+1}{x}$

12) $\dfrac{1}{x} - \dfrac{3}{x+5} + \dfrac{2x}{x(x+5)}$

6) $\dfrac{x+1}{x-1} \div \dfrac{x+2}{x-2}$

13) $\dfrac{6}{x-2} + \dfrac{3}{x+3} - \dfrac{4x-5}{x^2+x-6}$

7) $\dfrac{(x-3)(x-4)}{(x-5)(x-6)} \div \dfrac{(x-3)(x-4)}{(x-5)(x-2)}$

14) $\dfrac{7}{2(x-3)} - \dfrac{4}{3(x+1)}$

8) $\left(\dfrac{x+3}{x+2} \div \dfrac{x+1}{x+2} \right) \div \left(\dfrac{x+3}{x-4} \div \dfrac{x+1}{x-4} \right)$

15) $\dfrac{5}{x} + \dfrac{2}{x+1} - \dfrac{4}{x+2}$

9) $\dfrac{x}{x+1} + \dfrac{3}{x+1}$

16) $\dfrac{x}{x+2} + \dfrac{x+5}{x-4} \div \dfrac{x+2}{x-7}$

SOLUTIONS

A. (1) $\frac{x^2-x-2}{x^2+x-2}$ (2) $\frac{x^2+x}{x^2-5x+6}$ (3) $\frac{x-2}{x^2+5x+6}$ (4) $\frac{x+1}{x+5}$ (5) $\frac{x^2}{x^2+2x+1}$ (6) $\frac{x^2-x-2}{x^2+x-2}$ (7) $\frac{x-2}{x-6}$ (8) 1

(9) $\frac{x+3}{x+1}$ (10) $\frac{9x+12}{x^2+3x}$ (11) $\frac{x^2-2x+3}{x^2-4}$ (12) $\frac{5}{x^2+5x}$ (13) $\frac{5x+17}{x^2+x-6}$ (14) $\frac{13x+45}{6x^2-12x-18}$

(15) $\frac{3x^2+15x+10}{x^3+3x^2+2x}$ (16) $\frac{x}{x+2} + \frac{x^2-2x-35}{(x+2)(x-4)} = \frac{2x^2-6x-35}{x^2-2x-8}$