Honors Advanced Algebra DATE: _____

Adding & Subtracting Rational Expressions

Target 3A. Perform operations with rational expressions to demonstrate the analogy with integers.

Add and Subtract Rational Expressions

As with fractions to add or subtract rational expressions you must have common denominators. If you do not already have common denominators find the lowest common denominator first.

Example: $\frac{2}{3}+\frac{3}{5}=$ $\frac{2}{3}\cdot\frac{5}{5}+\frac{3}{5}\cdot\frac{3}{3}=\frac{10}{15}+\frac{9}{15}=\frac{10+9}{15}=\boxed{\frac{19}{15}}$

Remember, to add or subtract rational expressions, you must have common denominators (just like with fractions).

Simplify.

1. $\frac{x+8}{x+5}+\frac{x+7}{x+5}=\frac{x+8+x+7}{x+5}=\boxed{\frac{2x+15}{x+5}}$

we have common denominators

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

Factor $3x^2-x-2$ first

-6, $-3\cdot 2$ $(x-3)(x+2)$ 3 3

$(x-1)(3x+2)$

very important to put parenthesis around expression w/ more than 1 term

$=\frac{7x+5}{(x-1)(3x+2)}-\frac{(4x+3)}{(x-1)(3x+2)}$

$=\frac{7x+5-(4x+3)}{(x-1)(3x+2)}=\frac{7x+5-4x-3}{(x-1)(3x+2)}=\frac{\cancel{3x+2}}{(x-1)(\cancel{3x+2})}$

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

3. $\frac{2}{x^2y}-\frac{x}{y}$

$=\frac{2}{x\cdot x\cdot y}-\frac{x}{y}\cdot\frac{x\cdot x}{x\cdot x}=\frac{2}{x^2y}-\frac{x^3}{x^2y}$

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

4. $\frac{5}{6r}-\frac{3}{2r^2}$

$=\frac{5}{2\cdot 3\cdot r}\cdot\frac{r}{r}-\frac{3}{2\cdot r\cdot r}\cdot\frac{3}{3}=\frac{5r}{6r^2}-\frac{9}{6r^2}$

$=\boxed{\frac{5r-9}{6r^2}}$

5. $\frac{5}{3m}-\frac{2}{7m}-\frac{1}{6m}$

$=\frac{5}{3m}\cdot\frac{2\cdot 7}{2\cdot 7}-\frac{2}{7m}\cdot\frac{3\cdot 2}{3\cdot 2}-\frac{1}{2\cdot 3\cdot m}\cdot\frac{7}{7}$

$=\frac{70}{42m}-\frac{12}{42m}-\frac{7}{42m}$

$=\frac{70-12-7}{42m}=\frac{51}{42m}=\frac{\cancel{3}\cdot 17}{\cancel{3}\cdot 14\cdot m}$

$=\boxed{\frac{17}{14m}}$

6. $\frac{3}{2a}-\frac{1}{3a}+\frac{1}{6a}$

$=\frac{3}{2a}\cdot\frac{3}{3}-\frac{1}{3a}\cdot\frac{2}{2}+\frac{1}{2\cdot 3\cdot a}$

$=\frac{9}{6a}-\frac{2}{6a}+\frac{1}{6a}$

$=\frac{9-2+1}{6a}=\frac{8}{6a}=\frac{\cancel{2}\cdot 2\cdot 2}{\cancel{2}\cdot 3\cdot a}=\boxed{\frac{4}{3a}}$

7. $\frac{x-2}{x-1}+\frac{6}{7x-7}$

$= \frac{7\cdot(x-2)}{7\cdot(x-1)} + \frac{6}{7(x-1)}$

$= \frac{7(x-2)+6}{7(x-1)}$

$= \frac{7x-14+6}{7(x-1)} = \boxed{\frac{7x-8}{7(x-1)}}$

8. $\frac{2}{x-1}+\frac{3}{x-5}$

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

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

$= \frac{2x-10+3x-3}{(x-1)(x-5)} = \boxed{\frac{5x-13}{(x-1)(x-5)}}$

9. $\frac{x+10}{3x-15}-\frac{3x-15}{6x-30}$

$= \frac{x+10}{3(x-5)} - \frac{3x-15}{6(x-5)}$

$= \frac{(x+5)}{3(x-5)}\cdot\frac{2}{2} - \frac{(3x-15)}{2\cdot3(x-5)}$

$= \frac{2(x+5)}{6(x-5)} - \frac{(3x-15)}{6(x-5)}$

$= \frac{2(x+5)-(3x-15)}{6(x-5)} = \frac{2x+10-3x+15}{6(x-15)}$

$= \boxed{\frac{-x+25}{6(x-15)}}$

10. $\frac{6}{d^2+4d+4}+\frac{5}{d+2}$

$= \frac{6}{(d+2)(d+2)} + \frac{5}{d+2}\cdot\frac{(d+2)}{(d+2)}$

$= \frac{6+5(d+2)}{(d+2)(d+2)}$

$= \frac{6+5d+10}{(d+2)(d+2)}$

$= \boxed{\frac{5d+16}{(d+2)^2}}$

Complex Fractions

A complex fraction is a rational expression whose numerator and/or denominator contain a rational expression.

Simplify each complex fraction.

11. $\dfrac{\frac{6x^2-6}{8x^2+8x}}{\frac{3x-3}{4x^2+4x}}$

$= \frac{6x^2-6}{8x^2+8x} \div \frac{3x-3}{4x^2+4x}$ flip

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

$= \frac{\cancel{2}\cdot3\cancel{(x+1)}\cancel{(x-1)}}{\cancel{2}\cdot\cancel{2}\cdot2\cdot\cancel{x}\cancel{(x+1)}}\cdot\frac{\cancel{2}\cdot\cancel{2}\cdot\cancel{x}\cancel{(x+1)}}{\cancel{3}\cancel{(x-1)}}$

$= \boxed{x+1}$

12. $\dfrac{\frac{2}{x-y}+\frac{1}{x+y}}{\frac{1}{x-y}}$

$= \dfrac{\frac{2}{(x-y)}\cdot\frac{(x+y)}{(x+y)}+\frac{1}{(x+y)}\cdot\frac{(x-y)}{(x-y)}}{\frac{1}{x-y}}$

$= \dfrac{\frac{2(x+y)+1(x-y)}{(x-y)(x+y)}}{\frac{1}{x-y}}$

$= \dfrac{\frac{2x+2y+x-y}{(x-y)(x+y)}}{\frac{1}{x-y}} = \dfrac{\frac{3x+y}{(x-y)(x+y)}}{\frac{1}{x-y}} =$

$\frac{3x+y}{(x-y)(x+y)} \div \frac{1}{x-y}$ flip

$= \frac{3x+y}{\cancel{(x-y)}(x+y)}\cdot\frac{\cancel{x-y}}{1} = \boxed{\frac{3x+y}{x+y}}$