Name:_____ Date:_____

PC: Complex Fractions Ms. Loughran

Do Now:

Perform the indicated operations and simplify.

1. $\dfrac{a}{(a+2)} + \dfrac{-2}{(3-a)} + \dfrac{-3a+1}{a^2-a-6}$

$(3-a)(-1)$

$-3+a$

$a-3$

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

$(a-3)$

$\dfrac{a^2-3a+2a+4-3a-1}{(a+2)(a-3)}$

$\dfrac{a^2-4a+3}{(a+2)(a-3)} = \dfrac{(a-3)(a-1)}{(a+2)(a-3)}$ $a \neq -2, 3$

$\dfrac{a-1}{a+2}$, $a \neq -2, 3$

$-(x^2+x-6)$

$-x^2-x+6$

2. $\dfrac{x^2-9}{27+3x^2} \cdot \left(\dfrac{x^2+x-6}{x-4} \div \dfrac{6-x-x^2}{3x-12} \right)$

$\dfrac{(x+3)(x-3)}{3(9+x^2)} \cdot \left(\dfrac{(x-2)(x+3)}{x-4} \cdot \dfrac{3(x-4)}{-(x-2)(x+3)} \right)$

$\dfrac{(x+3)(x-3)}{3(9+x^2)} \cdot \dfrac{3}{-1} = \dfrac{(x+3)(x-3)}{-(9+x^2)}$

$x \neq 4, 2, -3$

A fraction in which the numerator or denominator contains one or more fractions or negative exponents is called a *complex fraction*.

1. Simplify $\dfrac{2-\frac{1}{x}}{\frac{1}{x^2}-\frac{1}{2}}$

Method 1

numerator: $(x)\dfrac{2}{1}-\dfrac{1}{x}$

(x)

$\dfrac{2x-1}{x}$

denominator: $(2)\dfrac{1}{(2)x^2}-\dfrac{1}{2x^2}$

$\dfrac{2-x^2}{2x^2}$

$$\frac{\frac{2x-1}{x}}{\frac{2-x^2}{2x^2}}$$

$$\frac{2x-1}{x}\cdot\frac{2x^2}{2-x^2}$$

$$\frac{2x(2x-1)}{2-x^2}$$

$x\neq 0, \pm\sqrt{2}$

Method 2

$$\frac{2x^2\left(2-\frac{1}{x}\right)2x^2}{2x^2\left(\frac{1}{x^2}-\frac{1}{2}\right)2x^2}$$

$$\frac{4x^2-2x}{2-x^2}$$

$x\neq 0, \pm\sqrt{2}$

$$\frac{2x(2x-1)}{2-x^2}$$

$x\neq 0, \pm\sqrt{2}$

$2-x^2=0$

$2=x^2$

$\pm\sqrt{2}=x$

Complex Fractions

Method 1

Steps:

1. Combine fractions in numerator
2. Combine fractions in denominator
3. Rewrite as a division problem
4. Follow rules for division

Method 2

Steps:

1. Find LCD of all "little" fractions
2. Multiply entire fraction by LCD of all denominators
3. Simplify

******Don't forget to write restrictions, for the "little fractions" and on your final denominator******

Simplify each of the following.

2. $\dfrac{\frac{1}{a}+\frac{3}{b}}{\frac{1}{b}-\frac{3}{a}}$ $\quad ab \quad ab$

$\dfrac{(b+3a)}{(a-3b)}$ $\quad a,b \neq 0$ $\quad a \neq 3b$ $\quad a-3b=0$, $+3b+3b$, $a=3b$

3. $\dfrac{5-\frac{3}{a}}{3+\frac{1}{a}}$ $\quad a \quad a$

$\dfrac{5a-3}{3a+1}$ $\quad a \neq 0, -\frac{1}{3}$

$3a+1=0$, $-1\ -1$, $3a=-1$, $a=-\frac{1}{3}$

5. $\dfrac{\frac{1}{x}+\frac{1}{y}}{\frac{1}{x}-\frac{1}{y}}$ xy

$\dfrac{y+x}{y-x}$ $\quad y, x \neq 0$ $\quad y \neq x$

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

$\dfrac{x^2+x}{x^2-1}$ $\quad x \neq 0, \pm 1$

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

17. $\dfrac{\frac{x}{x+3}}{1-\frac{x}{x+3}}$ $(x+3)$

$\dfrac{x}{x+3-x}$ $\quad x \neq -3$

$\dfrac{x}{3}$, $x \neq -3$

19. $\dfrac{\frac{1}{y-3}+\frac{-1}{y+4}}{1+\frac{1}{y^2+y-12}}$ $(y+4)(y-3)$

$\dfrac{y+4-y+3}{y^2+y-12+1}$ $\quad y \neq -4, 3$ $\quad y^2+y-11 \neq 0$

$\dfrac{7}{y^2+y-11}$

Review of Operations on Rational Expressions Key

Homework 09-28

① $\frac{\frac{y-7}{y}}{\frac{y^2-49}{y}}$ $\quad y \neq 0, \pm 7$

$\frac{y-7}{y} \cdot \frac{y}{(y-7)(y+7)} = \frac{1}{y+7}$

② $\frac{\frac{7x^2y^3}{9ab}}{\frac{14x^2y}{3a^2b^2}}$ $\quad a \neq 0, b \neq 0, x \neq 0, y \neq 0$

$\frac{7x^2y^3}{9ab} \cdot \frac{3a^2b^2}{14x^2y} = \frac{aby^2}{6}$

④ $\frac{x^2+3x-4}{x^2-5x} \cdot \frac{x^2-2x-15}{x+4}$ $\quad x \neq 0, 5, -4$

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

③ $\frac{b^2-25}{(b-5)^2} \div \frac{4b+20}{2b-10}$ $\quad b \neq \pm 5$

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

(5) $\frac{y^2-6y-7}{y^2-7y} \cdot \frac{y^2}{y+1}$ $\quad y \neq 0, 7, -1$

$y(y-7)$

$\frac{(y-7)(y+1)}{y(y-7)} \cdot \frac{y^2}{y+1} = y$

(6) $\frac{7a}{(4b)^3} \cdot \frac{64b}{21a^4}$ $\quad a \neq 0, b \neq 0$

$\frac{7a}{64b^3} \cdot \frac{64b}{21a^4} = \frac{1}{3a^3b^2}$

3

(7) $\frac{(y-1)(y+1)}{3(y-5)} \cdot \frac{(y-5)(y-3)}{4(y+1)} \cdot \frac{6y^2}{(y-5)(y-1)}$ $\quad y \neq 0, 3, \pm 1, 5$

$\frac{y^2}{2}$

(8) $\frac{x(x-3)}{(x+5)(x-2)} \cdot \frac{2(x+5)}{3} \cdot \frac{(x-2)(x+2)}{(x-3)(x+2)} = \frac{2x}{3}$ $\quad x \neq \pm 2, 3, -5$

(9) $\frac{(x-3)(x+3)}{(2x-1)(x+3)} \cdot \frac{2x-1}{1} = x-3$ $\quad x \neq \frac{1}{2}, -3$

(10) $x\frac{3}{x^2-16} + \frac{2(x+4)}{x^2-4x}$ $\quad x \neq 0, \pm 4$

$x(x-4)(x+4)$ $\quad x(x-4)(x+4)$

$\frac{3x}{x(x-4)(x+4)} + \frac{2x+8}{x(x-4)(x+4)} = \frac{5x+8}{x(x-4)(x+4)}$

(11) $\frac{2}{y-3} + \frac{4(-1)}{3-y(-1)}$ $\quad y \neq 3$

$\frac{2}{y-3} + \frac{-4}{y-3} = \frac{-2}{y-3}$

(12) $\frac{(x+1)4}{(x+1)(x+5)(x-1)} \overset{+}{\ominus} \frac{-3(x+5)}{(x-1)(x+1)(x+5)}$ $\quad x \neq \pm 1, -5$

$\frac{4x+4}{(x+5)(x-1)(x+1)} + \frac{-3x-15}{(x+5)(x-1)(x+1)} = \frac{x-11}{(x+5)(x-1)(x+1)}$

(13) $\frac{3(x+1)}{x+2(x-1)} \overset{+}{\ominus} \frac{-2}{(x+2)(x-1)} + \frac{2(x+2)}{(x-1)(x+2)}$ $x \neq -2, 1$

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

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

(14) $\frac{5}{x^2-4} \overset{+}{\ominus} \frac{-(3-x)(-1)}{4-x^2(-1)}$

$x \neq \pm 2$

$$\frac{5}{x^2-4} + \frac{3-x}{x^2-4} = \frac{8-x}{x^2-4}$$

(15) $\frac{x(x+1)}{x-1(x+1)} + \frac{x+7}{(x-1)(x+1)} \pm - \frac{x \pm 2}{(x+1)(x-1)}$ $x \neq \pm 1$

$$\frac{x^2+x}{(x-1)(x+1)} + \frac{x+7}{(x-1)(x+1)} + \frac{-x^2+3x-2}{(x-1)(x+1)}$$

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

$n \neq \pm 2, 0$

$n^2+2n+4 \neq 0$

(16) $\frac{(n-2)(n^2+2n+4)}{n+2} - \frac{2(n^2+4)}{n(n-2)(n+2)} - \frac{n^2(n+2)}{n(n^2+2n+4)} = \frac{2(n^2+4)}{n+2}$