6.1 Rational Expressions

algebraic fractions with numerator and denominator that are polynomials

form $\frac{f(x)}{g(x)}$ $\quad g(x) \neq 0$

$\frac{m}{m+1} \quad \frac{x}{y} \quad \frac{y^2-1}{y^2+2y+1} \quad x^3$ ← denominator is 1

Restrictions → division by zero

$\frac{x-7}{x-3}$ exists for $x \neq 3$

$\frac{x-7}{x^2-9} = \frac{x-7}{(x+3)(x-3)}$ exists for $x \neq 3, -3$

$\frac{x-7}{x^2-4x+3} = \frac{x-7}{(x-3)(x-1)}$ exist for $x \neq 1, 3$

$\frac{6-x}{2x} \rightarrow x \neq 0$

example 1 pg 312 a) $\frac{5t}{45r^2}$ $\quad s \neq 0$, $r \neq 0$

b) $\frac{3x}{x(2x-3)}$ $\quad x \neq 0$, $x \neq 3/2$

c) $\frac{2p-1}{p^2-p-12} = \frac{2p-1}{(p-4)(p+3)}$ $\quad p \neq 4, -3$

Simplifying

example 2 pg 314

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

$= \frac{3}{2x+5}$ $\quad$ + restrictions $x \neq 2, -5/2$

b) $\dfrac{1-t}{t^2-1} = \dfrac{1-t}{(t+1)(t-1)}$ $\quad * \ t \neq 1, -1$

$= \dfrac{-(t-1)}{(t+1)(t-1)}$ $\quad * \ \dfrac{a-b}{b-a} = -1$

$= \dfrac{-1}{t+1}$

example 3 pg 315 $\quad \dfrac{16x^2 - 9y^2}{8x - 6y} = \dfrac{(4x-3y)(4x+3y)}{2(4x-3y)}$ $\quad 4x \neq 3y$

(a) $\therefore x \neq \frac{3}{4}y$

$= \dfrac{4x+3y}{2}$ (b)

(c) $\dfrac{4(2.6)+3(1.2)}{2} = 7$

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1 a) 18 b) $14x$ c) 7 d) $4x-12$ e) 8 f) $y+2$

2 a) $\div pq$ b) $\times(x-4)$ c) $\div(m-3)$ d) $\times(y^2+y)$

3 a) $x=0$ b) $c=1$ c) $y=-5$ d) none e) $d=\pm 1$ f) none

4 a) $a\neq 4$ b) $e\neq 0$ c) $y\neq 4,-2$ d) $r\neq 1,-3$ e) $K\neq 0$
f) $x\neq 4/3, -5/2$

5. a) $r\neq 0$ b) $t\neq \pm 1$ c) $x\neq 2$ d) $\frac{3g}{g(g^2-9)}$ $g\neq 0,3,-3$

6 a) $\frac{2}{3}$ $c\neq 0,5$ b) $\frac{3(2w+3)}{2(3w+2)}$ $w\neq 0,-\frac{2}{3}$

c) $\frac{x+7}{2x-1}$ $x\neq \frac{1}{2},7$ d) $-\frac{1}{2}$ $a\neq 3,-2$

7 a) x^2 is not a common factor of numerator or denominator
b) factor denominator $(x+3)(x-1)$ $\therefore$ $x\neq 1,-3$
c) factor, "cancel" out common factors. $\frac{(x+1)(x-1)}{(x+3)(x-1)} = \frac{x+1}{x+3}$

8. a) $\frac{3r}{2p}$ b) $\frac{3(x-2)}{5(2-x)} = -\frac{3}{5}$ c) $\frac{(b+6)(b-4)}{2(b+6)(b-6)} = \frac{b-4}{2(b-6)}$
$r\neq 0$
$p\neq 0$
$x\neq 2$
$b\neq 6,-6$

d) $\frac{10K^2+55K+75}{20K^2-10K-150} = \frac{5(2K+5)(K+3)}{10(2K+5)(K-3)} = \frac{K+3}{2(K-3)}$ $K\neq 3,-5/2$

e) -1 $x\neq 4$ f) $\frac{5(x+y)(x-y)}{(x-y)(x-y)} = \frac{5(x+y)}{x-y}$ $x\neq y$

9. sometimes true $\frac{x^2+2x-15}{x+3}$ does not exist at $x=3$
but $x+5$ does exist at $x=3$
they are equivalent for all other values of x

10. $\frac{Y}{Y-6}$ is simplest form and $Y \neq 6$ but non-simplified form may include other restrictions ie: $\frac{(Y-1)Y}{(Y-1)(Y-6)}$ $Y \neq 1, 6$

11. Mike is correct $\frac{5-x}{x-5} = \frac{-(x-5)}{x-5} = -1$ * as long as restriction $x \neq 5$ is followed.

12. $\frac{(x+1)(x+2)}{(x+1)(x+3)} \rightarrow \frac{x^2+3x+2}{x^2+4x+3}$ * start with factored form

$\frac{2(x-3)(x+3)}{(x-3)(x-5)} \rightarrow \frac{2x^2-18}{x^2-8x+15}$

13. $\frac{g+2}{2}$ was the final answer $\frac{g+2}{2}$ cannot be reduced as there are no common factors.

14 $p \neq 1, -2$ $\frac{\text{anything}}{(p-1)(p+2)}$ ie: $\frac{p^2}{p^2+p-2}$

15a) $d = rt$ $\therefore t = \frac{d}{r}$ $t = \frac{2n^2+11n+12}{2n^2-32}$

b) $\frac{(2n+3)(n+4)}{2(n+4)(n-4)}$ $\therefore t = \frac{2n+3}{2(n-4)}$ $n \neq 4, -4$