

Rationals Practice

1. a) $x^2 - x - 12$
 $= (x-4)(x+3)$

b) $9x^2 - 4$
 $= (3x-2)(3x+2)$

c) $8xy^2 - 4xy + 6x^2y$
 $= 2xy(4y - 2 + 3x)$

d) $2x^2 - 16x + 30$
 $= 2(x^2 - 8x + 15)$
 $= 2(x-3)(x-5)$

e) $4x^2 + 20x + 24$
 $= 4(x^2 + 5x + 6)$
 $= 4(x+2)(x+3)$

f) $6x^2 + 13x - 5$ $\left. \begin{matrix} P(-30) \\ S(13) \end{matrix} \right\} \begin{matrix} 15, -2 \\ -1, 5 \end{matrix}$
 $= 6x^2 + 15x - 2x - 5$
 $= 3x(2x+5) - 1(2x+5)$
 $= (3x-1)(2x+5)$

2. a) $\frac{x+5}{x+2} \cdot \frac{x-3}{2x-5}$
 $\downarrow \quad \downarrow$
 $x \neq -2 \quad 2x-5 \neq 0$
 $\frac{2x \neq 5}{2} \quad \frac{2x \neq 5}{2}$
 $x \neq \frac{5}{2}$

b) $\frac{2x}{x-3} + \frac{3}{2x^2+5x-3}$
 $= \frac{2x}{x-3} + \frac{3}{(2x-1)(x+3)}$
 $\downarrow \quad \downarrow$
 $2x-1 \neq 0 \quad x \neq -3$
 $\frac{2x \neq 1}{2} \quad \frac{2x \neq 1}{2}$
 $x \neq \frac{1}{2}$

c) $\frac{5}{x-y} \div \frac{2x}{3x-6}$
 $= \frac{5}{x-y} \div \frac{2x}{3(x-2)} \rightarrow x \neq 0$
 $\downarrow \quad \downarrow$
 $x \neq y \quad x \neq 2$

$2x^2 + 5x - 3$
 $= 2x^2 + 6x - x - 3$ $\left. \begin{matrix} P(-6) \\ S(5) \end{matrix} \right\} \begin{matrix} 6, -1 \\ -1, 5 \end{matrix}$
 $= 2x(x+3) - 1(x+3)$
 $= (2x-1)(x+3)$

$$\begin{aligned}
 3 \text{ a) } & x \frac{(2x)}{x(x+3)} + \frac{(4)(x+3)}{x(x+3)} \\
 &= \frac{2x^2}{x(x+3)} + \frac{4x+12}{x(x+3)} \\
 &= \frac{2x^2+4x+12}{x(x+3)} \\
 &= \frac{2(x^2+2x+6)}{x(x+3)}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } & \frac{3}{x^2-x-6} - \frac{4}{x^2-2x-3} \\
 &= \frac{3}{(x-3)(x+2)} - \frac{4}{(x-3)(x+1)(x+2)} \\
 &= \frac{3x+3-4x-8}{(x-3)(x+2)(x+1)} \\
 &= \frac{-x-5}{(x-3)(x+2)(x+1)}
 \end{aligned}$$

$$\begin{aligned}
 & b^2-4ac \\
 &= (2)^2-4(1)(6) \\
 &= -20 \\
 & \therefore \text{not factorable}
 \end{aligned}$$

$$\begin{aligned}
 \text{c) } & \frac{3x}{x^2-2x} \div \frac{y}{x^2-4} \\
 &= \frac{3x}{x(x-2)} \cdot \frac{(x-2)(x+2)}{y} \\
 &= \frac{3(x+2)}{y}, x \neq 0, 2
 \end{aligned}$$

$$\begin{aligned}
 \text{d) } & \frac{3x}{x^2+6x+8} \cdot \frac{x^2-4}{x+3} \\
 &= \frac{3x}{(x+2)(x+4)} \cdot \frac{(x-2)(x+2)}{(x+3)} \\
 &= \frac{3x(x-2)}{(x+3)(x+4)}, x \neq -2
 \end{aligned}$$

$$\begin{aligned}
 \text{e) } & \frac{2}{x+1} + \frac{3x}{x-5} \div \frac{x^2+x}{10-2x} \\
 & \begin{aligned}
 5-x & \\
 = -(-5+x) & \\
 = -(x-5) &
 \end{aligned} \\
 &= \frac{2}{x+1} + \frac{3x}{x-5} \cdot \frac{2(5-x)}{x(x+1)} \\
 &= \frac{2}{x+1} + \frac{3}{\cancel{x-5}} \cdot \frac{-2(x-5)}{x+1}, x \neq 0 \\
 &= \frac{2}{x+1} + \frac{-6}{x+1}, x \neq 5 \\
 &= \frac{-4}{x+1}
 \end{aligned}$$

$$\begin{aligned}
 \text{f) } & \frac{1}{mn} + \frac{m}{1mn} + \frac{1}{nm} \\
 &= \frac{n}{mn} + \frac{m^2n}{mn} + \frac{m}{mn} \\
 &= \frac{m^2n+m+n}{mn}
 \end{aligned}$$

$$m^2 - mn = m(m-n)$$

Yikes!!!

$$m^2 - n^2 = (m-n)(m+n)$$

■ = look here for restrictions

4.

$$\frac{m^2 - mn}{6m^2 + 11mn + 3n^2} \cdot \frac{m^2 - n^2}{2m^2 - mn - 6n^2}$$

$$\frac{4m^2 - 7mn - 2n^2}{3m^2 + 7mn + 2n^2}$$

$$\begin{aligned} 6m^2 + 11mn + 3n^2 & \quad P(12) \quad \left. \begin{array}{l} 9, 2 \\ S(11) \end{array} \right\} 9, 2 \\ &= 6m^2 + 9mn + 2mn + 3n^2 \\ &= 3m(2m+3n) + n(2m+3n) \\ &= (3m+n)(2m+3n) \end{aligned}$$

$$\begin{aligned} 2m^2 - mn - 6n^2 & \quad P(-12) \\ &= 2m^2 - 4mn + 3mn - 6n^2 \quad \left. \begin{array}{l} S(-1) \\ -4, 3 \end{array} \right\} -4, 3 \\ &= 2m(m-2n) + 3n(m-2n) \\ &= (2m+3n)(m-2n) \end{aligned}$$

$$\begin{aligned} 4m^2 - 7mn - 2n^2 & \quad P(-8) \quad \left. \begin{array}{l} -8, 1 \\ S(-7) \end{array} \right\} -8, 1 \\ &= 4m^2 - 8mn + mn - 2n^2 \\ &= 4m(m-2n) + n(m-2n) \\ &= (4m+n)(m-2n) \end{aligned}$$

$$\begin{aligned} 3m^2 + 7mn + 2n^2 & \quad P(6) \quad \left. \begin{array}{l} 6, 1 \\ S(7) \end{array} \right\} 6, 1 \\ &= 3m^2 + 6mn + mn + 2n^2 \\ &= 3m(m+2n) + n(m+2n) \\ &= (3m+n)(m+2n) \end{aligned}$$

$$\begin{aligned} & \frac{m(m-n)}{(3m+n)(2m+3n)} \cdot \frac{(2m+3n)(m-2n)}{(m-n)(m+n)} \\ &= \frac{(4m+n)(m-2n)}{(3m+n)(m+2n)} \end{aligned}$$

$$= \frac{m(m-2n)}{(3m+n)(m+n)} \div \frac{(4m+n)(m-2n)}{(3m+n)(m+2n)}$$

$$= \frac{m(m-2n)}{(3m+n)(m+n)} \cdot \frac{(3m+n)(m+2n)}{(4m+n)(m-2n)}$$

$$= \frac{m(m+2n)}{(m+n)(4m+n)}, m \neq \left(-\frac{n}{3}, -\frac{3n}{2}, \pm n, -\frac{n}{4}, \pm 2n\right)$$

Ex $3m+n \neq 0$

$$\frac{3m}{3} \neq \frac{-n}{3}$$

$$m \neq -\frac{n}{3}$$