

$$1. \frac{4x^2y}{6xy^7} = \frac{2x}{3y^6}$$

$$2. \frac{x^2+6x+9}{x^2-5x-24}$$

$$\begin{array}{l} x^2+6x+9 \\ | \quad 3 \Rightarrow (1)(3) + (1)(3) = 6 \checkmark \\ | \quad 3 \\ \hline \Rightarrow (x+3)(x+3) = (x+3)^2 \end{array}$$

$$\begin{array}{l} x^2-5x-24 \\ | \quad -8 \Rightarrow (1)(-8) + (1)(3) = -5 \checkmark \\ | \quad 3 \\ \hline \Rightarrow (x-8)(x+3) \end{array}$$

$$\Rightarrow \frac{x^2+6x+9}{x^2-5x-24} = \frac{(x+3)^2}{(x-8)(x+3)} = \frac{x+3}{x-8}$$

$$3. \frac{4-y^2}{y^2-4y-12}$$

$4-y^2$: Difference of Squares! $4-y^2 = (2-y)(2+y)$ Expand and check!

$$y^2-4y-12$$

$$| \quad -6 \Rightarrow (1)(-6) + (1)(2) = -6+2 = -4 \checkmark$$

$$\Rightarrow (y-6)(y+2)$$

$$\Rightarrow \frac{4-y^2}{y^2-4y-12} = \frac{(2-y)(2+y)}{(y-6)(y+2)} = \frac{2-y}{y-6} \quad \text{We can also factor out the negative in the numerator!}$$

$$2-y = -(y-2)$$

$$= -\frac{(y-2)}{y-6}$$

$$4. \frac{(4x-5)^7}{(4x-5)^6} = 4x-5$$

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

$$6. \frac{10x^3(7-4x)}{12x(4x-7)} = \frac{5x^2(7-4x)}{6(4x-7)} = \frac{-5x^2(4x-7)}{6(4x-7)} = -\frac{5x^2}{6}, \text{ by factoring out the negative.}$$

$$7. \frac{3xy-4y}{8^2 6x} = \frac{y(3x-4)}{2(4-3x)} = \frac{-y(4-3x)}{2(4-3x)} = -\frac{y}{2}$$

$$8. \frac{2x^3-2x}{4x^3-8x^2+4x} = \frac{2x(x^2-1)}{4x(x^2-2x+1)} = \frac{(x-1)(x+1)}{2(x^2-2x+1)} \text{ difference of squares.}$$

$$\text{Now, } x^2-2x+1 = (x-1)(x-1) = (x-1)^2$$

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

$$9. \frac{3x^2 + 7x - 6}{6 - 11x + 3x^2}$$

$$3x^2 + 7x - 6$$

$$\begin{array}{r} 3 \quad -2 \\ 1 \quad 3 \end{array} \Rightarrow (3)(3) + (-2)(1) = 9 - 2 = 7 \checkmark \text{ cross multiplying the factors.}$$

$$\Rightarrow (3x - 2)(x + 3)$$

$$6 - 11x + 3x^2 = 3x^2 - 11x + 6$$

$$\begin{array}{r} 3 \quad -2 \\ 1 \quad -3 \end{array} \Rightarrow (3)(-3) + (1)(-2) = -9 - 2 = -11 \checkmark$$

$$\Rightarrow 3x^2 - 11x + 6 = (3x - 2)(x - 3)$$

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

$$10. \frac{9x^2y}{12xy^4} = \frac{3x}{4y^3}$$

$$11. \frac{1 - y^2}{y^2 - 6y - 7}$$

$$1 - y^2 = (1 - y)(1 + y) \text{ Difference of squares}$$

$$\begin{array}{r} y^2 - 6y - 7 \\ 1 \quad -7 \\ 1 \quad 1 \end{array} \Rightarrow (1)(-7) + (1)(1) = -7 + 1 = -6 \checkmark$$

$$1 \quad 1$$

$$y^2 - 6y - 7 = (y - 7)(y + 1)$$

$$\Rightarrow \frac{1 - y^2}{y^2 - 6y - 7} = \frac{(1 + y)(1 - y)}{(y - 7)(y + 1)} = \frac{1 - y}{y - 7} = \frac{-(y + 1)}{y - 7} \text{ if you wish to factor out the negative.}$$