

$$1. \quad a) \frac{4x-24}{x^2-12x+36} = \frac{4(x-6)}{(x-6)(x-6)} = \frac{4}{x-6} \quad (x \neq 6)$$

$$b) \frac{2p^2-14p}{p^2-49} = \frac{2p(p-7)}{(p+7)(p-7)} = \frac{2p}{p+7} \quad p \neq \{7, -7\}$$

$$c) \frac{2y^2+9y+4}{4y^2-4y-3} = \frac{(2y+1)(y+4)}{(2y-3)(2y+1)} = \frac{y+4}{2y-3} \quad y \neq \{\frac{3}{2}, -\frac{1}{2}\}$$

$$d) \frac{3a^2b(b^3+3a-2a^3)}{3a^2b} = b^3+3a-2a^3 \quad a \neq 0, b \neq 0$$

$$e) \frac{t^2-81}{t^2-12t+27} = \frac{(t+9)(t-9)}{(t-9)(t-3)} = \frac{t+9}{t-3} \quad t \neq \{9, 3\}$$

$$f) \frac{x^2+10x+21}{x^3+x^2-42x} = \frac{(x+7)(x+3)}{x(x^2+x-42)} = \frac{(x+7)(x+3)}{x(x+7)(x-6)} = \frac{x+3}{x(x-6)} \quad x \neq \{-7, 0, 6\}$$

$$2. \quad a) \frac{3t+2}{t^2-2t-3} + \frac{t+1}{t-3} = \frac{3t+2}{(t-3)(t+1)} + \frac{t+1}{t-3} = \frac{(3t+2)}{(t-3)(t+1)} + \frac{t+1(t+1)}{(t-3)(t+1)}$$

$$\frac{t^2+5t+3}{(t-3)(t+1)}, t \neq \{-1, 3\} \leftarrow \frac{(3t+2) + (t^2+2t+1)}{(t-3)(t+1)} \leftarrow \frac{(3t+2) + (t+1)^2}{(t-3)(t+1)} \quad t \neq \{-1, 3\}$$

$$b) \frac{w-3}{w^2-w-20} + \frac{w}{w+4} = \frac{w-3}{(w-5)(w+4)} + \frac{w}{w+4} = \frac{w-3}{(w-5)(w+4)} + \frac{w(w-5)}{(w-5)(w+4)}$$

$$= \frac{w^2-4w-3}{(w-5)(w+4)}, w \neq \{-4, 5\}$$

$$c) \frac{2x}{x^2+8x+15} - \frac{x+3}{x+5} = \frac{2x}{(x+5)(x+3)} - \frac{x+3}{x+5} \cdot \frac{(x+3)}{(x+3)} = \frac{2x}{(x+5)(x+3)} - \frac{(x+3)^2}{(x+5)(x+3)}$$

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

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

$$= \frac{-x^2-4x-9}{(x+5)(x+3)}, x \neq \{-5, -3\}$$

$$d) \frac{y}{y-3} - \frac{2}{y^2+y-12} \Rightarrow \frac{y}{y-3} - \frac{2}{(y-3)(y+4)} \Rightarrow \frac{y(y+4)-2}{(y-3)(y+4)}$$

$$= \frac{y^2+4y-2}{(y-3)(y+4)} \quad y \neq \{-4, 3\}$$

$$e) \frac{p+1}{p^2+3p-4} + \frac{p}{p+4} \Rightarrow \frac{p+1}{(p+4)(p-1)} + \frac{p(p-1)}{(p+4)(p-1)} \Rightarrow \frac{p+1+p(p-1)}{(p+4)(p-1)}$$

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

$$f) \frac{4}{5n} - \frac{1}{10n^3} \Rightarrow \left(\frac{2n^2}{2n^2}\right) \frac{4}{5n} - \frac{1}{10n^3} \Rightarrow \frac{8n^2-1}{10n^3} \quad n \neq 0$$

$$3. a) \frac{a+4}{a^2} \times \frac{a}{a^2+2a-8} \Rightarrow \frac{a+4}{a^2} \times \frac{a}{(a+4)(a-2)} \Rightarrow \frac{1}{a(a-2)} \quad a \neq \{-4, 0, 2\}$$

$$b) \frac{n^2+7n+12}{10n^2} \div \frac{n+3}{2n} \Rightarrow \frac{(n+4)(n+3)}{10n^2} \times \frac{2n}{(n+3)} = \frac{n+4}{5n} \quad n \neq 0$$

$$c) \frac{t^2+6t+9}{t^2-10t+25} \times \frac{t^2-t-20}{t^2+7t+12} \Rightarrow \frac{(t+3)(t+3)}{(t-5)(t-5)} \times \frac{(t-5)(t+4)}{(t+4)(t+3)} = \frac{t+3}{t-5} \quad t \neq \{-4, 3, 5\}$$

$$d) \frac{y^2+6y-7}{y^2+8y-9} \div \frac{y^2+9y+14}{y^2+7y-18} \Rightarrow \frac{(y+7)(y-1)}{(y+9)(y-1)} \times \frac{(y+7)(y-2)}{(y+7)(y+2)} = \frac{y-2}{y+2} \quad y \neq \{-9, -7, -2, 1\}$$

$$e) \frac{b^2+2b-8}{b^2-11b+18} \div \frac{2b-8}{2b-18} \Rightarrow \frac{(b+4)(b-2)}{(b-9)(b-2)} \times \frac{2(b-4)}{2(b-9)} = \frac{b+4}{b-4} \quad b \neq \{2, 4, 9\}$$

$$f) \frac{y^2-1}{y^2-49} \cdot \frac{y-7}{y+1} = \frac{(y+1)(y-1)}{(y+7)(y-7)} \cdot \frac{y-7}{y+1} = \frac{y-1}{y+7} \quad y \neq \{-7, -1, 7\}$$

$$4. \quad a) \quad \begin{array}{r} 3x^2 - 2x + 3 \\ 2x+3 \overline{) 6x^3 + 5x^2 + 0x + 9} \\ \underline{-(6x^3 + 9x^2)} \\ -4x^2 + 9 \\ \underline{-(-4x^2 - 6x)} \\ 6x + 9 \\ \underline{6x + 9} \\ 0 \end{array}$$

$$b) \quad \begin{array}{r} 2h^2 - 3 \\ h+4 \overline{) 2h^3 + 8h^2 - 3h - 12} \\ \underline{-(2h^3 + 8h^2)} \\ -3h - 12 \\ \underline{-(-3h - 12)} \\ 0 \end{array}$$

$$c) \quad \begin{array}{r} 2c^2 + c + 2 \\ 4c-2 \overline{) 8c^3 + 0c^2 + 6c - 5} \\ \underline{-(8c^3 - 4c^2)} \\ 4c^2 + 6c \\ \underline{-(4c^2 - 2c)} \\ 8c - 5 \\ \underline{-(8c - 4)} \\ -1 \end{array}$$

$$5. \quad a) \quad \begin{array}{l} 16gh + 24g - 2h - 3 \\ 8g(2h+3) - 1(2h+3) \\ (2h+3)(8g-1) \end{array}$$

$$b) \quad \begin{array}{l} x^2 + 6x - 27 \\ (x-3)(x+9) \end{array}$$

$$c) \quad \begin{array}{l} w^3 - 3w^2 - 9w + 27 \\ w^2(w-3) - 9(w-3) \\ (w-3)(w^2-9) \\ (w-3)(w+3)(w-3) \\ (w-3)^2(w+3) \end{array}$$

$$d) \quad \begin{array}{l} 27g^3 - 3g \\ 3g(9g^2 - 1) \\ 3g(3g+1)(3g-1) \end{array}$$

$$e) \quad \begin{array}{l} 5x^2 + 34x + 24 \\ 5x^2 + 30x + 4x + 24 \\ 5x(x+6) + 4(x+6) \\ (x+6)(5x+4) \end{array}$$

$$f) \quad \begin{array}{l} 12x^2 + 69x + 45 \\ 3(4x^2 + 23x + 15) \\ 3(4x^2 + 20x + 3x + 15) \\ 3(4x(x+5) + 3(x+5)) \\ 3(x+5)(4x+3) \end{array}$$

$$6. \quad a) \quad \begin{array}{l} 2x^2 + 9x + 9 = 0 \\ 2x + 6x + 3x + 9 = 0 \\ 2x(x+3) + 3(x+3) = 0 \\ (x+3)(2x+3) = 0 \\ x+3=0 \quad 2x+3=0 \\ x=-3 \quad 2x=-3 \\ \quad \quad x=-3/2 \end{array}$$

$$b) \quad \begin{array}{l} 3x^2 - 10x + 8 = 0 \\ 3x^2 - 6x - 4x + 8 = 0 \\ 3x(x-2) - 4(x-2) = 0 \\ (x-2)(3x-4) = 0 \\ x-2=0 \quad 3x-4=0 \\ x=2 \quad 3x=4 \\ \quad \quad x=4/3 \end{array}$$

$$c) \quad \begin{array}{l} -3x^2 + 5x = -2 \\ -3x^2 + 5x + 2 = 0 \\ 3x^2 - 5x - 2 = 0 \\ 3x^2 - 6x + 1x - 2 = 0 \\ 3x(x-2) + 1(x-2) = 0 \\ (x-2)(3x+1) = 0 \end{array}$$

$$\left. \begin{array}{l} x-2=0 \\ x=2 \end{array} \right\} > \begin{array}{l} 3x+1=0 \\ 3x=-1 \\ x=-1/3 \end{array}$$