

145 Amplifie successivement par 2, 3a, 2 + a, a² - 1:

$$a) \left\{ \begin{aligned} \frac{3}{4} &= \frac{3 \cdot 2}{4 \cdot 2} = \frac{6}{8} \\ &= \frac{3 \cdot 3a}{4 \cdot 3a} = \frac{9a}{12a} \\ &= \frac{3 \cdot (2+a)}{4 \cdot (2+a)} = \frac{6+3a}{8+4a} \\ &= \frac{3 \cdot (a^2-1)}{4 \cdot (a^2-1)} = \frac{3a^2-3}{4a^2-4} \end{aligned} \right.$$

$$e) \left\{ \begin{aligned} \frac{a-2}{2a} &= \frac{(a-2) \cdot 2}{2a \cdot 2} = \frac{2a-4}{4a} \\ &= \frac{(a-2) \cdot 3a}{2a \cdot 3a} = \frac{3a^2-6a}{6a^2} \\ &= \frac{(a-2) \cdot (2+a)}{2a \cdot (2+a)} = \frac{a^2-4}{4a+2a^2} \\ &= \frac{(a-2) \cdot (a^2-1)}{2a \cdot (a^2-1)} = \frac{a^3-2a^2-a-2}{2a^3-2a} \end{aligned} \right.$$

$$b) \left\{ \begin{aligned} \frac{2a}{5} &= \frac{2a \cdot 2}{5 \cdot 2} = \frac{4a}{10} \\ &= \frac{2a \cdot 3a}{5 \cdot 3a} = \frac{6a^2}{15a} \\ &= \frac{2a \cdot (2+a)}{5 \cdot (2+a)} = \frac{4a+2a^2}{10+5a} \\ &= \frac{2a \cdot (a^2-1)}{5 \cdot (a^2-1)} = \frac{2a^3-2a}{5a^2-5} \end{aligned} \right.$$

$$f) \left\{ \begin{aligned} \frac{a-1}{a+1} &= \frac{(a-1) \cdot 2}{(a+1) \cdot 2} = \frac{2a-2}{2a+2} \\ &= \frac{(a-1) \cdot 3a}{(a+1) \cdot 3a} = \frac{3a^2-3a}{3a^2+3a} \\ &= \frac{(a-1) \cdot (2+a)}{(a+1) \cdot (2+a)} = \frac{a^2+a-2}{a^2+3a+2} \\ &= \frac{(a-1) \cdot (a^2-1)}{(a+1) \cdot (a^2-1)} = \frac{a^3-a^2-a+1}{a^3+a^2-a-1} \end{aligned} \right.$$

$$c) \left\{ \begin{aligned} \frac{4x}{y} &= \frac{4x \cdot 2}{y \cdot 2} = \frac{8x}{2y} \\ &= \frac{4x \cdot 3a}{y \cdot 3a} = \frac{12ax}{3ay} \\ &= \frac{4x \cdot (2+a)}{y \cdot (2+a)} = \frac{8x+4ax}{2y+ay} \\ &= \frac{4x \cdot (a^2-1)}{y \cdot (a^2-1)} = \frac{4xa^2-4x}{a^2y-y} \end{aligned} \right.$$

$$g) \left\{ \begin{aligned} \frac{a^2-1}{a+2} &= \frac{(a^2-1) \cdot 2}{(a+2) \cdot 2} = \frac{2a^2-2}{2a+4} \\ &= \frac{(a^2-1) \cdot 3a}{(a+2) \cdot 3a} = \frac{3a^3-3a}{3a^2+6a} \\ &= \frac{(a^2-1) \cdot (2+a)}{(a+2)(2+a)} = \frac{2a^2+a^3-2-a}{a^2+4a+4} \\ &= \frac{(a^2-1)(a^2-1)}{(a+2)(a^2-1)} = \frac{a^4-2a^2+1}{a^3+2a^2-a-2} \end{aligned} \right.$$

$$d) \left\{ \begin{aligned} \frac{3a}{2b} &= \frac{3a \cdot 2}{2b \cdot 2} = \frac{6a}{4b} \\ &= \frac{3a \cdot 3a}{2b \cdot 3a} = \frac{9a^2}{6ab} \\ &= \frac{3a \cdot (2+a)}{2b \cdot (2+a)} = \frac{6a+3a^2}{4b+2ab} \\ &= \frac{3a \cdot (a^2-1)}{2b \cdot (a^2-1)} = \frac{3a^3-3a}{2a^2b-2b} \end{aligned} \right.$$

$$h) \left\{ \begin{aligned} \frac{(a+2)^2}{a^2+1} &= \frac{(a+2)^2 \cdot 2}{(a^2+1) \cdot 2} = \frac{2a^2+8a+8}{2a^2+2} \\ &= \frac{(a+2)^2 \cdot 3a}{(a^2+1) \cdot 3a} = \frac{3a^3+12a^2+12a}{3a^3+3a} \\ &= \frac{(a+2)^2 \cdot (2+a)}{(a^2+1)(2+a)} = \frac{a^3+6a^2+12a+8}{a^3+2a^2+a+2} \\ &= \frac{(a+2)^2 \cdot (a^2-1)}{(a^2+1)(a^2-1)} = \frac{a^4+4a^3+3a^2-4a-4}{a^4-1} \end{aligned} \right.$$

146 Amplifie les fractions de manière à avoir 24x³y² au dénominateur : = 2³·3x³y²

$$a) \frac{3x}{8} = \frac{3x \cdot 3x^3y^2}{8 \cdot 3x^3y^2} = \frac{9x^4y^2}{24x^3y^2}$$

$$d) \frac{21x^2}{72x^4y} = \frac{3 \cdot 7x^2y}{24x^3y \cdot 3xy} = \frac{7xy}{24x^3y^2}$$

$$b) \frac{x+1}{3y} = \frac{(x+1) \cdot 8x^3y}{3y \cdot 8x^3y} = \frac{8x^4y+8x^3y}{24x^3y^2}$$

$$e) \frac{a-2b}{6x} = \frac{(a-2b) \cdot 4x^2y^2}{6x \cdot 4x^2y^2} = \frac{4ax^2y^2-8bx^2y^2}{24x^3y^2}$$

$$c) \frac{a^2-1}{12x^2y} = \frac{(a^2-1) \cdot 2xy}{12x^2y \cdot 2xy} = \frac{2a^2xy-2xy}{24x^3y^2}$$

$$f) \frac{45y^3}{8x^2} = \frac{45y^3 \cdot 3xy^2}{8x^2 \cdot 3xy^2} = \frac{135xy^5}{24x^3y^2}$$

147 Amplifie les fractions de manière à obtenir le dénominateur indiqué après le point-virgule :

a) $\frac{5x}{8y} = \frac{5x \cdot 6x^2y}{8y \cdot 6x^2y} = \frac{30x^3y}{48x^2y^2}$

b) $\frac{3a-1}{a+1} = \frac{(3a-1)(a-1)}{(a+1)(a-1)} = \frac{3a^2-4a+1}{a^2-1}$

c) $\frac{x-y}{x+y} = \frac{(x-y)(x+y)}{(x+y)(x+y)} = \frac{x^2-y^2}{(x+y)^2}$

d) $\frac{2a+5}{a-5} = \frac{(2a+5)(a-5)}{(a-5)(a-5)} = \frac{2a^2+5a-25}{a^2-10a+25}$

e) $\frac{x-3y}{y-3x} = \frac{(x-3y)(-y-3x)}{(y-3x)(-y-3x)} = \frac{-3x^2+9y^2+8xy}{9x^2-y^2}$

f) $\frac{a^2-1}{a+1} = \frac{(a^2-1)(a-1)(a^2+1)}{(a+1)(a-1)(a^2+1)} = \frac{a^5-a^4-a+1}{a^4-1}$

148 Amplifie de manière à obtenir un dénominateur rationnel :

a) $\frac{5}{\sqrt{2}} = \frac{5\sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \frac{5\sqrt{2}}{2}$

b) $\frac{a+1}{\sqrt{12}} = \frac{(a+1) \cdot \sqrt{3}}{2\sqrt{3} \cdot \sqrt{3}} = \frac{\sqrt{3} \cdot a + \sqrt{3}}{6}$

c) $\frac{6}{\sqrt{2}-1} = \frac{6(\sqrt{2}+1)}{(\sqrt{2}-1)(\sqrt{2}+1)} = \frac{6\sqrt{2}+6}{2-1} = 6\sqrt{2}+6$

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

e) $\frac{5}{3\sqrt{48}} = \frac{5 \cdot \sqrt{3}}{3 \cdot 4\sqrt{3} \cdot \sqrt{3}} = \frac{5\sqrt{3}}{36}$

f) $\frac{\sqrt{x}+V}{\sqrt{x}} = \frac{(\sqrt{x}+V) \cdot \sqrt{x}}{\sqrt{x} \cdot \sqrt{x}} = \frac{x+V\sqrt{x}}{x}$

149 Simplifie le plus possible :

a) $\frac{27}{45} = \frac{3^3}{3^2 \cdot 5} = \frac{3}{5}$

b) $\frac{48}{72} = \frac{2^4 \cdot 3}{2^3 \cdot 3^2} = \frac{2}{3}$

c) $\frac{32}{80} = \frac{2^5}{2^4 \cdot 5} = \frac{2}{5}$

d) $\frac{18}{54} = \frac{2 \cdot 3^2}{2 \cdot 3^3} = \frac{1}{3}$

e) $\frac{96}{48} = \frac{2^5 \cdot 3}{2^4 \cdot 3} = 2$

f) $\frac{125}{425} = \frac{5^3}{5^2 \cdot 17} = \frac{5}{17}$

g) $\frac{288}{360} = \frac{2^5 \cdot 3^2}{2^3 \cdot 3^2 \cdot 5} = \frac{4}{5}$

h) $\frac{60}{144} = \frac{2^2 \cdot 3 \cdot 5}{2^4 \cdot 3^2} = \frac{5}{12}$

150 Simplifie :

a) $\frac{2^3}{2^5} = \frac{1}{2^2} = \frac{1}{4}$

b) $\frac{10^{12}}{10^{-8}} = 10^{20}$

c) $\frac{2^4 \cdot 3^9}{2^3 \cdot 3^7} = 2 \cdot 3^2 = 18$

d) $\frac{3 \cdot 5^2 \cdot 7^3}{3^3 \cdot 7^4 \cdot 5} = \frac{5}{3^2 \cdot 7} = \frac{5}{63}$

e) $\frac{(5 \cdot 4)^3}{5^2 \cdot 2^5} = \frac{5^3 \cdot 2^6}{5^2 \cdot 2^5} = 10$

f) $\frac{10^3 \cdot 2^0 \cdot 4^5}{2^3 \cdot 5^4 \cdot 8^2} = \frac{2^3 \cdot 5^3 \cdot 2^{10}}{2^3 \cdot 5^4 \cdot 2^6} = \frac{2^4}{5} = \frac{16}{5}$

g) $\frac{(3^2)^3 \cdot 5^4}{5^5 \cdot 3^5} = \frac{3^6 \cdot 5^4}{5^5 \cdot 3^5} = \frac{3}{5}$

h) $\frac{2^4 \cdot 3^2}{4^5 \cdot 2^4 \cdot 3^2} = \frac{1}{2^{10}} = \frac{1}{1024}$

151 Simplifie :

a) $\frac{5x^2y^3}{20x^3y^2} = \frac{y}{4x}$

b) $\frac{12a^3b^2}{a^3b^2} = 12$

c) $-\frac{24x^2}{36y^2} = -\frac{2x^2}{3y^2}$

d) $\frac{-16x^2y^3}{-4xy^2} = 4xy$

e) $\frac{27a^3b^2}{81a^4b} = \frac{b}{3a}$

f) $\frac{30a^2b^3c}{-36a^4b^2c} = -\frac{5b}{6a^2}$

g) $\frac{21a^2x}{14xy} = \frac{3a^2}{2y}$

h) $\frac{(2x^2y^3)^2}{8(x^2y^2)^3} = \frac{4x^4y^6}{8x^6y^6} = \frac{1}{2x^2}$

152 Simplifie :

$$\begin{aligned} \text{a) } \frac{5(a+b)}{10(a+b)} &= \frac{1}{2} & \text{e) } \frac{(2a-3)^2}{(3-2a)^2} &= \frac{(2a-3)^2}{(2a-3)^2} = 1 \\ \text{b) } \frac{8(x^2-y)}{12(x^2-y)} &= \frac{2}{3} & \text{f) } \frac{9(x^3-y^2)}{6(x^2-y^3)} &= \frac{3(x^3-y^2)}{2(x^2-y^3)} \\ \text{c) } \frac{12(a-b)^3}{18(a-b)^2} &= \frac{2(a-b)}{3} & \text{g) } \frac{(2a-3b)(a-3)}{(3-a)(3b-2a)} &= \frac{-(3b-2a)(a-3)}{-(a-3)(3b-2a)} = 1 \\ \text{d) } \frac{x-y}{y-x} &= \frac{-(y-x)}{y-x} = -1 & \text{h) } \frac{(a-2x)^2(x-y)}{(y-x)(a+2b)} &= \frac{-(y-x)(a-2x)^2}{(y-x)(a-2b)} = -\frac{(a-2x)^2}{a-2b} \end{aligned}$$

153 Simplifie :

$$\begin{aligned} \text{a) } \frac{5a-15b}{4a-12b} &= \frac{5(a-3b)}{4(a-3b)} = \frac{5}{4} & \text{e) } \frac{8x^2-32y^2}{12y+6x} &= \frac{8(x+2y)(x-2y)}{6(2y+x)} = \frac{4(x-2y)}{3} \\ \text{b) } \frac{ac-bc}{ad-bd} &= \frac{c(a-b)}{d(a-b)} = \frac{c}{d} & \text{f) } \frac{16-a^4}{a^2+4a+4} &= \frac{(4+a^2)(2+a)(2-a)}{(a+2)^2} = \frac{(4+a^2)(2-a)}{a+2} \\ \text{c) } \frac{x^2-y^2}{ax-ay} &= \frac{(x+y)(x-y)}{a(x-y)} = \frac{x+y}{a} & \text{g) } \frac{6x^2-8xy}{9xy-12y^2} &= \frac{2x(3x-4y)}{3y(3x-4y)} = \frac{2x}{3y} \\ \text{d) } \frac{12ax^2+18a^2x}{9a^2+12ax+4x^2} &= \frac{6ax(2x+3a)}{(3a+2x)^2} = \frac{6ax}{3a+2x} & \text{h) } \frac{(3x-y)^2}{27x^3-27x^2y+9xy^2-y^3} &= \frac{(3x-y)^2}{(3x-y)^3} = \frac{1}{3x-y} \end{aligned}$$

154 Simplifie :

$$\begin{aligned} \text{a) } \frac{2a^2-18}{4a^2+24a+36} &= \frac{2(a+3)(a-3)}{4(a^2+6a+9)} = \frac{(a+3)(a-3)}{2(a+3)^2} = \frac{a-3}{2(a+3)} \\ \text{b) } \frac{x^2+4-4x}{4-x^2} &= \frac{(x-2)^2}{(2-x)(2+x)} = -\frac{x-2}{x+2} & \text{c) } \frac{8a^2x^2-8a^2}{24-24x^2} &= \frac{8a^2(x+1)(x-1)}{24(1+x)(1-x)} = -\frac{a^2}{3} \\ \text{d) } \frac{ax-ay+bx-by}{x^2-2xy+y^2} &= \frac{a(x-y)+b(x-y)}{(x-y)^2} = \frac{(x-y)(a+b)}{(x-y)^2} = \frac{a+b}{x-y} \\ \text{e) } \frac{4x^2+8xy+4y^2}{8ax-8ay} &= \frac{4(x^2+2xy+y^2)}{8a(x-y)} = \frac{4(x+y)^2}{8a(x-y)} = \frac{(x+y)^2}{2a(x-y)} \\ \text{f) } \frac{42a^3-30a^2x}{35ax^2-25x^3} &= \frac{6a^2(7a-5x)}{5x^2(7a-5x)} = \frac{6a^2}{5x^2} & \text{g) } \frac{a^2-2a+1}{a^4-1} &= \frac{(a-1)^2}{(a^2+1)(a+1)(a-1)} = \frac{a-1}{(a^2+1)(a+1)} \\ \text{h) } \frac{x^2+8x+15}{x^2-9} &= \frac{(x+3)(x+5)}{(x+3)(x-3)} = \frac{x+5}{x-3} \end{aligned}$$

155 Simplifie :

$$\begin{aligned} \text{a) } \frac{x^4-a^4}{ax^3-a^3x} &= \frac{(x^2+a^2)(x+a)(x-a)}{ax(x+a)(x-a)} = \frac{x^2+a^2}{ax} \\ \text{b) } \frac{8a^3-36a^2b+54ab^2-27b^3}{16a^2-48ab+36b^2} &= \frac{(2a-3b)^3}{4(4a^2-12ab+9b^2)} = \frac{(2a-3b)^3}{4(2a-3b)^2} = \frac{2a-3b}{4} \\ \text{c) } \frac{xy^2+x-1-y^2}{x^2-2x+1} &= \frac{x(y^2+1)-(y^2+1)}{(x-1)^2} = \frac{(y^2+1)(x-1)}{(x-1)^2} = \frac{y^2+1}{x-1} \end{aligned}$$

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

$$e) \frac{2a^2 - 8a + 8}{4a^2 - 16} = \frac{2(a^2 - 4a + 4)}{4(a^2 - 4)} = \frac{2(a-2)^2}{4(a+2)(a-2)} = \frac{a-2}{2(a+2)}$$

$$f) \frac{2x^2y - 8xy^2}{16y^2 - 8xy + x^2} = \frac{2xy(x-4y)}{(4y-x)^2} = -\frac{2xy}{4y-x}$$

$$g) \frac{15ay^3 - 5ay}{4 - 12y^2} = \frac{5ay(3y^2 - 1)}{4(1 - 3y^2)} = -\frac{5ay}{4}$$

$$h) \frac{a^4b - bx^4}{2a^3 + 2a^2x + 2ax^2 + 2x^3} = \frac{b(a^2 + x^2)(a+x)(a-x)}{2[a^2(a+x) + x^2(a+x)]} = \frac{b(a^2 + x^2)(a+x)(a-x)}{2(a+x)(a^2 + x^2)} = \frac{b(a-x)}{2}$$

156 Simplifie :

$$a) \frac{x^2 - 14x + 48}{4x - 32} = \frac{(x-6)(x-8)}{4(x-8)} = \frac{x-6}{4}$$

$$b) \frac{9a^2 + 42ab + 49b^2}{49b^2 - 9a^2} = \frac{(3a+7b)^2}{(7b+3a)(7b-3a)} = \frac{3a+7b}{7b-3a}$$

$$c) \frac{64x^4 - 32x^2y + 4y^2}{12x^3 - 3xy} = \frac{4(16x^4 - 8x^2y + y^2)}{3x(4x^2 - y)} = \frac{4(4x^2 - y)^2}{3x(4x^2 - y)} = \frac{4(4x^2 - y)}{3x}$$

$$d) \frac{ab - ac + bc - a^2}{(a^2 - c^2)(a-b)^2} = \frac{b(a+c) - a(c+a)}{(a+c)(a-c)(a-b)^2} = \frac{(a+c)(b-a)}{(a+c)(a-c)(a-b)^2} = -\frac{1}{(a-c)(a-b)}$$

$$e) \frac{8 - 8a^2}{64a - 64} = \frac{8(1+a)(1-a)}{64(a-1)} = -\frac{1+a}{8}$$

$$f) \frac{x^3 + 3x^2 + 3x + 1}{3x^2 + 6x + 3} = \frac{(x+1)^3}{3(x+1)^2} = \frac{x+1}{3}$$

$$g) \frac{8a^3 + 10a^2 - 2a}{5ax - x + 4a^2x} = \frac{2a(4a^2 + 5a - 1)}{x(4a^2 + 5ax - 1)} = \frac{2a}{x}$$

$$h) \frac{a^2 - 1}{3a^2 - 6a + 3} = \frac{(a+1)(a-1)}{3(a^2 - 2a + 1)} = \frac{(a+1)(a-1)}{3(a-1)^2} = \frac{a+1}{3(a-1)}$$

157 Simplifie :

$$a) \frac{(a+x)^2 - a^2}{4a^2 + 4ax + x^2} = \frac{[(a+x)+a][(a+x)-a]}{(2a+x)^2} = \frac{(2a+x) \cdot x}{(2a+x)^2} = \frac{x}{2a+x}$$

$$b) \frac{(x-y)^2 - (a+b)^2}{(a-y)^2 - (x+b)^2} = \frac{[(x-y)+(a+b)][(x-y)-(a+b)]}{[(a-y)+(x+b)][(a-y)-(x+b)]} = \frac{(x-y+a+b)(x-y-a-b)}{(a-y+x+b)(a-y-x-b)} = \frac{x-y-a-b}{-x-y+a-b}$$

$$c) \frac{a^2 - b^2 + 2bc - c^2}{a+b-c} = \frac{a^2 - (b-c)^2}{a+b-c} = \frac{(a+b-c)(a-b+c)}{a+b-c} = a-b+c$$

$$d) \frac{a^3 - a^2 + 2a - 2}{a^3 + a^2 + 2a + 2} = \frac{a^2(a-1) + 2(a-1)}{a^2(a+1) + 2(a+1)} = \frac{(a-1)(a^2+2)}{(a+1)(a^2+2)} = \frac{a-1}{a+1}$$

$$e) \frac{2x^2 + x - 6}{4a + 3x + 6 + 2ax} = \frac{(2x-3)(x+2)}{2a(2+x) + 3(2+x)} = \frac{(2x-3)(x+2)}{(2+x)(2a+3)} = \frac{2x-3}{2a+3}$$

$$f) \frac{x^2 + 2xy + y^2}{ax - bx + ay - by} = \frac{(x+y)^2}{x(a-b) + y(a-b)} = \frac{(x+y)^2}{(a-b)(x+y)} = \frac{x+y}{a-b}$$

$$g) \frac{a^2 - 12a + 32}{4a^2 - 32a + 64} = \frac{(a-4)(a-8)}{4(a^2 - 8a + 16)} = \frac{(a-4)(a-8)}{4(a-4)^2} = \frac{a-8}{4(a-4)}$$

$$h) \frac{x^8 - 1}{x^6 - x^4 + x^2 - 1} = \frac{(x^4+1)(x^2+1)(x+1)(x-1)}{x^4(x^2-1) + (x^2-1)} = \frac{(x^4+1)(x^2+1)(x^2-1)}{(x^2-1)(x^4+1)} = x^2 + 1$$

158 Simplifie et rends le dénominateur rationnel:

a) $\frac{\sqrt{12}}{\sqrt{4}} = \frac{2\sqrt{3}}{2} = \sqrt{3}$

c) $\frac{\sqrt{15}}{3\sqrt{5}} = \frac{\sqrt{3} \cdot \sqrt{5}}{3\sqrt{5}} = \frac{\sqrt{3}}{3}$

b) $\frac{6\sqrt{3}}{\sqrt{27}} = \frac{6\sqrt{3}}{3\sqrt{3}} = 2$

d) $\frac{12\sqrt{8}}{\sqrt{72}} = \frac{12 \cdot \sqrt{4 \cdot 2}}{\sqrt{36 \cdot 2}} = \frac{24\sqrt{2}}{6\sqrt{2}} = 4$

e) $\frac{8}{\sqrt{12}-2} = \frac{8(\sqrt{12}+2)}{(\sqrt{12}-2)(\sqrt{12}+2)} = \frac{8 \cdot 2\sqrt{3}+16}{12-4} = \frac{16(\sqrt{3}+1)}{8} = 2(\sqrt{3}+1)$

f) $\frac{\sqrt{8}+2}{\sqrt{32}} = \frac{2\sqrt{2}+2}{\sqrt{16 \cdot 2}} = \frac{2(\sqrt{2}+1)}{4\sqrt{2}} = \frac{(\sqrt{2}+1) \cdot \sqrt{2}}{2\sqrt{2} \cdot \sqrt{2}} = \frac{2+\sqrt{2}}{4}$

g) $\frac{12-\sqrt{108}}{\sqrt{48}} = \frac{12-\sqrt{36 \cdot 3}}{\sqrt{16 \cdot 3}} = \frac{12-6\sqrt{3}}{4\sqrt{3}} = \frac{6(2-\sqrt{3}) \cdot \sqrt{3}}{4\sqrt{3} \cdot \sqrt{3}} = \frac{2\sqrt{3}-3}{2}$

h) $\frac{4+\sqrt{24}}{2+\sqrt{8}} = \frac{4+\sqrt{4 \cdot 6}}{2+\sqrt{4 \cdot 2}} = \frac{(4+2\sqrt{6})(1-\sqrt{2})}{(2+2\sqrt{2})(1-\sqrt{2})} = \frac{2(2+\sqrt{6})(1-\sqrt{2})}{2(1+\sqrt{2})(1-\sqrt{2})} = \frac{2-2\sqrt{2}+\sqrt{6}-\sqrt{6} \cdot \sqrt{2}}{1-2} = -2+2\sqrt{2}-\sqrt{6}+2\sqrt{3}$

i) $\frac{\sqrt{18}+\sqrt{27}}{9-\sqrt{45}} = \frac{(3\sqrt{2}+3\sqrt{3})(3+\sqrt{5})}{(9-3\sqrt{5})(3+\sqrt{5})} = \frac{(\sqrt{2}+\sqrt{3})(3+\sqrt{5})}{3 \cdot (3-\sqrt{5})(3+\sqrt{5})} = \frac{3\sqrt{2}+\sqrt{2} \cdot \sqrt{5}+3\sqrt{3}+\sqrt{3} \cdot \sqrt{5}}{3(9-5)} = \frac{3\sqrt{2}+\sqrt{10}+3\sqrt{3}+\sqrt{15}}{12}$

j) $\frac{\sqrt{a^4x}+\sqrt{a^3x^2}}{a\sqrt{ax}} = \frac{(a^2\sqrt{x}+ax\sqrt{a})\sqrt{ax}}{a\sqrt{ax} \cdot \sqrt{ax}} = \frac{a[(a\sqrt{x}+x\sqrt{a})\sqrt{ax}]}{a \cdot a \cdot x} = \frac{a\sqrt{x \cdot ax}+x\sqrt{a \cdot ax}}{ax} = \frac{ax\sqrt{a}+xa\sqrt{x}}{ax} = \sqrt{a}+\sqrt{x}$

159 Effectue les produits et donne ta réponse sous la forme d'une fraction :

a) $\frac{2}{3} \cdot \frac{3}{4} \cdot \frac{4}{5} = \frac{2 \cdot 3 \cdot 2 \cdot 2}{3 \cdot 2 \cdot 2 \cdot 5} = \frac{2}{5}$

c) $x^2 \cdot \frac{3a}{x^3} = \frac{3a}{x}$

b) $\frac{a^2}{b^3} \cdot a^2 = \frac{a^4}{b^3}$

d) $\frac{12x^2}{16y} \cdot \frac{4y^3}{6x^3} = \frac{2 \cdot 2 \cdot 3x^2 \cdot 2 \cdot 2y^3}{2 \cdot 2 \cdot 2 \cdot 2y \cdot 2 \cdot 3x^3} = \frac{y^2}{2x}$

e) $\frac{(2a)^2}{9b^2} \cdot \frac{3b^3}{8a} \cdot \frac{5x^2}{(2y)^3} = \frac{2 \cdot 2a^2 \cdot 3b^3 \cdot 5x^2}{3 \cdot 3b^2 \cdot 2 \cdot 2 \cdot 2a \cdot 2 \cdot 2 \cdot 2y^3} = \frac{5abx^2}{2^4 \cdot 3y^3}$

f) $\frac{2x}{5y} \cdot \frac{15xy^2}{12x^3} \cdot \frac{6x^2}{4y} = \frac{2 \cdot 3 \cdot 5 \cdot 2 \cdot 3x^4y^2}{5 \cdot 2 \cdot 2 \cdot 3 \cdot 2 \cdot 2x^3y^2} = \frac{3x}{4}$

g) $\left(-\frac{4a^2}{3b^3}\right) \cdot \left(\frac{-6a}{8b} \cdot \frac{5b^4}{-2ab^2}\right) = -\frac{2 \cdot 2a^2 \cdot 2 \cdot 3a \cdot 5b^4}{3b^3 \cdot 2 \cdot 2 \cdot 2b \cdot 2ab^2} = -\frac{5a^2}{2 \cdot b^2}$

h) $\frac{3x^2}{2a} \left(-\frac{2a}{4x^3} \cdot \frac{12ax^3}{-8a^2}\right) = \frac{3x^2 \cdot 2a \cdot 2 \cdot 2 \cdot 3ax^3}{2a \cdot 2 \cdot 2x^3 \cdot 2 \cdot 2 \cdot 2a^2} = \frac{9x^2}{8a}$

160 Simplifie et effectue :

a) $\frac{x^2-y^2}{x} \cdot \frac{x^2}{x+y} = \frac{(x-y)(x+y) \cdot x^2}{x \cdot (x+y)} = x(x-y) = x^2 - xy$

b) $\frac{2a}{4a+8b} \cdot \frac{a^2-4b^2}{a^3} = \frac{2a(a+2b)(a-2b)}{4(a+2b) \cdot a^3} = \frac{a-2b}{2a^2}$

c) $\frac{x^2-2xy+y^2}{x-y} \cdot \frac{3}{3x-3y} = \frac{(x-y)^2 \cdot 3}{(x-y) \cdot 3(x-y)} = 1$

d) $\frac{1+4a}{1-4a} \cdot \frac{1-8a+16a^2}{1-16a^2} = \frac{(1+4a)(1-4a)^2}{(1-4a)(1+4a)(1-4a)} = 1$

e) $\frac{a^4-b^4}{a^2+b^2} \cdot \frac{(a-b)^2}{(a-b)^3} = \frac{(a^2+b^2)(a+b)(a-b)(a-b)^2}{(a^2+b^2)(a-b)^3} = a+b$

$$f) \frac{4x^2 - 12xy + 9y^2}{3x + 2y} \cdot \frac{9x^2 - 4y^2}{4x^2 - 9y^2} = \frac{(2x - 3y)^2(3x + 2y)(3x - 2y)}{(3x + 2y)(2x + 3y)(2x - 3y)} = \frac{(2x - 3y)(3x - 2y)}{2x + 3y} = \frac{6x^2 - 13xy + 6y^2}{2x + 3y}$$

$$g) \frac{16a^2 - 25b^2}{a^2 - 16} \cdot \frac{a^3 - 4a^2}{4a - 5b} = \frac{(4a + 5b)(4a - 5b) \cdot a^2(a - 4)}{(a + 4)(a - 4)(4a - 5b)} = \frac{a^2(4a + 5b)}{a + 4} = \frac{4a^3 + 5a^2b}{a + 4}$$

$$h) \frac{x^2 + 6x + 9}{a + b} \cdot \frac{2ab + 2b^2}{x^2 + 5x + 6} = \frac{(x + 3)^2 \cdot 2b(a + b)}{(a + b)(x + 2)(x + 3)} = \frac{2b(x + 3)}{x + 2} = \frac{2bx + 6b}{x + 2}$$

161 Simplifie et effectue :

$$a) \frac{a^2 - a}{a^2 + 4a + 4} \cdot \frac{a^2 + 3a + 2}{2 - a} \cdot \frac{a^2 - 4}{a^2 - 1} = \frac{a(a - 1)(a + 1)(a + 2)(a + 2)(a - 2)}{(a + 2)^2(2 - a)(a + 1)(a - 1)} = -a$$

$$b) \frac{3 - a}{a^2 - 6a + 9} \cdot \frac{-a}{1 + 4a^2 + 4a} \cdot \frac{2a^2 - 5a - 3}{a^2} = + \frac{(a - 3) \cdot a(2a + 1)(a - 3)}{(a - 3)^2(1 + 2a)^2 \cdot a^2} = \frac{1}{a(1 + 2a)}$$

$$c) (a + b) \cdot \frac{ax + ay}{x^2 - y^2} \cdot \frac{x - y}{a^3 + 2a^2b + ab^2} = \frac{(a + b) \cdot a(x + y)(x - y)}{(x + y)(x - y) \cdot a(a^2 + 2ab + b^2)} = \frac{a + b}{(a + b)^2} = \frac{1}{a + b}$$

$$d) \frac{3a - 5b}{4x^2} \cdot \frac{12x^2 - 12x^2y}{3ax - 3ay - 5bx + 5by} \cdot (x - y) = \frac{(3a - 5b) \cdot 12x^2(1 - y)(x - y)}{4x^2[3a(x - y) - 5b(x - y)]} = \frac{12x^2(3a - 5b)(1 - y)(x - y)}{4x^2(x - y)(3a - 5b)} = 3(1 - y) = 3 - 3y$$

162 Simplifie et effectue :

$$a) \frac{2}{3} \div \frac{4}{9} = \frac{2 \cdot 9}{3 \cdot 4} = \frac{3}{2}$$

$$b) \frac{5a^2}{7b} \cdot \frac{14b^2}{15a} = \frac{5a^2 \cdot 14b^2}{7b \cdot 15a} = \frac{2ab}{3}$$

$$c) 3a^2 \div \frac{12a^2}{3} = \frac{3a^2 \cdot 3}{12a^2} = \frac{3}{4}$$

$$d) \frac{4a^2}{b^4} \div 8a^3 = \frac{4a^2}{b^4 \cdot 8a^3} = \frac{1}{2ab^4}$$

$$h) \left(\frac{3a^3}{5b^2} \div \frac{4x^3}{6ab^2} \right) \div \frac{2ax}{5} = \frac{3a^3}{5b^2} \cdot \frac{6ab^2}{4x^3} \cdot \frac{5}{2ax} = \frac{3a^3 \cdot 6ab^2 \cdot 5}{5b^2 \cdot 4x^3 \cdot 2ax} = \frac{9a^3}{4x^4}$$

$$e) \frac{4x^2y}{3a} \div \frac{8xy^2}{6a^3} = \frac{4x^2y \cdot 6a^3}{3a \cdot 8xy^2} = \frac{a^2x}{y}$$

$$f) \frac{-2a^2x}{5b^3y} \div \frac{-4x^2}{ay^2} = \frac{2a^2x \cdot ay^2}{5b^3y \cdot 4x^2} = \frac{a^3y}{10b^3x}$$

$$g) \frac{-4x^3y^2}{-6a^2x^2} \div \frac{12ay^3}{9xy^2} = \frac{4x^3y^2 \cdot 9xy^2}{6a^2x^2 \cdot 12ay^3} = \frac{x^2y}{2a^3}$$

163 Effectue :

$$a) \frac{4x}{x - y} \div 2x^2 = \frac{4x}{(x - y) \cdot 2x^2} = \frac{2}{x(x - y)}$$

$$b) (a + b) \div \frac{a + b}{2} = \frac{(a + b) \cdot 2}{a + b} = 2$$

$$c) \frac{(x - y)^2}{3a} \div \frac{x^2 - y^2}{6a} = \frac{(x - y)^2 6a}{3a \cdot (x + y)(x - y)} = \frac{2(x - y)}{x + y} = \frac{2x - 2y}{x + y}$$

$$d) \frac{a - b}{a + b} \div \frac{2a + 2b}{a^2 + ab} = \frac{(a - b) \cdot a(a + b)}{(a + b) \cdot 2(a + b)} = \frac{a(a - b)}{2(a + b)} = \frac{a^2 - ab}{2(a + b)}$$

$$e) \frac{x^2 + 2xy + y^2}{8x} \div \frac{x^2 - y^2}{4a} = \frac{(x + y)^2 \cdot 4a}{8x(x + y)(x - y)} = \frac{a(x + y)}{2x(x - y)}$$

$$f) \frac{12a - 8b}{a - b} \div \frac{9a^2 - 4b^2}{b - a} = \frac{4(3a - 2b)(b - a)}{(a - b)(3a + 2b)(3a - 2b)} = \frac{-4}{3a + 2b}$$

$$g) \frac{(x - y)^3}{(x^2 - y^2)} \div \frac{x - y}{(x - y)^2} = \frac{(x - y)^3(x - y)^2}{(x + y)(x - y)(x - y)} = \frac{(x - y)^3}{x + y}$$

$$h) \frac{a^2 - 4x^2}{a^2 + 4ax} \div \frac{a^2 - 2ax}{ax + 4x^2} = \frac{(a + 2x)(a - 2x) \cdot x(a + 4x)}{a(a + 4x) \cdot a(a - 2x)} = \frac{x(a + 2x)}{a^2} = \frac{ax + 2x^2}{a^2}$$

164 Effectue

$$\begin{aligned} \text{a) } & \frac{a}{x^2 - 2xy + y^2} \cdot \frac{x^2 - y^2}{ax + ay} = \frac{a \cdot (x+y)(x-y)}{(x-y)^2 \cdot a(x+y)} = \frac{1}{x-y} \\ \text{b) } & \frac{2a-2}{a-5} \div \frac{a-1}{a^2-25} = \frac{2(a-1)(a+5)(a-5)}{(a-5)(a-1)} = 2a+10 \\ \text{c) } & \frac{a^2-2ab}{a^4-b^4} \div \frac{a^2-3ab+2b^2}{a^2+b^2} = \frac{a(a-2b)(a^2+b^2)}{(a^2+b^2)(a+b)(a-b)(a-b)(a-2b)} = \frac{a}{(a+b)(a-b)^2} \\ \text{d) } & (4a^2 + 24ab + 36b^2) \cdot \frac{3a}{6a^2 + 18ab} = \frac{4(a^2 + 6ab + 9b^2) \cdot 3a}{6a(a+3b)} = \frac{4(a+3b)^2 \cdot 3a}{6a(a+3b)} = 2(a+3b) \\ \text{e) } & \left(\frac{a}{(x+y)^2} \cdot \frac{a-b}{x-y} \right) \div \frac{3a^2}{x^2-y^2} = \frac{a(a-b)(x+y)(x-y)}{(x+y)^2(x-y)3a^2} = \frac{(a-b)}{3a \cdot (x+y)} \\ \text{f) } & \left(\frac{2a-4b}{x^2-y^2} \div \frac{8x}{x+y} \right) \cdot \frac{x^2-2xy+y^2}{a^2-4b^2} = \frac{2(a-2b)(x+y)(x-y)^2}{(x+y)(x-y) \cdot 8x(a+2b)(a-2b)} = \frac{x-y}{4(a+2b)} \end{aligned}$$

165 Effectue :

$$\begin{aligned} \text{a) } & \frac{\sqrt{3}}{4} \cdot \frac{12}{\sqrt{27}} = \frac{\sqrt{3} \cdot 3 \cdot 4}{4 \cdot 3 \cdot \sqrt{3}} = 1 & \text{c) } & \frac{\sqrt{3}+1}{\sqrt{2}} \cdot \frac{\sqrt{32}}{12} = \frac{(\sqrt{3}+1) \cdot 4\sqrt{2}}{\sqrt{2} \cdot 3 \cdot 4} = \frac{\sqrt{3}+1}{3} \\ \text{b) } & \frac{\sqrt{2}}{3\sqrt{3}} \div \frac{\sqrt{8}}{\sqrt{12}} = \frac{\sqrt{2} \cdot 2\sqrt{3}}{3\sqrt{3} \cdot 2\sqrt{2}} = \frac{1}{3} & \text{d) } & \frac{\sqrt{2}-1}{5} \div \frac{\sqrt{2}-1}{4} = \frac{(\sqrt{2}-1) \cdot 4}{5 \cdot (\sqrt{2}-1)} = \frac{4}{5} \\ \text{e) } & \frac{a+1}{\sqrt{3}-2} \cdot \frac{2-\sqrt{3}}{a^2-1} = \frac{-(a+1)(\sqrt{3}-2)}{(\sqrt{3}-2)(a+1)(a-1)} = -\frac{1}{a-1} = \frac{1}{1-a} \\ \text{f) } & \frac{\sqrt{8}+\sqrt{12}}{\sqrt{2}+1} \div \frac{4}{1+\sqrt{2}} = \frac{(2\sqrt{2}+2\sqrt{3})(1+\sqrt{2})}{(\sqrt{2}+1) \cdot 4} = \frac{2(\sqrt{2}+\sqrt{3})}{4} = \frac{(\sqrt{2}+\sqrt{3})}{2} \end{aligned}$$

166 Effectue les divisions :

$$\begin{aligned} \text{a) } & (10y^2 - 2y - 12) \div (5y - 6) = \frac{2(5y^2 - y - 6)}{5y - 6} = \frac{2(5y-6)(y+1)}{5y-6} = 2(y+1) \\ \text{b) } & (80a + 14a^2 + 50) \div (7a + 5) = \frac{2(7a^2 + 40a + 25)}{7a + 5} = \frac{2(7a+5)(a+5)}{7a+5} = 2(a+5) \\ \text{c) } & \frac{12a^2 - 14a - 10}{3a - 5} = \frac{2(6a^2 - 7a - 5)}{3a - 5} = \frac{2(3a-5)(2a+1)}{3a-5} = 2(2a+1) \\ \text{d) } & (7a + 12 - 5a^2) \div (5a - 12) = \frac{-5a^2 + 7a + 12}{5a - 12} = \frac{(5a-12)(-a-1)}{5a-12} = -a-1 \\ \text{e) } & \frac{x^3 + y^3}{x+y} = \frac{(x+y)(x^2 - xy + y^2)}{x+y} = x^2 - xy + y^2 \\ \text{f) } & (3x^3 - 8x^2 + 7x - 2) \div (3x - 2) = \frac{3x^3 - 8x^2 + 7x - 2}{3x - 2} = \frac{(3x-2)(x^2 - 2x + 1)}{3x - 2} = (x-1)^2 \\ \text{g) } & \frac{8a^4 + 2a^3 + a^2 - 5a - 6}{4a + 3} = \frac{(4a+3)(2a^3 - a^2 + a - 2)}{4a+3} = 2a^3 - a^2 + a - 2 \\ \text{h) } & (9x^2 - 12x^3 + 4x^4 - 4) \div (2 + 3x - 2x^2) = \frac{9x^2 - 12x^3 + 4x^4 - 4}{-2x^2 + 3x + 2} = \frac{(-2x^2 + 3x + 2)(-2x^2 + 3x - 2)}{-2x^2 + 3x + 2} = -2x^2 + 3x - 2 \end{aligned}$$

167 Effectue les divisions :

$$\text{a) } \frac{x^2 + 3ax + 2a^2}{x+a} = \frac{(x+a)(x+2a)}{x+a} = x+2a$$

$$\begin{aligned}
 \text{b)} \quad & \frac{9x^2 - 12x + 4}{2 - 3x} = \frac{(3x - 2)^2}{2 - 3x} = -(3x - 2) = -3x + 2 \\
 \text{c)} \quad & \frac{27a^3 - 8x^3}{2x - 3a} = \frac{(2x - 3a)(-4x^2 - 6ax - 9a^2)}{2x - 3a} = -4x^2 - 6ax - 9a^2 \\
 \text{d)} \quad & \frac{a^3 - 3a^2 + 5a - 6}{a^2 - a + 1} = \frac{(a^2 - a + 1)(a - 2)}{a^2 - a + 1} + \frac{2a - 4}{a^2 - a + 1} = (a - 2) + \frac{2a - 4}{a^2 - a + 1} \\
 \text{e)} \quad & \frac{4x^2 + 9y^2 + z^2 - 12xy + 4xz - 6yz}{2x - 3y + z} = \frac{(2x - 3y + z)(2x - 3y)}{2x - 3y + z} + \frac{z^2}{2x - 3y + z} = 2x - 3y + \frac{z^2}{2x - 3y + z} \\
 \text{f)} \quad & \frac{125a^3 - 225a^2 + 135a - 27}{25a^2 - 30a + 9} = \frac{(25a^2 - 30a + 9)(5a + 3)}{25a^2 - 30a + 9} - \frac{54}{25a^2 - 30a + 9} = 5a + 3 - \frac{54}{25a^2 - 30a + 9} \\
 \text{g)} \quad & \frac{a^2 + 3a^3 - 3a - 1}{a^2 - 1} = \frac{(a^2 - 1)(3a + 1)}{a^2 - 1} = 3a + 1 \\
 \text{h)} \quad & \frac{x^2 + 12a^2 + 7ax}{4a + x} = \frac{(4a + x)(x + 3a)}{4a + x} = x + 3a
 \end{aligned}$$

168 Effectue les divisions :

$$\begin{aligned}
 \text{a)} \quad & (x^3 - 5x^2 + 4x - 1) \div (x - 1) = \frac{x^3 - 5x^2 + 4x - 1}{x - 1} = \frac{(x^2 - 4x)(x - 1)}{x - 1} - \frac{1}{x - 1} = x^2 - 4x - \frac{1}{x - 1} \\
 \text{b)} \quad & (2x^3 - 3x^2 - 5) \div (2x + 1) = \frac{2x^3 - 3x^2 - 5}{2x + 1} = \frac{(x^2 - 2x + 1)(2x + 1)}{2x + 1} - \frac{6}{2x + 1} = x^2 - 2x + 1 - \frac{6}{2x + 1} \\
 \text{c)} \quad & \frac{a^4 - 5a^3 - 6a - 10}{a + 4} = \frac{(a + 4)(a^3 - 9a^2 + 36a - 150)}{a + 4} + \frac{590}{a + 4} = a^3 - 9a^2 + 36a - 150 + \frac{590}{a + 4} \\
 \text{d)} \quad & \frac{8x - x^4 - 1 + 3x^2}{x^2 - 2x - 2} = \frac{(-x^4 + 3x^2 + 8x - 1)}{x^2 - 2x - 2} = \frac{(-x^2 + x)(x^2 - 2x - 2)}{x^2 - 2x - 2} + \frac{8x - 1}{x^2 - 2x - 2} = x(1 - x) + \frac{8x - 1}{x^2 - 2x - 2} \\
 \text{e)} \quad & \frac{a^4 - 1}{a + 2} = \frac{(a^3 - 2a^2 + 4a - 8)(a + 2)}{a + 2} + \frac{15}{a + 2} = a^3 - 2a^2 + 4a - 8 + \frac{15}{a + 2} \\
 \text{f)} \quad & \frac{4x^3 + 2x^2y - 4xy^2 + 3y^3}{2x - y} = \frac{(2x^2 + 2xy - y^2)(2x - y)}{2x - y} + \frac{-2y^3}{2x - y} = 2x^2 + 2xy - y^2 - \frac{2y^3}{2x - y} \\
 \text{g)} \quad & (3y^2 + 2y - 1) \div (y - 1) = \frac{3y^2 + 2y - 1}{y - 1} = \frac{(3y + 5)(y - 1)}{y - 1} = 3y + 5 \\
 \text{h)} \quad & \frac{10a^2 + 23ab + 12b^2}{5a + 4b} = \frac{(2a + 3b)(5a + 4b)}{5a + 4b} = 2a + 3b
 \end{aligned}$$

169 Réduis les expressions suivantes au même dénominateur :

$$\begin{aligned}
 \text{a)} \quad & \frac{5x}{3} \text{ et } \frac{8a}{5} \Leftrightarrow \frac{25x}{15} \text{ et } \frac{24a}{15} \\
 \text{b)} \quad & \frac{3x}{16a} \text{ et } \frac{5y}{4a^2} \Leftrightarrow \frac{3ax}{16a^2} \text{ et } \frac{20y}{16a^2} \\
 \text{c)} \quad & \frac{12u^2}{7x} \text{ et } \frac{2}{21x^3} \Leftrightarrow \frac{36u^2x^2}{21x^3} \text{ et } \frac{2}{21x^3} \\
 \text{d)} \quad & \frac{8a^3}{12y^3} \text{ et } \frac{7a^2}{9y^5} \Leftrightarrow \frac{24a^3y^2}{36y^5} \text{ et } \frac{28a^2}{36y^5} \\
 \text{e)} \quad & \left\{ \begin{array}{l} \frac{3a}{x-1} \text{ et } \frac{2b}{x+1} \Leftrightarrow \frac{3a(x+1)}{(x-1)(x+1)} \text{ et } \frac{2b(x-1)}{(x-1)(x+1)} \\ \Leftrightarrow \frac{3ax+3a}{(x-1)(x+1)} \text{ et } \frac{2bx-2b}{(x-1)(x+1)} \end{array} \right. \\
 \text{f)} \quad & \frac{5x}{2(x+y)} \text{ et } \frac{3x}{3(x+y)} \Leftrightarrow \frac{15x}{6(x+y)} \text{ et } \frac{6x}{6(x+y)}
 \end{aligned}$$

$$g) \left\{ \begin{array}{l} \frac{a+b}{3a-3b} \text{ et } \frac{a-b}{2a^2-2b^2} \Leftrightarrow \frac{a+b}{3(a-b)} \text{ et } \frac{a-b}{2(a+b)(a-b)} \\ \Leftrightarrow \frac{2(a+b)^2}{6(a-b)(a+b)} \text{ et } \frac{3(a-b)}{6(a-b)(a+b)} \\ \Leftrightarrow \frac{2a^2+4ab+2b^2}{6(a-b)(a+b)} \text{ et } \frac{3a-3b}{6(a-b)(a+b)} \end{array} \right.$$

$$h) \left\{ \begin{array}{l} \frac{a+x}{x-3} \text{ et } \frac{a-x}{x+2} \Leftrightarrow \frac{(a+x)(x+2)}{(x-3)(x+2)} \text{ et } \frac{(a-x)(x-3)}{(x-3)(x+2)} \\ \Leftrightarrow \frac{x^2+2x+ax+2a}{(x-3)(x+2)} \text{ et } \frac{-x^2+3x+ax-3a}{(x-3)(x+2)} \end{array} \right.$$

170 Réduis les expressions suivantes au même dénominateur :

$$a) \left\{ \begin{array}{l} \frac{5a}{(x-y)^2} \text{ et } \frac{7a}{(x-y)^3} \Leftrightarrow \frac{5a(x-y)}{(x-y)^3} \text{ et } \frac{7a}{(x-y)^3} \\ \Leftrightarrow \frac{5ax-5ay}{(x-y)^3} \text{ et } \frac{7a}{(x-y)^3} \end{array} \right.$$

$$b) \left\{ \begin{array}{l} \frac{2x^2}{a^2-2ab+b^2} \text{ et } \frac{3a}{a^2-b^2} \Leftrightarrow \frac{2x^2}{(a-b)^2} \text{ et } \frac{3a}{(a+b)(a-b)} \\ \Leftrightarrow \frac{2x^2(a+b)}{(a-b)^2(a-b)} \text{ et } \frac{3a(a-b)}{(a-b)^2(a-b)} \\ \Leftrightarrow \frac{2ax^2+2bx^2}{(a-b)^2(a-b)} \text{ et } \frac{3a^2-3ab}{(a-b)^2(a-b)} \end{array} \right.$$

$$c) \left\{ \begin{array}{l} \frac{x^2-4}{x^2-2x} \text{ et } \frac{x-3x^2}{1-3x} \Leftrightarrow \frac{(x+2)(x-2)}{x(x-2)} \text{ et } \frac{x(1-3x)}{1-3x} \\ \Leftrightarrow \frac{x+2}{x} \text{ et } x \\ \Leftrightarrow \frac{x+2}{x} \text{ et } \frac{x^2}{x} \end{array} \right.$$

$$d) \left\{ \begin{array}{l} \frac{a-1}{a^2+2a+1} \text{ et } \frac{a}{a^2-1} \Leftrightarrow \frac{a-1}{(a+1)^2} \text{ et } \frac{a}{(a+1)(a-1)} \\ \Leftrightarrow \frac{(a-1)(a-1)}{(a+1)^2(a-1)} \text{ et } \frac{a(a+1)}{(a+1)^2(a-1)} \\ \Leftrightarrow \frac{a^2-2a+1}{(a+1)^2(a-1)} \text{ et } \frac{a^2+a}{(a+1)^2(a-1)} \end{array} \right.$$

$$\begin{array}{l}
 e) \left\{ \begin{array}{l}
 \frac{2x-4}{6-3x} \text{ et } \frac{x-a}{4-4x^2} \Leftrightarrow \frac{2(x-2)}{3(2-x)} \text{ et } \frac{x-a}{4(1-x^2)} \\
 \Leftrightarrow \frac{-2}{3} \text{ et } \frac{x-a}{4(1-x^2)} \\
 \Leftrightarrow \frac{-2 \cdot 4(1-x^2)}{12(1+x)(1-x)} \text{ et } \frac{3(x-a)}{12(1+x)(1-x)} \\
 \Leftrightarrow \frac{-8+8x^2}{12(1+x)(1-x)} \text{ et } \frac{3x-3a}{12(1+x)(1-x)}
 \end{array} \right. \\
 f) \left\{ \begin{array}{l}
 \frac{2b}{x^2-5x+6} \text{ et } \frac{3a}{x^2-4x+3} \Leftrightarrow \frac{2b}{(x-2)(x-3)} \text{ et } \frac{3a}{(x-3)(x-1)} \\
 \Leftrightarrow \frac{2b(x-1)}{(x-2)(x-3)(x-1)} \text{ et } \frac{3a(x-2)}{(x-2)(x-3)(x-1)} \\
 \Leftrightarrow \frac{2bx-2b}{(x-2)(x-3)(x-1)} \text{ et } \frac{3ax-6a}{(x-2)(x-3)(x-1)}
 \end{array} \right.
 \end{array}$$

171 Effectue :

$$a) \frac{a}{3} - \frac{2b}{3} = \frac{a-2b}{3}$$

$$b) \frac{2x}{5} + \frac{7x}{15} = \frac{6x+7x}{15} = \frac{13x}{15}$$

$$c) \frac{a}{3} + \frac{a}{4} - \frac{a}{12} = \frac{4a+3a-a}{12} = \frac{6a}{12} = \frac{a}{2}$$

$$d) \frac{2x}{3} - \frac{x}{2} + \frac{7x}{6} = \frac{4x-3x+7x}{6} = \frac{8x}{6} = \frac{4x}{3}$$

$$e) \frac{5}{a} + \frac{7}{a} - \frac{9}{a} = \frac{5+7-9}{a} = \frac{3}{a}$$

$$f) \frac{3}{a^2} + \frac{2}{a} - \frac{5}{a^2} = \frac{3+2a-5}{a^2} = \frac{2a-2}{a^2} = \frac{2a-2}{a^2}$$

$$g) \frac{x}{5} - \frac{1}{4} + \frac{x}{10} = \frac{4x-5+2x}{20} = \frac{6x-5}{20}$$

$$h) 5a - \frac{2a}{3} + \frac{1}{a^2} = \frac{5a^2 - 2a^3 + 1}{a^2} = \frac{-2a^3 + 5a^2 + 1}{a^2}$$

172 Effectue :

$$a) \left\{ \begin{array}{l}
 \frac{x+y}{3} + \frac{x-y}{2} = \frac{2(x+y)}{6} + \frac{3(x-y)}{6} \\
 = \frac{2x+2y}{6} + \frac{3x-3y}{6} \\
 = \frac{2x+2y+3x-3y}{6} \\
 = \frac{5x-y}{6}
 \end{array} \right.$$

$$b) \left\{ \begin{array}{l}
 \frac{2a-1}{5a} - \frac{3+5a}{4a} = \frac{4(2a-1)}{20a} - \frac{5(3+5a)}{20a} \\
 = \frac{8a-4}{20a} - \frac{15+25a}{20a} \\
 = \frac{8a-4-15-25a}{20a} \\
 = \frac{-17a-19}{20a}
 \end{array} \right.$$

$$c) \left\{ \begin{array}{l}
 \frac{a-b}{6} - \frac{a+2b}{9} = \frac{6(a-b)}{36} - \frac{4(a+2b)}{36} \\
 = \frac{6a-6b}{36} - \frac{4a+8b}{36} \\
 = \frac{6a-6b-(4a+8b)}{36} \\
 = \frac{6a-6b-4a-8b}{36} \\
 = \frac{2a-14b}{36} \\
 = \frac{2(a-7b)}{36} \\
 = \frac{a-7b}{18}
 \end{array} \right.$$

$$d) \left\{ \begin{aligned} & \frac{3x^2 - 5}{4a} - \frac{6 - 2x^2}{3a} = \frac{3(3x^2 - 5)}{12a} - \frac{4(6 - 2x^2)}{12a} \\ & = \frac{9x^2 - 15}{12a} - \frac{24 - 8x^2}{12a} \\ & = \frac{9x^2 - 15 - (24 - 8x^2)}{12a} \\ & = \frac{9x^2 - 15 - 24 + 8x^2}{12a} \\ & = \frac{17x^2 - 39}{12a} \end{aligned} \right.$$

$$e) \left\{ \begin{aligned} & \frac{2y^2 - 3z}{a^2} + \frac{2a - 3}{a^3} = \frac{a(2y^2 - 3z)}{a^3} + \frac{2a - 3}{a^3} \\ & = \frac{2ay^2 - 3az}{a^3} + \frac{2a - 3}{a^3} \\ & = \frac{2ay^2 - 3az + 2a - 3}{a^3} \end{aligned} \right.$$

$$f) \left\{ \begin{aligned} & \frac{5x - 3b}{3a} - \frac{2y + a}{5b} = \frac{5b(5x - 3b)}{15ab} - \frac{3a(2y + a)}{15ab} \\ & = \frac{25bx - 15b^2}{15ab} - \frac{6ay + 3a^2}{15ab} \\ & = \frac{25bx - 15b^2 - (6ay + 3a^2)}{15ab} \\ & = \frac{25bx - 15b^2 - 6ay - 3a^2}{15ab} \end{aligned} \right.$$

$$g) \left\{ \begin{aligned} & \frac{1 - 8c}{5a} - \frac{3x - 4}{6a^2} = \frac{(1 - 8c) \cdot 6a}{30a^2} - \frac{(3x - 4) \cdot 5}{30a^2} \\ & = \frac{6a - 48ac}{30a^2} - \frac{15x - 20}{30a^2} \\ & = \frac{6a - 48ac - (15x - 20)}{30a^2} \\ & = \frac{6a - 48ac - 15x + 20}{30a^2} \end{aligned} \right.$$

$$h) \left\{ \begin{aligned} & \frac{x - y}{xy} - \frac{z - y}{yz} + \frac{z - x}{xz} = \frac{(x - y) \cdot z}{xyz} - \frac{(z - y) \cdot x}{xyz} + \frac{(z - x)}{xyz} \\ & = \frac{xz - yz}{xyz} - \frac{xz - xy}{xyz} + \frac{yz - xy}{xyz} \\ & = \frac{xz - yz - (xz - xy) + (yz - xy)}{xyz} \\ & = \frac{xz - yz - xz + xy + yz - xy}{xyz} \\ & = \frac{0}{xyz} = 0 \end{aligned} \right.$$

173 Effectue :

$$a) \left\{ \begin{aligned} & \frac{a - b}{2b} - 5 + \frac{3ab - b^2}{b^2} = \frac{b(a - b)}{2b^2} - \frac{5 \cdot 2b^2}{2b^2} + \frac{2(3ab - b^2)}{2b^2} \\ & = \frac{ab - b^2 - 10b^2 + 6ab - 2b^2}{2b^2} \\ & = \frac{7ab - 13b^2}{2b^2} \end{aligned} \right.$$

$$b) \left\{ \frac{1}{a+b} + \frac{2}{a+b} = \frac{3}{a+b} \right.$$

$$c) \left\{ \begin{aligned} & \frac{x^2}{x - y} - \frac{y^2}{x - y} = \frac{x^2 - y^2}{x - y} \\ & = \frac{(x + y)(x - y)}{x - y} \\ & = x + y \end{aligned} \right.$$

$$d) \left\{ \begin{aligned} & 5a - \frac{3a + 2}{a + 1} = \frac{5a(a + 1)}{a + 1} - \frac{3a + 2}{a + 1} \\ & = \frac{5a^2 + 5a - (3a + 2)}{a + 1} \\ & = \frac{5a^2 + 5a - 3a - 2}{a + 1} \\ & = \frac{5a^2 + 2a - 2}{a + 1} \end{aligned} \right.$$

$$e) \left\{ \begin{aligned} \frac{5}{m-n} + \frac{4}{m+n} &= \frac{5(m+n)}{(m+n)(m-n)} + \frac{4(m-n)}{(m+n)(m-n)} \\ &= \frac{5m+5n+4m-4n}{(m+n)(m-n)} \\ &= \frac{9m+n}{(m+n)(m-n)} \end{aligned} \right.$$

$$f) \left\{ \begin{aligned} \frac{3a}{a^2-1} - \frac{4}{a+1} &= \frac{3a}{(a+1)(a-1)} - \frac{4}{a+1} \\ &= \frac{3a}{(a+1)(a-1)} - \frac{4(a-1)}{(a+1)(a-1)} \\ &= \frac{3a-4(a-1)}{(a+1)(a-1)} \\ &= \frac{3a-4a+4}{(a+1)(a-1)} \\ &= \frac{-a+4}{(a+1)(a-1)} \end{aligned} \right.$$

$$g) \left\{ \begin{aligned} \frac{x}{x-y} - \frac{xy}{x^2-y^2} &= \frac{x}{x-y} - \frac{xy}{(x+y)(x-y)} \\ &= \frac{x(x+y)}{(x+y)(x-y)} - \frac{xy}{(x+y)(x-y)} \\ &= \frac{x^2+xy-xy}{(x+y)(x-y)} \\ &= \frac{x^2}{(x+y)(x-y)} \end{aligned} \right.$$

$$h) \left\{ \begin{aligned} \frac{a-1}{a+1} - \frac{a+1}{a-1} &= \frac{(a-1)(a-1)}{(a+1)(a-1)} - \frac{(a+1)(a+1)}{(a+1)(a-1)} \\ &= \frac{a^2-2a+1}{(a+1)(a-1)} - \frac{a^2+2a+1}{(a+1)(a-1)} \\ &= \frac{a^2-2a+1-(a^2+2a+1)}{(a+1)(a-1)} \\ &= \frac{a^2-2a+1-a^2-2a-1}{(a+1)(a-1)} \\ &= \frac{-4a}{(a+1)(a-1)} \end{aligned} \right.$$

174 Effectue :

$$a) \left\{ \begin{aligned} \frac{3}{2x+y} - \frac{6x}{4x^2+4xy+y^2} &= \frac{3}{2x+y} - \frac{6x}{(2x+y)^2} \\ &= \frac{3(2x+y)}{(2x+y)^2} - \frac{6x}{(2x+y)^2} \\ &= \frac{6x+3y-6x}{(2x+y)^2} \\ &= \frac{3y}{(2x+y)^2} \end{aligned} \right.$$

$$b) \left\{ \begin{aligned} \frac{a^2}{(a+b)^3} - \frac{2a}{(a+b)^2} + \frac{1}{a+b} &= \frac{a^2}{(a+b)^3} - \frac{2a(a+b)}{(a+b)^3} + \frac{(a+b)^2}{(a+b)^3} \\ &= \frac{a^2 - (2a^2+2ab) + (a^2+2ab+b^2)}{(a+b)^3} \\ &= \frac{a^2 - 2a^2 - 2ab + a^2 + 2ab + b^2}{(a+b)^3} \\ &= \frac{-2a^2 + b^2}{(a+b)^3} \end{aligned} \right.$$

$$c) \left\{ \begin{aligned} \frac{7x^2}{8x+12y} - \frac{5x^2}{6x+9y} &= \frac{7x^2}{4(2x+3y)} - \frac{5x^2}{3(2x+3y)} \\ &= \frac{21x^2}{12(2x+3y)} - \frac{20x^2}{12(2x+3y)} \\ &= \frac{x^2}{12(2x+3y)} \end{aligned} \right.$$

$$\begin{aligned}
 d) \left\{ \begin{aligned}
 & \frac{x}{x-1} - \frac{x}{x+1} + \frac{2x^2}{x^2-1} = \frac{x}{x-1} - \frac{x}{x+1} + \frac{2x^2}{(x+1)(x-1)} \\
 & = \frac{x(x+1)}{(x+1)(x-1)} - \frac{x(x-1)}{(x+1)(x-1)} + \frac{2x^2}{(x+1)(x-1)} \\
 & = \frac{x^2+x-(x^2-x)+2x^2}{(x+1)(x-1)} \\
 & = \frac{x^2+x-x^2+x+2x^2}{(x+1)(x-1)} \\
 & = \frac{2x+2x^2}{(x+1)(x-1)} \\
 & = \frac{2x(1+x)}{(x+1)(x-1)} \\
 & = \frac{2x}{(x-1)}
 \end{aligned}
 \right.
 \end{aligned}$$

$$\begin{aligned}
 e) \left\{ \begin{aligned}
 & \frac{1}{a-1} + \frac{1}{(a-1)(a-2)} + \frac{1}{(a-2)(a-3)} = \frac{(a-2)(a-3)}{(a-1)(a-2)(a-3)} + \frac{a-3}{(a-1)(a-2)(a-3)} + \frac{a-1}{(a-1)(a-2)(a-3)} \\
 & = \frac{a^2-5a+6+a-3+a-1}{(a-1)(a-2)(a-3)} \\
 & = \frac{a^2-3a+4}{(a-1)(a-2)(a-3)}
 \end{aligned}
 \right.
 \end{aligned}$$

$$\begin{aligned}
 f) \left\{ \begin{aligned}
 & \frac{1}{(x-1)^2} - \frac{4}{(x^2-1)^2} + \frac{1}{(x+1)^2} = \frac{1}{(x-1)^2} - \frac{4}{(x+1)^2(x-1)^2} + \frac{1}{(x+1)^2} \\
 & = \frac{(x+1)^2}{(x+1)^2(x-1)^2} - \frac{4}{(x+1)^2(x-1)^2} + \frac{(x-1)^2}{(x+1)^2(x-1)^2} \\
 & = \frac{x^2+2x+1-4+x^2-2x+1}{(x+1)^2(x-1)^2} \\
 & = \frac{2x^2+2}{(x+1)^2(x-1)^2} = \frac{2(x^2+1)}{(x+1)^2(x-1)^2}
 \end{aligned}
 \right.
 \end{aligned}$$

$$\begin{aligned}
 g) \left\{ \begin{aligned}
 & \frac{x}{x+y} + \frac{x}{x-y} - \frac{2xy}{y^2-x^2} = \frac{x}{x+y} + \frac{x}{x-y} + \frac{2xy}{(x+y)(x-y)} \\
 & = \frac{x(x-y)}{(x+y)(x-y)} + \frac{x(x+y)}{(x+y)(x-y)} + \frac{2xy}{(x+y)(x-y)} \\
 & = \frac{x^2-xy+x^2+xy+2xy}{(x+y)(x-y)} \\
 & = \frac{2x^2+2xy}{(x+y)(x-y)} = \frac{2x(x+y)}{(x+y)(x-y)} = \frac{2x}{x-y}
 \end{aligned}
 \right.
 \end{aligned}$$