

$$4 \quad \frac{a^6 b}{8a^2 b} ; \quad \frac{-4a^2 b^3 c}{-2ab^4 c} ; \quad \frac{2ac^2}{-4c} \quad \left[\frac{a^4}{8} ; \frac{2a}{b} ; -\frac{ac}{2} \right]$$

$$5 \quad \frac{-14a^2 b}{-21a^2 b} ; \quad \frac{-2a^6}{6a^6} ; \quad \frac{-2a^3 b}{a^3 b} \quad \left[\frac{2}{3} ; -\frac{1}{3} ; -2 \right]$$

$$6 \quad \frac{2a}{a+a^2} ; \quad \frac{3ab}{2a+ab} ; \quad \frac{a^{n+2}}{a^n} \quad \left[\frac{2}{1+a} ; \frac{3b}{2+b} ; a^2 \right]$$

$$7 \quad \frac{3x}{9x+3xy} ; \quad \frac{a^3}{2a^2+a^4} ; \quad \frac{2x^{m+1}}{6x^m} \quad \left[\frac{1}{3+y} ; \frac{a}{2+a^2} ; \frac{x}{3} \right]$$

$$8 \quad \frac{a^2 - a}{2a} ; \quad \frac{a^2 b + a^3 b^2}{3ab} \quad \left[\frac{a-1}{2} ; \frac{a(1+ab)}{3} \right]$$

$$9 \quad \frac{3a^4 - 6a^2}{9a + 3a^3} ; \quad \frac{a^4 + a^5}{2a^2 - 3a^3} \quad \left[\frac{a(a^2 - 2)}{3 + a^2} ; \frac{a^2(1+a)}{2-3a} \right]$$

$$10 \quad \frac{a^2 + a}{2 + 2a} ; \quad \frac{a^3 - 2a}{a^2 b - 2b} \quad \left[\frac{a}{2} ; \frac{a}{b} \right] \quad 11 \quad \frac{am + bm}{3a + 3b} ; \quad \frac{6x - 6y}{3x^2 - 3xy} \quad \left[\frac{m}{3} ; \frac{2}{x} \right]$$

$$12 \quad \frac{(x-y)^2}{(x-y)^3} ; \quad \frac{(2x+y)^2}{2x+y} \quad \left[\frac{1}{x-y} ; 2x+y \right]$$

$$13 \quad \frac{a^4 - 3a^2 b}{a^2 - 3a^2 b} ; \quad \frac{(2x+3y)^2}{4x+6y} \quad \left[\frac{a^2 - 3b}{1-3b} ; \frac{2x+3y}{2} \right]$$

$$14 \quad \frac{mx + my}{x^2 + 2xy + y^2} ; \quad \frac{ax - ay}{x^2 - 2xy + y^2} \quad \left[\frac{m}{x+y} ; \frac{a}{x-y} \right]$$

$$15 \quad \frac{x^2 - y^2}{4x - 4y} ; \quad \frac{4x^2 - 9y^2}{2ax + 3ay} \quad \left[\frac{x+y}{4} ; \frac{2x-3y}{a} \right]$$

$$16 \quad \frac{7a^2 - 7b^2}{3a + 3b} ; \quad \frac{4a^2 - 1}{4a^2 + 1 + 4a} \quad \left[\frac{7(a-b)}{3} ; \frac{2a-1}{2a+1} \right]$$

$$17 \quad \frac{4x^2 y^2 + 1 + 4xy}{4x^2 y^2 - 1} ; \quad \frac{x^3 + y^3 + 3x^2 y + 3xy^2}{4x^2 + 8xy + 4y^2} \quad \left[\frac{2xy+1}{2xy-1} ; \frac{x+y}{4} \right]$$

$$18 \quad \frac{a^3 - 3a^2 + 3a - 1}{a^2 - 1} ; \quad \frac{a^2 + 2a + 1}{a^3 + 1 + 3a + 3a^2} \quad \left[\frac{(a-1)^2}{a+1} ; \frac{1}{a+1} \right]$$

$$19 \quad \frac{x^3 - 1}{x^2 - 2x + 1} ; \quad \frac{x^3 + 1}{3x + 3} \quad \left[\frac{x^2 + x + 1}{x-1} ; \frac{x^2 - x + 1}{3} \right]$$

$$20 \quad \frac{a^3 b^3 - 8}{2ab - 4} ; \quad \frac{1 - 27a^3}{1 + 27a^3 + 9a^2 + 27a^2} \quad \left[\frac{a^2 b^2 + 2ab + 4}{2} ; \frac{1-3a+9a^2}{3} \right]$$

$$21 \quad \frac{14x - 7y}{4x^2 - y^2} ; \quad \frac{a^2 - 5a + 6}{a^2 - 4a + 4} \quad \left[\frac{7}{2x+y} ; \frac{a-3}{a-2} \right]$$

$$22 \quad \frac{x^2 + 5x + 6}{x^2 + 4x + 4} ; \quad \frac{2x^2 - 10x + 12}{x^2 - 6x + 9} \quad \left[\frac{x+3}{x+2} ; \frac{2(x-2)}{x-3} \right]$$

$$23 \quad \frac{x^4 - 16}{x^4 + 16 - 8x^2} ; \quad \frac{16 - a^4}{a^4 - 4a^2} \quad \left[\frac{x^2 + 4}{x^2 - 4} ; \frac{(4+a^2)(2+a)}{2-a} \right]$$

- 24 $\frac{8x^3 - y^3}{4x^2 - y^2}$; $\frac{8x^3 + y^3}{2xy + y^2}$ $\left[\frac{4x^2 + 2xy + y^2}{2x + y}; \frac{4x^2 - 2xy + y^2}{y} \right]$
- 25 $\frac{4a^2 + 12ab + 9b^2}{14a + 21b}$; $\frac{4a^2 + 20ab + 25b^2}{18a + 45b}$ $\left[\frac{2a + 3b}{7}; \dots \right]$
- 26 $\frac{27x^3 - y^3}{18x^2 + 6xy + 2y^2}$; $\frac{8a^3 - b^3}{12a^2 + 6ab + 3b^2}$ $\left[\frac{3x - y}{2}; \dots \right]$
- 27 $\frac{a^2 + 2a + 1}{a^3 - a}$; $\frac{4b^2 + 4b + 1}{8b^3 - 2b}$; $\frac{a^3 + 1}{4a^3 - 4a^2 + 4a}$ $\left[\frac{a + 1}{a(a - 1)}; \dots \right]$
- 28 $\frac{a^2 - 3a - 4}{a^2 - 4a - 5}$; $\frac{a^2 - 3a + 2}{a^2 - 4a + 3}$; $\frac{x^4 - 2x^2 + 1}{x^3 - x + 3x^2 - 3}$ $\left[\frac{a - 4}{a - 5}; \dots \right]$
- 29 $\frac{x^3 - 3x^2 + 3x - 1}{x^2 - 2x + 1}$; $\frac{8a^3 - 12a^2 + 6a - 1}{4a^2 - 4a + 1}$ $[x - 1; \dots]$
- 30 $\frac{x^5 - 1}{2x^4 + 2x^3 + 2x^2 + 2x + 2}$; $\frac{a^5 - b^5}{3a^4 + 3a^3b + 3a^2b^2 + 3ab^3 + 3b^4}$ $\left[\frac{x - 1}{2}; \dots \right]$
- 31 $\frac{ax + ay + x + y}{2x^2 + 2y}$; $\frac{3x + 3y + ax + ay}{7x + 7y}$; $\frac{x(x^2 + 1)^2 - x^3}{x^6 - 1}$ $\left[\frac{a + 1}{2}; \dots \right]$
- 32 $\frac{3x - 3y + (x - y)^2}{(x - y)^2}$; $\frac{(a + 1)^2 + 2a + 2}{(a + 1)^2}$ $\left[\frac{3 + x - y}{x - y}; \dots \right]$
- 33 $\frac{2a^3 - a^2b - 2a^2 + ab}{12a^2 - 3b^2 - 12a^3 + 3ab^2}$; $\frac{x^4 - y^4 + 2xy(x^2 - y^2)}{x^4 - y^4}$ $\left[-\frac{a}{3(2a + b)}; \dots \right]$
- 34 $\frac{5x^3 + 15x^2 - 5x - 15}{(x^2 - 9)(2x + 2)}$; $\frac{a^3 + 2ax^2 - 2a^2x - 4x^3}{a^4 - 4x^4}$ $\left[\frac{5(x - 1)}{2(x - 3)}; \dots \right]$
- 35 $\frac{a^3 - 4a^2 - 3a + 18}{(a^2 + 4a + 4)(a^2 - 4a + 3)}$; $\left[\frac{a - 3}{(a + 2)(a - 1)} \right]$
- 36 $\frac{(a - 3b)^2 - (2a + b)^2}{(a + 4b)^2}$; $\frac{81x^2 - 3a^3x^2}{27x^3 + 9ax^3 + 3a^2x^3}$ $\left[-\frac{3a + 2b}{a + 4b}; \dots \right]$
- 37 $\frac{(x + 4y)^2 - (x - 2y)^2}{4x^2 + 4y^2 + 8xy}$; $\frac{8a^2x - 12abx + 18b^2x}{8a^3 - 27b^3}$ $\left[\frac{3y}{x + y}; \dots \right]$
- 38 $\frac{(x + y)^2 + 2(2x - 3y)(x + y) + (2x - 3y)^2}{(3x - 2y)^2}$ $[1]$
- 39 $\frac{(a - 2)^2 + 2(a - 2)(a + 1) + (a + 1)^2}{4a^2 - 1}$ $\left[\frac{2a - 1}{2a + 1} \right]$
- 40 $\frac{ax + ay + a - x - y - 1}{x^2 + y^2 + 1 + 2x + 2y + 2xy}$ $\left[\frac{a - 1}{x + y + 1} \right]$
- 41 $\frac{2x + 2y + 2 - ax - ay - a}{3x + 3y + 3}$ $\left[\frac{2 - a}{3} \right]$
- 42 $\frac{a^5 - a^3 + a}{a^5 - a^3 + a + a^4 - a^2 + 1}$ $\left[\frac{a}{a + 1} \right]$
- 43 $\frac{x^2 + 2x + 1 - y^2}{x + 1 + y}$ $\left[\frac{x + 1 - y}{x + 1 + y} \right]$

$$\begin{aligned}
 44 \quad & \frac{x^2 - 2x + 1 - 4y^2}{x^2 + 1 + 4y^2 - 2x + 4xy - 4y} & \left[\frac{x - 1 - 2y}{x - 1 + 2y} \right] \\
 45 \quad & \frac{1 - x^2 - y^2 - 2xy}{1 + x^2 + y^2 + 2x + 2y + 2xy} & \left[\frac{1 - x - y}{1 + x + y} \right] \\
 46 \quad & \frac{a^2 - b^2 - c^2 - 2bc}{a^2 + b^2 - 2ab - c^2} & \left[\frac{a + b + c}{a - b + c} \right]
 \end{aligned}$$

Ridurre le seguenti frazioni letterali al minimo comune denominatore:

$$\begin{aligned}
 47 \quad & \frac{2}{3x}; \quad \frac{1}{6x^2}; \quad \frac{y}{2x} & \left[\frac{4x}{6x^2}; \quad \frac{1}{6x^2}; \quad \frac{3xy}{6x^2} \right] \\
 48 \quad & \frac{a}{3b^2}; \quad \frac{3}{2ab}; \quad \frac{5b}{15a^2} & \left[\frac{2a^3}{6a^2b^2}; \quad \frac{9ab}{6a^2b^2}; \quad \frac{2b^3}{6a^2b^2} \right] \\
 49 \quad & \frac{3}{a+b}; \quad \frac{2}{a^2+ab} & \left[\frac{3a}{a(a+b)}; \quad \frac{2}{a(a+b)} \right] \\
 50 \quad & \frac{2x}{x-y}; \quad \frac{4y}{x+y}; \quad \frac{1}{x^2-y^2} & \left[\frac{2x^2+2xy}{(x-y)(x+y)}; \quad \frac{4xy-4y^2}{(x-y)(x+y)}; \quad \frac{1}{(x-y)(x+y)} \right] \\
 51 \quad & \frac{2-x}{x^2+2xy+y^2}; \quad \frac{3+y}{x^2-y^2} & \left[\frac{2x-2y-x^2+xy}{(x+y)^2(x-y)^2}; \quad \frac{3x+3y+xy+y^2}{(x+y)^2(x-y)^2} \right] \\
 52 \quad & \frac{3}{x^2-2xy+y^2}; \quad \frac{2}{x^2+2xy+y^2}; \quad \frac{1}{x^2-y^2} & \left[\frac{3(x+y)^2}{(x+y)^2(x-y)^2}; \quad \frac{2(x-y)^2}{(x+y)^2(x-y)^2}; \quad \frac{(x+y)(x-y)}{(x+y)^2(x-y)^2} \right]
 \end{aligned}$$

Eseguire le seguenti somme algebriche tra frazioni letterali, semplificando i risultati:

$$\begin{aligned}
 53 \quad & \frac{1}{ab} + \frac{1}{a^2} + \frac{1}{b^2}; \quad \frac{z}{xy} + \frac{x}{yz} + \frac{y}{xz} & \left[\frac{ab+b^2+a^2}{a^2b^2}; \quad \frac{z^2+x^2+y^2}{xyz} \right] \\
 54 \quad & \frac{a+b}{2b} + \frac{a-b}{2a}; \quad \frac{x+y}{2y} + \frac{y-x}{2x} & \left[\frac{a^2+2ab-b^2}{2ab}; \quad \frac{x^2+y^2}{2xy} \right] \\
 55 \quad & \frac{a-b}{b} - \frac{a}{2b} + \frac{a+b}{a} - \frac{a^2+b^2}{2ab} & \left[\frac{b}{2a} \right] \\
 56 \quad & \frac{a+1}{a} + \frac{a+4}{2a} - \frac{2a+9}{3a} & \left[\frac{5}{6} \right] \\
 57 \quad & \frac{x}{2} + \frac{2}{x} + 1 & \left[\frac{x^2+4+2x}{2x} \right] \\
 58 \quad & \frac{1}{x+y} + \frac{1}{x-y} + \frac{2x}{x^2-y^2} & \left[\frac{4x}{x^2-y^2} \right] \\
 59 \quad & \frac{1}{2a+2b} + \frac{1}{2(a+b)} + \frac{b-a}{a^2+2ab+b^2} & \left[\frac{2b}{(a+b)^2} \right]
 \end{aligned}$$

$$60 \quad \frac{3a}{3a+b} + \frac{b}{3a-b} + \frac{1-9a^2}{9a^2-b^2} \quad \left[\frac{1+b^2}{9a^2-b^2} \right]$$

$$61 \quad \frac{a-b}{a^2} + \frac{a}{a^2+ab} + \frac{b-a}{b^2+ab} \quad \left[\frac{3a^2b-b^3-a^3}{a^2b(a+b)} \right]$$

$$62 \quad \frac{x}{2x+2y} - \frac{2y}{3x-3y} - \frac{2}{3} \quad \left[-\frac{x^2+7xy}{6(x^2-y^2)} \right]$$

$$63 \quad \frac{1}{x^2-y^2} + \frac{1}{x^2+2xy+y^2} - \frac{2}{x^2-2xy+y^2} \quad \left[\frac{-2y^2-6xy}{(x^2-y^2)^2} \right]$$

$$64 \quad a - \frac{3a}{a^3-1} - \frac{a^3-a^2}{a^2+a+1} \quad \left[\frac{2a^3-a^2-4a}{a^3-1} \right]$$

$$65 \quad \frac{2a^2+b^2}{a^3-b^3} - \frac{a}{a^2+ab+b^2} - \frac{1}{a-b} \quad [0]$$

$$66 \quad \frac{a^2}{16-a^4} - \frac{1}{4+a^2} - \frac{2}{4-a^2} \quad \left[-\frac{12}{16-a^4} \right]$$

$$67 \quad \frac{1}{a^2+ab} - \frac{1}{a^2-b^2} + \frac{1}{ab-b^2} \quad \left[\frac{a^2-b^2+ab}{ab(a+b)(a-b)} \right]$$

$$68 \quad \frac{3}{a} - \frac{2}{b} + \frac{1}{a+b} - \frac{4}{a-b} \quad \left[\frac{-3ab^2-2a^3-3b^3}{ab(a-b)(a+b)} \right]$$

$$69 \quad \frac{1}{a+2b} - \frac{1}{a-2b}; \quad \frac{x}{x^2-xy} + 1 - \frac{y}{xy-y^2} \quad \left[\frac{-4b}{a^2-4b^2}; 1 \right]$$

$$70 \quad \frac{x-y}{x^2+2xy+y^2} - \frac{1}{3x+3y}; \quad \frac{1}{x-1} - \frac{1+x}{x^2-2x+1} \quad \left[\frac{2x-4y}{3(x+y)^2}; \frac{-2}{(x-1)^2} \right]$$

$$71 \quad \frac{1}{a^2-1} - \frac{1}{a^2-3a+2} \quad \left[-\frac{3}{(a-1)(a+1)(a-2)} \right]$$

$$72 \quad \frac{6a}{9a^2-1} - \frac{1}{3a+1} - \frac{1}{3a-1}; \quad \frac{5a-9}{a^2-4a+3} - \frac{2}{a-1} - \frac{3}{a-3} \quad [0; 0]$$

$$73 \quad \frac{4(1+4x^2)}{(1-4x^2)^2} - \frac{1+2x}{1-4x+4x^2} - \frac{1-2x}{1+4x+4x^2} \quad \left[\frac{2}{1-4x^2} \right]$$

$$74 \quad \frac{b^2-7b+10}{b^3-6b^2+12b-8} + \frac{b+1}{b^2-4b+4} - \frac{1}{b-2} \quad \left[\frac{1}{b-2} \right]$$

$$75 \quad \frac{1}{x^2-9} + \frac{1}{x^3+3x^2-x-3} - \frac{1}{x^2-1} - \frac{1}{x^3-3x^2-x+3} \quad \left[\frac{2}{(x^2-9)(x^2-1)} \right]$$

$$76 \quad \frac{3(a+b)-1-m}{a+b+ma+mb} + \frac{2a+2b}{a^2+2ab+b^2} - \frac{3+3m}{1+m^2+2m} \quad \left[\frac{1}{a+b} \right]$$

$$77 \quad \frac{x+y+1}{x^2+2xy+y^2-1} - \frac{x-y+1}{x^2+y^2+1+2xy-2x-2y} \quad \left[\frac{2y-2}{(x+y-1)^2} \right]$$

$$78 \quad \frac{2a}{a^2-b^2} - \frac{2}{a+b} + \frac{3}{b-a} \quad \left[\frac{-3a-b}{(a-b)(a+b)} \right]$$

$$79 \quad \frac{a^2 - 4a + 4}{a^3 - 6a^2 + 12a - 8} + \frac{a}{4 - a^2}$$

$$\left[\frac{2}{(a-2)(a+2)} \right]$$

$$80 \quad \frac{2x^2}{x^3 - 8} - \frac{x^2 + 2}{x^2 + 2x + 4} + \frac{1}{2 - x}$$

$$\left[\frac{-2x}{x^3 - 8} \right]$$

$$81 \quad \frac{1}{2a + b} - \frac{1}{2a - b} - \frac{2b}{b^2 - 4a^2}$$

[0]

$$82 \quad \frac{1 + m}{2a - 2b + ma - mb} - \frac{1}{a - b}$$

$$\left[-\frac{1}{(a-b)(2+m)} \right]$$

$$83 \quad \frac{x^2 + y^2 + z^2 + 2xy + 2xz + 2yz}{x^2 - y^2 - z^2 - 2yz} + \frac{x + y - z}{x - y - z}$$

$$\left[\frac{2x + 2y}{x - y - z} \right]$$

$$84 \quad \frac{1}{a^2 + 2a + 1 - b^2} - \frac{1}{a^2 + 1 + b^2 + 2a + 2b + 2ab}$$

$$\left[\frac{2b}{(a+1+b)^2(a+1-b)} \right]$$

$$85 \quad \frac{a^2 - ab}{a^2 + ab} - 1 + \frac{a + b}{b - a} + \frac{a^3 + 4a^2b}{a^3 - ab^2}$$

$$\left[\frac{b^2}{a^2 - b^2} \right]$$

Eseguire le seguenti moltiplicazioni tra frazioni letterali:

$$86 \quad \frac{3a^2b}{4xy^2} \cdot \frac{2x^2}{3a^3b} ; \quad \frac{1}{2} \cdot \frac{4a^6}{3b^2c} \cdot \frac{6b^2}{a^5}$$

$$\left[\frac{x}{2ay^2} ; \frac{4a}{c} \right]$$

$$87 \quad \frac{5a^4b^2c^3}{2x^6y^2z} \cdot \frac{4x^4yz}{10a^4c^3} ; \quad \frac{2}{3} \cdot \left(-\frac{4a^2b}{3a^6} \right) \cdot \frac{9a}{b}$$

$$\left[\frac{b^2}{x^2y} ; -\frac{8}{a^3} \right]$$

$$88 \quad -\frac{8a^4x^2}{ay^4} \cdot \left(-\frac{2a}{x^3} \right) \cdot \left(-\frac{y^2}{8} \right)$$

$$\left[-\frac{2a^4}{xy^2} \right]$$

$$89 \quad \frac{a^2 - b^2}{2a} \cdot \frac{4}{3a + 3b}$$

$$\left[\frac{2(a-b)}{3a} \right]$$

$$90 \quad \frac{a^2 + 2a + 1}{a^2 - 2a + 1} \cdot \frac{2a - 2}{3a + 3} \cdot \left(-\frac{1}{1 + a} \right)$$

$$\left[-\frac{2}{3(a-1)} \right]$$

$$91 \quad \frac{1 - a^3}{a^2 - 4a + 4} \cdot \frac{a - 2}{1 - a} \cdot \left(-\frac{2 - a}{a^2 + a + 1} \right)$$

[1]

$$92 \quad \frac{a^2 + 4a - 5}{ax - 2a - 3x + 6} \cdot \frac{x^2 + x - 6}{ax - 3a - x + 3} \cdot \frac{ax - 5a - 3x + 15}{ax - 5a + 5x - 25}$$

$$\left[\frac{x+3}{x-3} \right]$$

$$93 \quad \frac{a^2 + ax + ay + xy}{a^2 + ay} \cdot \frac{a^2 - y^2}{a^2 - ay + ax - xy}$$

$$\left[\frac{a+y}{a} \right]$$

$$94 \quad \frac{a^3 - ab^2}{a^2 + 2ab + b^2} \cdot \frac{ab + 2b}{a^2b - ab^2} \cdot \frac{a^2 + a + ab + b}{a^2 + 2a}$$

$$\left[\frac{a+1}{a} \right]$$

$$95 \quad \frac{x^3 - 8}{x^2 - 4x + 4} \cdot \left(-\frac{2-x}{x^3 + 2x^2 + 4x} \right) \cdot \frac{x}{4}$$

$$\left[-\frac{1}{4} \right]$$

$$96 \quad \frac{3x}{4x-6y} \cdot \frac{4x^2-12xy+9y^2}{2x+3y} \cdot \left(-\frac{2}{x}\right) \quad \left[-\frac{6x-9y}{2x+3y}\right]$$

$$97 \quad \frac{a-1}{a} \cdot \left(-\frac{a^2+a+1}{2-a}\right) \cdot \frac{a-2}{a^3-1} \quad \left[\frac{1}{a}\right]$$

$$98 \quad \frac{2x-2}{x^2-6x+5} \cdot \frac{(x-5)^2}{4x} \cdot \left(-\frac{2x^2y}{5-x}\right) \quad [xy]$$

$$99 \quad \frac{a^6-a^5}{b^5-b^4} \cdot \frac{b^3-b^2}{a^4-a^3} \cdot (-1) \quad \left[-\frac{a^2}{b^2}\right]$$

$$100 \quad \frac{(a+b)^2-1}{(a-b)^2-1} \cdot \frac{(a-1)^2-b^2}{(a+1)^2-b^2} \quad \left[\frac{(a+b-1)^2}{(a-b+1)^2}\right]$$

$$101 \quad \frac{(x-1)^2-y^2}{(x+1)^2-y^2} \cdot \frac{(x-y)^2-1}{(x+y)^2-1} \cdot \frac{x^2+y^2+1+2xy+2x+2y}{x^2+y^2+1-2xy-2x+2y} \quad [1]$$

$$102 \quad \frac{a^2-b^2-1-2b}{a+b+1} \cdot \frac{3a+3b}{(a-b-1)^2} \cdot \frac{3a-3b-3}{a+b} \quad [9]$$

$$103 \quad \frac{a+b+ca+cb}{c^2+2c+1} \cdot \frac{a}{a^2+2ab+b^2} \cdot \left(-\frac{1}{a}\right) \cdot (-2-2c) \quad \left[\frac{2}{a+b}\right]$$

$$104 \quad \frac{3}{x^3-8y^3} \cdot (x^2-4xy+4y^2) \cdot \left(-\frac{x^2+2xy+4y^2}{6}\right) \quad \left[\frac{x-2y}{2}\right]$$

Eseguire le seguenti divisioni tra frazioni letterali:

$$105 \quad \frac{12a^3b}{7c} : \frac{3a^2}{c^2}; \quad \frac{25a^4b^3}{12a^2c^5} : \left(-\frac{5a^2b}{3c^5}\right) \quad \left[\frac{4abc}{7}; -\frac{5b^2}{4}\right]$$

$$106 \quad \frac{16a^4x^3y^2}{b^4c^2} : \frac{8a^4y^2}{3b^2c}; \quad -\frac{7a^5b^2}{x^4y^3} : \left(-\frac{7a^5b}{xy^3}\right) \quad \left[\frac{6x^3}{b^2c}; \frac{b}{x^3}\right]$$

$$107 \quad \frac{ax+ay}{3b+3c} : \frac{x^2+2xy+y^2}{6ab+6ac} \quad \left[\frac{2a^2}{x+y}\right]$$

$$108 \quad \frac{a^2+4a+4}{a^2-4a+4} : \left(-\frac{a^2+a-2}{a^2-3a+2}\right) \quad \left[-\frac{a+2}{a-2}\right]$$

$$109 \quad \frac{4a^2-1}{a^3-1} : \frac{4a+2}{3a^2+3a+3} \quad \left[\frac{3(2a-1)}{2(a-1)}\right]$$

$$110 \quad \frac{a^3-9a^2+27a-27}{b^2+ab} : \frac{a^2b-6ab+9b}{2a+2b} \quad \left[\frac{2(a-3)}{b^2}\right]$$

$$111 \quad \frac{a^2+ab+b^2-c^2}{3x+3y} : \frac{a^2+2ac+c^2-b^2}{x^2-y^2} \quad \left[\frac{(a+b-c)(x-y)}{3(a+c-b)}\right]$$

$$112 \quad \frac{x^2-xy+y^2}{x^2-4y^2} : \frac{y^2-x^2}{x^2+4xy+4y^2} \quad \left[-\frac{x+2y}{x+y}\right]$$

$$113 \quad \left(\frac{4a^2 - 9}{a^4 - a} : \frac{4a^2 + 12a + 9}{1 - a^2} \right) : \frac{2a^2 - a - 3}{a + a^2 + a^3} \quad \left[-\frac{1}{2a + 3} \right]$$

$$114 \quad \left[\left(\frac{8 - a^3}{6ab} : \frac{2a - 4}{4 + 2a + a^2} \right) : \left(-\frac{3a^3 b^2}{2} \right) \right] : \frac{(a^2 + 2a + 4)^2}{18a^4} \quad \left[\frac{1}{b^3} \right]$$

$$115 \quad \left(-\frac{a^2 - 2a + 4}{a^2 - 4a + 4} : \frac{a^3 + 8}{a^2 - 3a + 2} \right) : \left[-\frac{2 - 2a}{3(a - 2)^2} \right] \quad \left[-\frac{3(a - 2)}{2(a + 2)} \right]$$

$$116 \quad \left[\frac{(a + b)(x + y) + x + y}{(a - b)(x - y) + x - y} : \frac{a^2 + b^2 + 1 + 2ab + 2a + 2b}{2x - 2y} \right] : \frac{4x + 4y}{3a - 3b + 3} \quad \left[\frac{3}{2(a + b + 1)} \right]$$

Eseguire le seguenti divisioni e moltiplicazioni tra frazioni letterali:

$$117 \quad \left(\frac{4a^2 b^2 c}{3x^3 y} : \frac{6xy}{5ab^3 c} \right) : \frac{a}{10b} \quad \left[\frac{16}{x^2} \right]$$

$$118 \quad \left(\frac{3a^3}{2b^2} : \frac{6a}{b^5 c} \right) \frac{3a}{2bc} \quad \left[\frac{3a^3 b^2}{8} \right]$$

$$119 \quad \left(\frac{a + b}{a - b} : \frac{a^2 + 2ab + b^2}{3a - 3b} \right) : \frac{6(a + b)^3}{a^2 - 2ab + b^2} \quad \left[\frac{1}{18} \right]$$

$$120 \quad \left[-\frac{(a - 2b)^2}{3a^3} : \frac{a^2 - 4b^2}{6ab} \right] : \frac{a^2 + 4b^2 + 4ab}{2b^2} \quad \left[\frac{4b^2 - a^2}{a^2 b} \right]$$

$$121 \quad \left(\frac{2a - 8b}{a + 3b} : \frac{a^2 + 9b^2 + 6ab}{a - 4b} \right) : \left(\frac{a^2 - 9b^2}{8a} : \frac{6a^3}{7} \right) \quad \left[\frac{56}{3a^2(a - 3b)} \right]$$

$$122 \quad \left(-\frac{4a^2 - 1}{8a^3 b} : \frac{2a + 1}{4a^4 b} \right) : \left(\frac{2a^5}{6a - 3} : \frac{a^2}{27} \right) \quad [-9a^4]$$

$$123 \quad \left(\frac{a^2 + 4a + 4 - b^2}{a^2 + b^2 + 2ab - 4} : \frac{a^2 + b^2 + 4 + 4a - 2ab - 4b}{a^2 + b^2 + 4 + 2ab - 4a - 4b} \right) : \left(-\frac{3a + 6 - 3b}{2a + 2b - 4} \right) \quad \left[-\frac{3}{2} \right]$$

$$124 \quad \frac{4 - a^2 - b^2 + 2ab}{b - 2 - a} : \left(\frac{4 - 2a + 2b}{3a^2} : \frac{2}{a^3} \right) \quad \left[-\frac{3}{a} \right]$$

$$125 \quad \left(-\frac{8 - 27a^3}{4a^2} : \frac{4 + 6a + 9a^2}{3a - 2} \right) : \frac{2a^2}{4 + 9a^2 - 12a} \quad \left[\frac{1}{2} \right]$$

$$126 \quad \left(\frac{x^2 - 3xy + 4y^2}{8y - 2x} : \frac{x^2 + y^2 - 2xy}{3x} \right) : \left(\frac{2y - 2x}{4x} : \frac{6x}{x + y} \right) \quad \left[\frac{x + y}{8x} \right]$$

$$127 \quad \left[\frac{4a^2 - 9b^2}{2a^3 b} : \left(-\frac{4a^2 b^2}{3b - 2a} \right) \right] : \frac{4a^2 + 9b^2 + 12ab}{3ab} \quad \left[\frac{6b^2}{2a + 3b} \right]$$

Svolgere le seguenti **potenze** di frazioni letterali:

$$128 \quad \left(\frac{2a^3 b^2}{3c} \right)^2 ; \quad \left(-\frac{3ab^5}{2c^6} \right)^2 \quad \left[\frac{4a^6 b^4}{9c^2} ; \frac{9a^2 b^{10}}{4c^{12}} \right]$$

$$\begin{array}{lll}
 129 & \left(\frac{4x^2y^3}{5z}\right)^3; & \left(-\frac{2x^6y}{z^2}\right)^3 & \left[\frac{64x^6y^9}{125z^3}; -\frac{8x^{18}y^3}{z^6}\right] \\
 130 & \left(-\frac{2a}{3b^2}\right)^4; & \left(\frac{bc^2}{5a^3}\right)^4 & \left[\frac{16a^4}{81b^8}; \frac{b^4c^8}{625a^{12}}\right] \\
 131 & \left(\frac{a+b}{a-b}\right)^2; & \left[\frac{3a^2(x-y)}{2x}\right]^2 & \left[\frac{(a+b)^2}{(a-b)^2}; \frac{9a^4(x-y)^2}{4x^2}\right] \\
 132 & \left[-\frac{2a(a+b)^2}{3b}\right]^3; & \left[\frac{(x-1)(x+2)}{3x^2}\right]^3 & \left[-\frac{8a^3(a+b)^6}{27b^3}; \frac{(x-1)^3(x+2)^3}{27x^6}\right]
 \end{array}$$

Eseguire le operazioni indicate riducendo a forma più semplice le seguenti espressioni frazionarie:

$$133 \quad \left(\frac{1}{a+1} + \frac{1}{a-1}\right) \cdot \frac{a^2-1}{2a} \quad [1]$$

$$134 \quad \left(\frac{2}{x-2} + \frac{3}{x-1}\right) \cdot \frac{x^2-3x+2}{10x-16} \quad \left[\frac{1}{2}\right]$$

$$135 \quad \left(1 - \frac{1}{a} + \frac{1}{a^2}\right) : \frac{1-a+a^2}{2a^3} \quad [2a]$$

$$136 \quad \left(\frac{1}{a-2} - \frac{2}{a-3} + 1\right) : \left(\frac{2a^2-1}{a^2-5a+6} - 2\right) \quad \left[\frac{a^2-6a+7}{10a-13}\right]$$

$$137 \quad \left(\frac{3}{x^2-4} - \frac{1}{x-2} + \frac{1}{x+2}\right) : \frac{1}{x^2+4x+4} \quad \left[\frac{2+x}{2-x}\right]$$

$$138 \quad \left(\frac{a+2}{a^2-4a+4} - \frac{1}{a-2}\right) : \left(\frac{a}{2-a} + 1\right) \quad \left[\frac{2}{2-a}\right]$$

$$139 \quad \left(\frac{a+2}{a^3-8} - \frac{1}{a^2+2a+4}\right) \cdot \left(\frac{a}{2} - 1\right) \quad \left[\frac{2}{a^2+2a+4}\right]$$

$$140 \quad \left(1 - \frac{27}{27-x^3}\right) : \left(\frac{1}{9+3x+x^2} - \frac{1}{6-2x}\right) \quad \left[\frac{2x^3}{x^2+5x+3}\right]$$

$$141 \quad \left(\frac{1}{a^2-4} + \frac{1}{2-a} - \frac{2}{2+a}\right) \cdot \frac{a+2}{a-1} \quad \left[\frac{-3}{a-2}\right]$$

$$142 \quad \left(\frac{1}{a} + \frac{1}{a^2} + \frac{1}{a^3}\right) \cdot \left(\frac{1}{1-a^3} - 1\right) \quad \left[\frac{1}{1-a}\right]$$

$$143 \quad \left(\frac{3a-1}{2a-1} + \frac{a+1}{1-2a}\right) : \frac{2a^2}{1-4a^2} \quad \left[\frac{(1-a)(2a+1)}{a^2}\right]$$

$$144 \quad \left(\frac{1}{3x-y} - \frac{2}{y-3x}\right) \cdot (3x-y)^2 \quad [3(3x-y)]$$

$$145 \quad \left(\frac{1}{x-2y} + \frac{2}{2x+y}\right) \cdot \left(\frac{2x}{x^2-1} - \frac{1}{x+1} - \frac{1}{x-1}\right) \quad [0]$$

$$146 \left(\frac{6x}{9x^2-1} - \frac{1}{3x+1} - \frac{1}{3x-1} \right) \cdot \left(\frac{2}{x+1} - 3 \right) \quad [0]$$

$$147 \left(\frac{3x+1}{3x-1} - \frac{3x-1}{3x+1} \right) : \frac{4x^2}{1-3x} \quad \left[-\frac{3}{x(3x+1)} \right]$$

$$148 \left[(2-x)^2 \cdot \left(\frac{1}{x^2-4} + \frac{1}{x+2} \right) \right] : \left(\frac{x^2-2x+1}{x-1} \right) \quad \left[\frac{x-2}{x+2} \right]$$

$$149 \left(\frac{2x^2}{x^3-8} - \frac{x+2}{x^2+2x+4} + \frac{1}{2-x} \right) \cdot \frac{8-x^5}{4} \quad \left[\frac{x}{2} \right]$$

$$150 \left(1 + \frac{1}{a} \right) \cdot \left(\frac{2}{a-1} + \frac{3}{a-3} - \frac{5a-9}{a^2-4a+3} \right) \quad [0]$$

$$151 \left(\frac{1}{a^2-1} - \frac{1}{a^2-3a+2} \right) : \left(\frac{1}{a-1} - \frac{1}{a-2} \right) \quad \left[\frac{3}{a+1} \right]$$

$$152 \left(\frac{1}{2} + \frac{1}{x+y} - \frac{1}{4x+4y} \right) : \frac{2x+2y+3}{x^2+2xy+y^2} \quad \left[\frac{x+y}{4} \right]$$

$$153 \left(\frac{2}{x-1} + \frac{4}{x+2} \right)^2 : \left(\frac{x^2}{x^2-2x+1} - 1 \right) \quad \left[\frac{36x^2}{(2x-1)(x+2)^2} \right]$$

$$154 \left(\frac{x^2+1}{x^2-3x-4} - \frac{x+1}{x-4} \right)^2 : \left(\frac{1}{x-4} \right)^2 \quad \left[\frac{4x^2}{(x+1)^2} \right]$$

$$155 \left[\left(\frac{1}{3-x} + \frac{x}{x^2-9} \right) : \left(\frac{x}{x+3} - 1 \right) \right] \cdot (x^2-6x+9) \quad [x-3]$$

$$156 \left[\left(\frac{1}{x+5} - \frac{1}{x-5} \right) : \left(\frac{x}{5-x} + 1 \right) \right] \cdot \frac{x+5}{x-1} \quad \left[\frac{2}{x-1} \right]$$

$$157 \left(\frac{3}{9-6x+x^2} + \frac{1}{3-x} \right)^2 : \frac{36-12x+x^2}{x^2-9} \quad \left[\frac{x+3}{(x-3)^3} \right]$$

$$158 \frac{ax+ay+x+y}{ax-ay+x-y} : \left(\frac{x+y}{x-y} - \frac{x-y}{x+y} \right) \quad \left[\frac{(x+y)^2}{4xy} \right]$$

$$159 \left[\frac{2a+2b+xa+xb}{2a-2b+xa-xb} : \left(\frac{a^2}{a^2-b^2} - 1 \right) \right] : \left(-\frac{1}{b} \right)^3 \quad [-b(a+b)^2]$$

$$160 \left(\frac{a^2+1}{a^3+3a^2+3a+1} + \frac{2a}{a^2+2a+1} - \frac{1}{a+1} \right) : \left(\frac{2a}{a+1} \right)^2 \quad \left[\frac{1}{2(a+1)} \right]$$

$$161 \left(\frac{x^2+1}{x^3-3x^2+3x-1} - \frac{2x}{x^2-2x+1} - \frac{1}{x-1} \right)^2 : \left(\frac{2x}{x-1} \right)^4 \quad \left[\frac{(2-x)^2}{4x^2(x-1)^2} \right]$$

$$162 \left(\frac{a+b}{9-a^2-b^2-2ab} + \frac{1}{a+b-3} \right) \cdot \frac{9+a^2+b^2-6a-6b+2ab}{9} \quad \left[\frac{a+b-3}{3(3+a+b)} \right]$$

$$163 \frac{(x+y+z)^2}{x^2+2xy+y^2-z^2} \cdot \left(\frac{x-z}{x+y-z} - 1 \right)^2 \cdot \frac{x^2+y^2+z^2+2xy-2xz-2yz}{x+y+z} \quad \left[\frac{y^2}{x+y-z} \right]$$

$$164 \quad \left(\frac{5a+5}{a^2+3a+2} - 1 \right) \cdot \left(\frac{1}{2} + \frac{3a+6}{a^2-a-6} \right) \cdot (a+2) \quad \left[-\frac{a+3}{2} \right]$$

$$165 \quad \left(\frac{1}{y} + \frac{x}{xy-y^2} - \frac{y^3-x^3}{xy^3-x^3y} + \frac{y}{x^2+xy} \right) \cdot \frac{xy-y^2}{x} - 1 \quad [0]$$

$$166 \quad \left(\frac{5x-13}{2x^2-2} + \frac{6x-21}{2x+2} - \frac{3x-5}{x-1} \right) : \frac{3}{x^2+2x+1} + x \quad [-2x-3]$$

$$167 \quad \left(\frac{1}{x-2} + \frac{x+2}{x^2+2x+4} + \frac{2x^2}{8-x^3} \right) : \left(\frac{4}{x^2+2x+4} - 1 \right) + \frac{2}{x^2-4} \quad [0]$$

$$168 \quad \frac{1 + \frac{1}{2x}}{1 - \frac{1}{2x}} - 1; \quad \frac{2 - \frac{1}{a+2}}{1 + \frac{2}{a+2}} \quad \left[\frac{2}{2x-1}; \frac{2a+3}{a+4} \right]$$

$$169 \quad \left\{ \left[\left(\frac{1}{x-3} + \frac{1}{1-x} \right) \cdot (x^2-4x+3) - \frac{4}{3x-1} \right] \cdot \frac{1}{6} \right\}^2 \quad \left[\frac{x^2-2x+1}{9x^2+1-6x} \right]$$

$$170 \quad \left(\frac{3+a}{ab-a^2} - \frac{b+3}{b^2-ab} - \frac{3}{ab} \right)^2 \cdot \left(\frac{1}{ab} - 1 + ab \right) \quad [0]$$

$$171 \quad \frac{1 + \frac{1}{x} + \frac{1}{x^2}}{1 - \frac{1}{x} + \frac{1}{x^2}} : \frac{x^3-1}{x^3+1} - 1 \quad \left[\frac{2}{x-1} \right]$$

$$172 \quad \frac{\frac{2x}{y^2-x^2} - \frac{1}{x+y} - \frac{1}{x-y}}{\left(\frac{2x}{x-y} \right)^2} \quad \left[\frac{y-x}{x(y+x)} \right]$$

$$173 \quad \frac{\frac{a+1}{a^2-a} + 1}{\frac{a-1}{a+1} + \frac{1}{a}}; \quad \frac{1 - \frac{a^2-3}{a^2+1}}{\frac{3a^2+1}{a^2-1} - 3} \quad \left[\frac{a+1}{a-1}; \frac{a^2-1}{a^2+1} \right]$$

$$174 \quad \left[\left(1 + \frac{a^2+1}{2a} \right) : \frac{a^2+1}{a} \right] : \frac{a^2-1}{2+2a^2} + 1 \quad \left[\frac{2a}{a-1} \right]$$

$$175 \quad \left[\frac{xy+y^2}{x^2-2xy+y^2} : \frac{y^2}{x^2-y^2} + \frac{(x+y)^2}{y^2-xy} \right] : \frac{3x-y}{x^2-y^2} \quad [0]$$

$$176 \quad \left[\left(\frac{2}{x-2} + \frac{1}{2x} - \frac{1}{x-1} \right) : \left(3 + \frac{2}{x^2-xy} \right) + \frac{1}{x-2} \right] (x-2)^2 + 3 \quad \left[\frac{3}{2}x \right]$$

$$177 \quad \left[\left(\frac{4}{a^2-1} + \frac{a^2+3a+2}{a^2+a-2} - \frac{a^2-3a+2}{a^2-a-2} \right) : \frac{4a}{5-5a} + \frac{20}{3a} \right]^2 \quad \left[\frac{25}{9a^2} \right]$$

$$178 \quad \left\{ \left[\left(\frac{y+1}{y^2+9-6y} + \frac{y-2}{9-y^2} \right) : \left(\frac{1}{3+y} - \frac{1}{3-y} \right) \right] \left(3 - \frac{8y}{3y-1} \right) \right\}^3 - \frac{3}{8y^3} \quad \left[\frac{3}{y^3} \right]$$

- 179 $\left[\left(\frac{2a^2 + a}{1 - a^2} + \frac{3a}{2a - 2} + \frac{2a}{3 + 3a} \right) : \left(\frac{3}{1 - a} + \frac{2}{1 + a} + \frac{4}{a^2 - 1} \right) \right] :$
 $\left(\frac{1}{a + 1} - \frac{1}{a^2 + 1} \right) + \frac{a^2}{3} \quad \left[\frac{a^2 - 1}{6} \right]$
- 180 $\left(\frac{1}{a^2} + \frac{2}{ab} - \frac{a^2 + b^2}{a^2 b^2} - \frac{3}{b^2} + \frac{12}{3b^2} \right) : \left(\frac{1}{a} + \frac{1}{b} \right) - \frac{2}{a - b} \quad \left[-\frac{4b}{a^2 - b^2} \right]$
- 181 $\left(\frac{5a^2}{a - 1} \cdot \frac{a - 3}{a - 2} \cdot \frac{a^2 - 3a + 2}{3a^2 - 9a} - \frac{8}{3} \right) a^3 + (a^4 - 1) : (a - 1) \quad [a^2 + a + 1]$
- 182 $\left[\left(a + \frac{a}{a - 1} - \frac{a}{a + 1} \right) \cdot \frac{a^2 - 1}{a^2 + 1} + \left(\frac{1}{1 - a} - \frac{1}{1 + a} \right) : \frac{2}{1 - a^2} \right] : 2a - 1 \quad [0]$
- 183 $\left[\left(\frac{1}{1 - x} + \frac{2x}{1 - x^2} \right) \frac{x - 1}{x} + \left(\frac{x^2}{1 - x^2} + \frac{2x}{1 - x} \right) \frac{1 - x}{2 + 3x} \right] : (3x + 1 - x^2) \quad \left[-\frac{1}{x(1 + x)} \right]$
- 184 $\left[\frac{(a + 2)^2(a^2 - 2a + 4)}{a^5 - 32 + 8a^2 - 4a^3} : \frac{a^2 + ab - a}{a^2 - 3a + ab - 2b + 2} + a \right]^2 : (1 + a^2)^2 \quad \left[\frac{1}{a^2} \right]$
- 185 $1 + b \left[\frac{5}{6b} + \frac{a}{3b^2 - 2a^2} \left(\frac{2a + b}{2a} - \frac{a + 3b}{3b} \right) \right] \quad [2]$
- 186 $\left(\frac{x}{x + 1} - \frac{y}{y + 1} + \frac{x + y}{x^2 + x + y + xy} \right) \frac{y + 1}{y - 1} - \frac{1}{y^2 - 1} \quad \left[\frac{y}{y^2 - 1} \right]$
- 187 $\left[\left(\frac{2a + b}{2} - \frac{3a - b}{3} \right) \frac{a}{5} + \frac{b}{2} \left(\frac{a + 3b}{3} - \frac{a + 2b}{2} \right) \right] : \frac{ab}{6} \quad \left[\frac{1}{2} \right]$
- 188 $\left(y - \frac{x^2 y + xy^2}{x^2 + xy + y^2} \right) \left(1 + \frac{y}{x - y} \right) \left(1 - \frac{x^3}{y^3} \right) \quad [-x]$
- 189 $\left(\frac{a + 1}{b} + a \right) \left(\frac{a + 1}{b} - a \right) - \left(\frac{a + 1}{b} + 2a \right)^2 + a^2 \left(\frac{4}{b} + 5 \right) \quad \left[-\frac{4a}{b} \right]$
- 190 $\left(\frac{a + 1}{a - 1} - \frac{a + 3}{a - 2} + \frac{2a + 1}{a^2 - 3a + 2} \right) : \left(\frac{a^2 - a + 1}{a - 1} - a \right) + 1 \quad [0]$
- 191 $\left(\frac{2x - 2y}{xy + y^2} + \frac{3x + 3y}{xy - y^2} + \frac{4x^2 + 4y^2}{-x^2 y + y^3} \right) \left(\frac{2}{x + y} - \frac{1}{y} \right) \quad \left[-\frac{1}{y^2} \right]$
- 192 $\left\{ \frac{1}{a + 2b} - \frac{1}{(a + 2b)^2} \left[a - \frac{12b^2 - 2a(a + b)}{a - 2b} \right] \right\} : \left(\frac{1}{2b - a} + \frac{6b - a}{a^2 - 4b^2} \right) \quad [1]$
- 193 $\left(\frac{2ab}{a + b} - a \right) : \left(\frac{1}{b} + \frac{1}{a - 2b} \right) + \left(\frac{2ab}{a + b} - b \right) : \left(\frac{1}{a} + \frac{1}{b - 2a} \right) \quad [ab]$
- 194 $\left(\frac{2a}{1 - a^2} + \frac{1}{a - a^2} - \frac{1}{1 - a} \right) \cdot \left(1 - \frac{2}{a^2 + 1} \right) \cdot \frac{a}{a - 1} \quad \left[-\frac{1}{a - 1} \right]$
- 195 $\left(\frac{1}{a - b} + \frac{1}{a + b} \right) \cdot \left(\frac{a + b}{a^3 - b^3} + \frac{1}{b^2 - a^2} \right) \cdot \frac{(a^2 - b^2)(a^3 - b^3)}{ab} \quad \left[\frac{2a}{a + b} \right]$
- 196 $\left(\frac{x + a}{x - a} - \frac{x - a}{x + a} \right) : \left(1 - \frac{x - a}{x + a} \right) \quad \left[\frac{2x}{x - a} \right]$