

# Base algèbre 5ème : Rappels de calcul algébrique

## Solutions

1. Simplifier les expressions suivantes en ne laissant aucun exposant négatif  
 $(a, b, c, x, y, z \in \mathbb{R}_0)$ .

$$(a) \left(-\frac{1}{2}a^3b\right)\left(-\frac{4}{5}ab^3c\right)\left(-\frac{5}{2}a^7\right) = -\frac{20}{20} a^{3+1+7} b^{1+3} c^1 \\ = -a^{11} b^4 c$$

$$(b) \frac{3(xy)^2z}{5ab^2} \cdot \frac{2ab}{xy^2} \cdot \frac{15z}{2} = \frac{90}{10} x^{2-1} y^{2-2} z^{1+1} a^{1-1} b^{1-2} \\ = 9 x z^2 b^{-1} = \frac{9xz^2}{b}$$

$$(c) (-3abc)^2 \cdot \left(\frac{1}{27}a^4b\right) 9a^4b^{12} = 9 a^2 b^2 c^2 \frac{1}{27} a^4 b \cdot 9 a^4 b^{12} \\ = \frac{81}{27} a^{2+4+4} b^{2+1+12} c^2 = 3 a^{10} b^{15} c^2$$

$$(d) \left(-\frac{3x^{-1}}{2y}\right) \cdot \left(\frac{-7x^2y}{-3z^{-2}}\right)^2 \cdot \left(\frac{14yz^{-3}}{-x^4}\right)^{-3} = -\frac{3}{2xy} \cdot \frac{49x^4y^2z^4}{9^3} \cdot \left(\frac{-x^4z^3}{14y}\right)^3 \\ = -\frac{49}{6} x^{4-1} y^{2-1} z^4 \left( + \frac{x^{12}z^9}{14^3 y^3} \right) \\ = \frac{1}{336} x^{3+12} y^{1-3} z^{4+9} \\ = \frac{x^{15} z^{13}}{336 y^2}$$

2. Déterminer le quotient  $Q(x)$  et le reste  $R(x)$  de la division de  $P(x)$  par  $d(x)$  si :

(a)  $P(x) = 10x^3 + 17x^2 - 3x - 4$  et  $d(x) = 2x + 3$

$$\begin{array}{r} 10x^3 + 17x^2 - 3x - 4 \\ \underline{- (10x^3 + 15x^2)} \\ 2x^2 - 3x \\ \underline{- (2x^2 + 3x)} \\ -6x - 4 \\ \underline{- (-6x - 9)} \\ 5 \end{array} \quad \begin{array}{c} 2x + 3 \\ \hline 5x^2 + x - 3 \end{array}$$

$$Q(x) = 5x^2 + x - 3$$

$$R(x) = 5$$

$$(b) P(x) = x^5 - x^4 - 2x^3 - 3x^2 + 4x + 5 \text{ et } d(x) = x^2 - x - 3$$

$$\begin{array}{r} x^5 - x^4 - 2x^3 - 3x^2 + 4x + 5 \\ - (x^5 - x^4 - 3x^3) \\ \hline x^3 \\ - (x^3 - x^2 - 3x) \\ \hline - 2x^2 + 7x \\ - (-2x^2 + 2x + 6) \\ \hline 5x + 6 \end{array} \quad \left| \begin{array}{l} x^2 - x - 3 \\ \hline x^3 + x - 2 \end{array} \right.$$

$$Q(x) = x^3 + x - 2$$

$$R(x) = 5x + 6$$

$$(c) P(x) = x^6 + 2x^5 - 3x^3 - 4x^2 + x + 1 \text{ et } d(x) = x^3 - 2$$

$$\begin{array}{r} x^6 + 2x^5 \\ - (x^6 - 2x^3) \\ \hline 2x^5 - x^3 \\ - (2x^5 - 4x^2) \\ \hline -x^3 + x + 1 \\ - (-x^3 + 2) \\ \hline x - 1 \end{array} \quad \left| \begin{array}{c} x^3 - 2 \\ \hline x^3 + 2x^2 - 1 \end{array} \right.$$

$$Q(x) = x^3 + 2x^2 - 1$$

$$R(x) = x - 1$$

$$(d) P(x) = 5x^6 + x^5 + x^4 - 4x^2 \text{ et } d(x) = x^4 - 1$$

$$\begin{array}{r} 5x^6 + x^5 + x^4 \\ - (5x^6) \\ \hline x^5 + x^4 + x^2 \\ - (x^5) \\ \hline x^4 + x^2 + x \\ - (x^4) \\ \hline x^2 + x \\ - 1 \\ \hline x^2 + x + 1 \end{array}$$

$x^4 - 1$   
 $5x^2 + x + 1$

$$Q(x) = 5x^2 + x + 1$$

$$R(x) = x^2 + x + 1$$

3. Sans effectuer la division, déterminer le reste des divisions suivantes

(a)  $(x^2 + x - 6) \div (x + 4)$

$$P(-4) = (-4)^2 + (-4) - 6 = 6$$

(b)  $(-5x^2 + 7x + 3) \div (x - 7)$

$$P(7) = -5(7)^2 + 7(7) + 3 = -193$$

(c)  $(x^2 - 5x + 6) \div (x - \sqrt{3})$

$$P(\sqrt{3}) = 9 - 5\sqrt{3}$$

4. Compléter

(a)  $(2x+3)(4x^2 - 6x + 9) = 8x^3 + 27$

(b)  $(9x^2 + 15x + 25)(3m-5) = 27x^3 - 125$

(c)  $(11m+6)(121x^2 + 66x + 36) = 1331x^3 - 216$

(d)  $(x^3 - 2)(...x^6...) = x^9 - 8$

$$\textcircled{x} \quad x^6 + 2x^2 + 4$$

(e)  $(3x^3 + 2x)(...x^6...) = 27x^9 + 8x^3$

$$\textcircled{x} \quad 9x^6 - 6x^4 + 4x^2$$

5. Développer les expressions suivantes :

$$(a) (2a+b)^3 = (2a)^3 + 3(2a)^2b + 3(2a)b^2 + b^3$$

$$= 8a^3 + 12a^2b + 6ab^2 + b^3$$

$$(b) (x-3z)^3 = x^3 - 3x^2(3z) + 3x(3z)^2 - (3z)^3$$

$$= x^3 - 9x^2z + 27xz^2 - 27z^3$$

$$(c) \left(\frac{x}{3} - 2z\right)^3 = \left(\frac{x}{3}\right)^3 - 3\left(\frac{x}{3}\right)^2(2z) + 3\left(\frac{x}{3}\right)(2z)^2 - (2z)^3$$

$$= \frac{x^3}{27} - \frac{2x^2z}{3} + 4xz^2 - 8z^3$$

$$(d) \left(\frac{a}{2b} + \frac{b}{3a}\right)^3 = \left(\frac{a}{2b}\right)^3 + 3\left(\frac{a}{2b}\right)^2\left(\frac{b}{3a}\right) + 3\frac{a}{2b}\left(\frac{b}{3a}\right)^2 + \left(\frac{b}{3a}\right)^3$$

$$= \frac{a^3}{8b^3} + \frac{a}{4b} + \frac{b}{6a} + \frac{b^3}{27a^3}$$

$$(e) (2x-3)^3 - (4x+1)^2$$

$$= 8x^3 - 36x^2 + 54x - 27 - (16x^2 + 8x + 1)$$

$$= 8x^3 - 52x^2 + 46x - 28$$

$$(f) x^2(3x-1)^2 + (2x-4)^3$$

$$= x^2(9x^2 - 6x + 1) + (8x^3 - 48x^2 + 96x - 64)$$

$$= 9x^4 + 2x^3 - 47x^2 + 96x - 64$$

$$(g) (x^2 - 4x + 2)(x-3)^2 - (2x-1)^3$$

$$= (x^4 - 4x^3 + 2x^2)(x^2 - 6x + 9) - (8x^3 - 12x^2 + 6x - 1)$$

$$= x^4 - 18x^3 + 47x^2 - 54x + 13$$

6. Factoriser les expressions suivantes :

$$(a) 15a^7b^2 - 10a^5b^3$$

$$= 5a^5b^2(3a^2 - 2b)$$

(h) = Horner

$$(b) y(b-a) + x(a-b)$$

$$= (b-a)(y-x)$$

$$(c) 45x^3y^4z^5 + 60x^5y^2z - 90x^4y^3z^2$$

$$= 15x^3y^2z(4x^2 - 6xyz + 3y^2z^2)$$

$$(d) (a-1)^2 - 1 = (a-1-1)(a-1+1) = a(a-2)$$

$$(e) a^4 - 2a^3 + a - 2 = (a^4 - 2a^3) + (a - 2)$$

$$= a^3(a-2) + (a-2)$$

$$= (a-2)(a^3 + 1)$$

$$= (a-2)(a+1)(a^2 - a + 1) \text{ on } (H)$$

$$(f) x^3 + 2x^2 - 5x - 6 \stackrel{(H)}{=} (x+1)(x-2)(x+3)$$

$$(g) x^4 - 7x^3 + 17x^2 - 17x + 6 \stackrel{(H)}{=} (x-1)^2(x-2)(x-3)$$

$$(h) 8x^3 + 36x^2y + 54xy^2 + 27y^3 = (2x + 3y)^3$$

$$(i) 27x^3 - 108x^2y + 144xy^2 - 64y^3 = (3x - 4y)^3$$

$$(j) 40x^9 + 60x^6 + 30x^3 + 5 = 5(8x^9 + 12x^6 + 6x^3 + 1)$$
$$= 5(2x^3 + 1)^3$$

$$(k) a^6 - b^6 = (a^3 - b^3)(a^3 + b^3)$$

$$= (a - b)(a^2 + ab + b^2)(a + b)(a^2 - ab + b^2)$$

$$\text{ou} = (a^2 - b^2)(a^4 + a^2b^2 + b^4)$$

$$= (a - b)(a + b)(a^4 + a^2b^2 + b^4)$$

$$(l) x^6 - 27y^3 = (x^2 - 3y)(x^4 + 3x^2y + 9y^2)$$

$$(m) 128a^5b - 2a^2b^4 = 2a^2b(a^3 - b^3)$$

$$= 2a^2b(4a - b)(16a^2 + 4ab + b^2)$$

7. Réduire les expressions suivantes après avoir donné les conditions d'existence :

$$(a) \frac{x+1}{2x^3-4x^2} + \frac{x-1}{2x^3+4x^2} - \frac{1}{x^2-4} \quad (1)$$

$$\begin{aligned} \text{C.E. : } & 2x^3 - 4x^2 \neq 0 \Leftrightarrow 2x^2(x-2) \neq 0 \Leftrightarrow x \neq 0, x \neq 2 \\ & 2x^3 + 4x^2 \neq 0 \Leftrightarrow 2x^2(x+2) \neq 0 \Leftrightarrow x \neq 0, x \neq -2 \\ & x^2 - 4 \neq 0 \Leftrightarrow (x-2)(x+2) \neq 0 \Leftrightarrow x \neq 2, x \neq -2 \end{aligned}$$

$$\text{D.C. : } 2x^2(x-2)(x+2) \quad (\text{dén. commun})$$

$$\begin{aligned} (1) &= \frac{(x+1)(x+2)}{\cancel{2x^2}} + \frac{(x-1)(x-2)}{\cancel{2x^2}} - \frac{1}{\cancel{2x^2}} \\ &= \frac{x^2 + 3x + 2 + x^2 - 3x + 2 - 1}{\cancel{2x^2}} \end{aligned}$$

$$= \frac{4}{\cancel{2x^2}}$$

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

$$(b) \frac{x^2 + 8x + 7}{5x + 35} \cdot \frac{x^2 - 1}{x^2 + 2x + 1} \quad (1)$$

$$\text{LÉ: } 5x + 35 \neq 0 \iff x \neq -7$$

$$x^2 + 2x + 1 \neq 0 \iff (x+1)^2 \neq 0 \iff x \neq -1$$

$$(1) \stackrel{(H)}{=} \frac{(x+1)(x+7)(x-1)(x+1)}{5(x+7)(x+1)^2} = \frac{x-1}{5}$$

$$(c) \frac{a^2 + a - 2}{a^2 + 2a - 15} \div \frac{a^2 + 7a + 10}{a^2 + 10a + 25} \quad (1)$$

$$\text{LÉ: } a^2 + 2a - 15 \neq 0 \stackrel{(H)}{\iff} (a+5)(a-3) \neq 0$$

$$\iff a \neq -5 \text{ et } a \neq 3$$

$$a^2 + 7a + 10 \neq 0 \stackrel{(H)}{\iff} (a+5)(a+2) \neq 0$$

$$\iff a \neq -5 \text{ et } a \neq -2$$

$$a^2 + 10a + 25 \neq 0 \iff (a+5)^2 \iff a \neq -5$$

$$(1) \stackrel{(H)}{=} \frac{(a+2)(a-1)}{(a+5)(a-3)} \cdot \frac{(a+5)^2}{(a+5)(a+2)}$$

$$= \frac{a-1}{a-3}$$

$$(d) \frac{x-6}{x^2+6x+9} \div \left( \frac{x^3-4x}{x^2+4x+4} \cdot \frac{x^2-4x-12}{x^3-9x} \right) (1)$$

CE :  $x \neq \pm 2, x \neq \pm 3, x \neq 6, x \neq 0$

$$\begin{aligned} (1) &= \frac{x-6}{(x+3)^2} \left( \frac{(x+2)^2}{x^2(x^2-4)} - \frac{x^2(x^2-9)}{(x-6)(x+2)} \right) \\ &= \frac{(x+2)^2(x-3)(x+3)}{(x+3)^2(x-2)(x+2)(x+2)} \\ &= \frac{x-3}{(x+3)(x-2)} \end{aligned}$$

8. Résoudre les équations suivantes dans  $\mathbb{R}$

$$(a) \frac{2x-8}{4x-1} + \frac{7-7x}{28x} = \frac{1}{4}$$

CE :  $x \neq \frac{1}{4}, x \neq 0$   
DC :  $(4x-1) 4x$

$$\Leftrightarrow \frac{4x(2x-8)+(1-x)(4x-1)}{4x} = \frac{(4x-1)x}{4x}$$

$$\Leftrightarrow 8x^2 - 32x - 4x^2 + 5x - 1 = 4x^2 - x$$

$$\Leftrightarrow -26x = 1$$

$$\Rightarrow x = -\frac{1}{26}$$

$$S: \left\{ -\frac{1}{26} \right\}$$

$$(b) \frac{6-5x}{2x+3} + \frac{1-3x}{-6x-3} = -2$$

$$\underline{\text{CE}} : x \neq -\frac{3}{2}, x \neq -\frac{1}{2}$$

$$\underline{\text{DC}} : -3(2x+1)(2x+3)$$

$$\Leftrightarrow \frac{-3(c-s_n)(2n+1)}{\cancel{\text{DC}}} + \frac{(1-3n)(2n+3)}{\cancel{\text{DC}}} + \frac{6(2n+1)(2n+3)}{\cancel{\text{DC}}}$$

$$\Leftrightarrow \cancel{30x^2} - 21x - 18 - \cancel{6x^2} - 7x + 3 = \cancel{24x^2} + 48x + 18$$

$$\Leftrightarrow -76x = 33$$

$$\Leftrightarrow x = -\frac{33}{76}$$

$$S: \left\{ -\frac{33}{76} \right\}$$

$$(c) \frac{-3x-10}{x-3} + \frac{2x-10}{2x+5} = -2$$

$$\underline{\text{CE}} : x \neq 3, x \neq -\frac{5}{2}$$

$$\underline{\text{DC}} : (x-3)(2x+5)$$

$$\Leftrightarrow \frac{(-3x-10)(2x+5)}{\cancel{\text{DC}}} + \frac{(2x-10)(x-3)}{\cancel{\text{DC}}} = \frac{-2(x-3)(2x+5)}{\cancel{\text{DC}}}$$

$$\Leftrightarrow \cancel{-6x^2 - 35x - 50} + \cancel{2x^2 - 16x + 30} = \dots \\ \dots - \cancel{4x^2} + 2x + 30$$

$$\Leftrightarrow -53x = 50$$

$$\Leftrightarrow x = -\frac{50}{53}$$

$$S: \left\{ -\frac{50}{53} \right\}$$

$$(d) 2x^2 + x - 15 = 0$$

$$\Leftrightarrow (x+3)(2x-5) = 0$$

$$\Leftrightarrow \begin{cases} x+3=0 \\ 2x-5=0 \end{cases} \Leftrightarrow \begin{cases} x=-3 \\ x=\frac{5}{2} \end{cases}$$

$$S: \left\{-3, \frac{5}{2}\right\}$$

$$(e) (x-3)(2x+1) + (4x-2)(3x-9) - 2x + 6 = 0$$

$$\Leftrightarrow (x-3)(2x+1) + 6(2x-1)(x-3) - 2(x-3) = 0$$

$$\Leftrightarrow (x-3) [2x+1 + 6(2x-1) - 2] = 0$$

$$\Leftrightarrow (x-3)(14x-7) = 0$$

$$\Leftrightarrow \begin{cases} x-3=0 \\ 14x-7=0 \end{cases} \Leftrightarrow \begin{cases} x=3 \\ x=\frac{1}{2} \end{cases}$$

$$S: \left\{\frac{1}{2}, 3\right\}$$

$$(f) (2x^2 - 5x + 8)^2 = (x^2 + 3x - 8)^2$$

$$\Leftrightarrow (2x^2 - 5x + 8)^2 - (x^2 + 3x - 8)^2 = 0$$

$$\Leftrightarrow [(2x^2 - 5x + 8) - (x^2 + 3x - 8)] \cdot \dots$$

$$\dots [ (2x^2 - 5x + 8) + (x^2 + 3x - 8) ] = 0$$

$$\Leftrightarrow (x^2 - 8x + 16)(3x^2 - 2x) = 0$$

$$\Leftrightarrow x(x-4)^2(3x-2) = 0$$

$$S : \left\{ 0, \frac{2}{3}, 4 \right\}$$

$$9 \quad (a) \frac{x-7}{2} - 4x \geq 12 - 6x$$

$$\Leftrightarrow x - 7 - 8x \geq 24 - 12x$$

$$\Leftrightarrow 5x \geq 31$$

$$\Leftrightarrow x \geq \frac{31}{5}$$

$$S: \left[ \frac{31}{5}, +\infty \right)$$

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

$$\Rightarrow 18 - 3(x-2) + 4 > 18x$$

$$\Leftrightarrow -21x > -28$$

$$\Leftrightarrow x < -\frac{28}{21} \Leftrightarrow x < -\frac{4}{3}$$

$$S: -\infty, -\frac{4}{3}$$

$$(2) \frac{x+7}{9} - \frac{3x-2}{2} < \frac{x+4}{18} - 1$$

$$\Leftrightarrow \frac{2x+14 - (27x-18)}{18} < \frac{x+4-18}{18}$$

$$\Leftrightarrow -25x + 32 < x - 14$$

$$\Leftrightarrow -26x < -46$$

$$\Leftrightarrow x > \frac{46}{26}$$

$$\Leftrightarrow x > \frac{23}{13}$$

$$S: \left] \frac{23}{13}, +\infty \right[$$

$$(3) \frac{2x-5}{6} - \frac{x+1}{3} \geq \frac{4x-1}{2}$$

$$\frac{2x-5 - 2(x+1)}{4} \geq \frac{12x-3}{6}$$

$$\Rightarrow 2x-5 - 2(x+1) \geq 12x-3$$

$$-4 \geq 12x$$

$$x \leq -\frac{1}{3}$$

$$S: -\infty, -\frac{1}{3} \left[$$

$$(2) (*) \frac{1}{5}(-x - 12) + \frac{1}{8}(2x - 12) > \frac{1}{10}(-5x - 12) + \frac{1}{3}(12 - 3x)$$

$$\Leftrightarrow \frac{-24x - 288 + 30x - 192}{110} > \frac{-60x - 144 + 480 - 120x}{110}$$

$$\Leftrightarrow 18x > 804$$

$$\Leftrightarrow x > \frac{804}{186}$$

$$\Leftrightarrow x > \frac{134}{31}$$

$$S: \left[ \frac{134}{31}, +\infty \right)$$

$$(3) (*) \frac{1}{4}(-x - 11) + \frac{1}{4}(7x + 1) \geq \frac{1}{8}(-6x - 3) + \frac{1}{8}(1 - 5x)$$

$$\Leftrightarrow \frac{-2x - 22 + 14x + 2}{8} \geq \frac{-6x - 3 + 1 - 5x}{8}$$

$$\Leftrightarrow 23x \geq 18$$

$$\Leftrightarrow x \geq \frac{18}{23}$$

$$S: \left[ \frac{18}{23}, +\infty \right)$$

10. Etudier le signe des fonctions suivantes :

(a)  $4x^2 - 9$

zéros:  $4x^2 - 9 = 0 \Leftrightarrow (2x-3)(2x+3) = 0$

$n$		$-\frac{3}{2}$		$\frac{3}{2}$	
$2x-3$	-		-	0	+
$2x+3$	-	0	+		+
$E(n)$	+	0	-	0	+

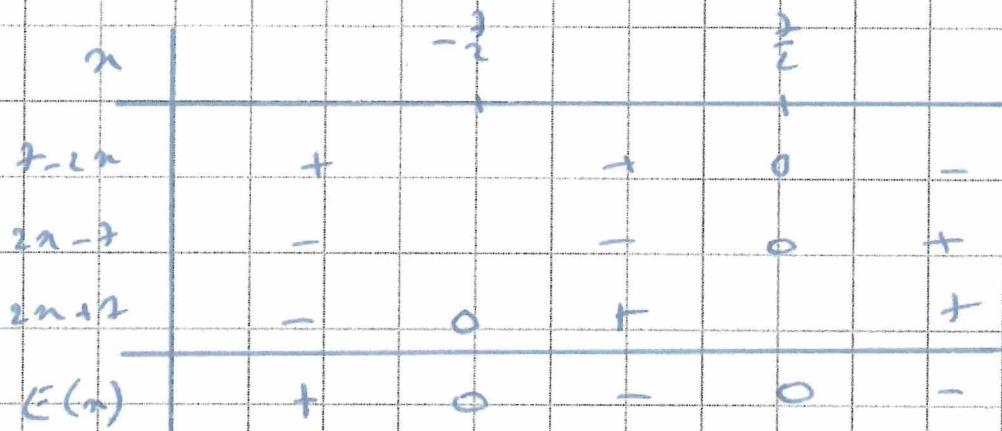
(b)  $-(x-1)(x+2)$

zéros:  $n=1$  et  $n=-2$

$n$		$-2$		$1$	
$-1$	-		-		-
$n-1$	-		-	0	+
$n+2$	-	0	+		+
$E(n)$	-	0	+	0	-

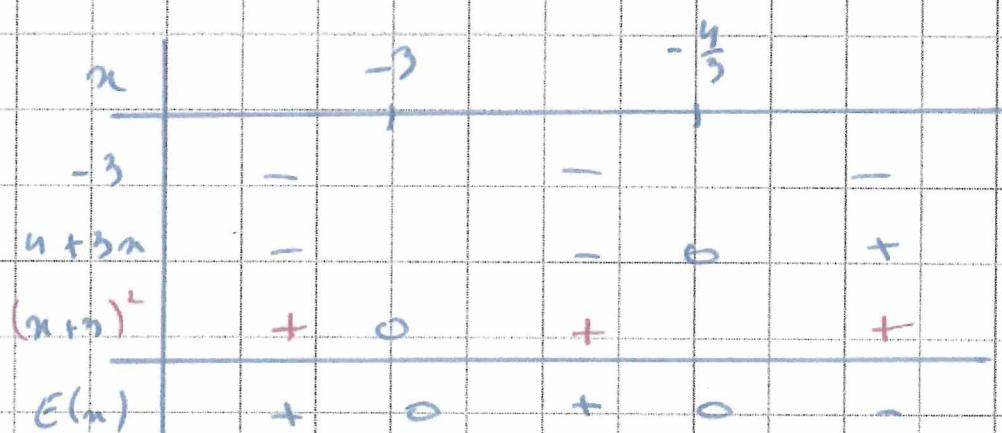
$$(c) (7 - 2x)(4x^2 - 49)$$

zéros:  $x = \frac{7}{2}$  /  $4x^2 - 49 = 0 \Leftrightarrow (2x-7)(2x+7) = 0$



$$(d) -3(4 + 3x)(x + 3)^2$$

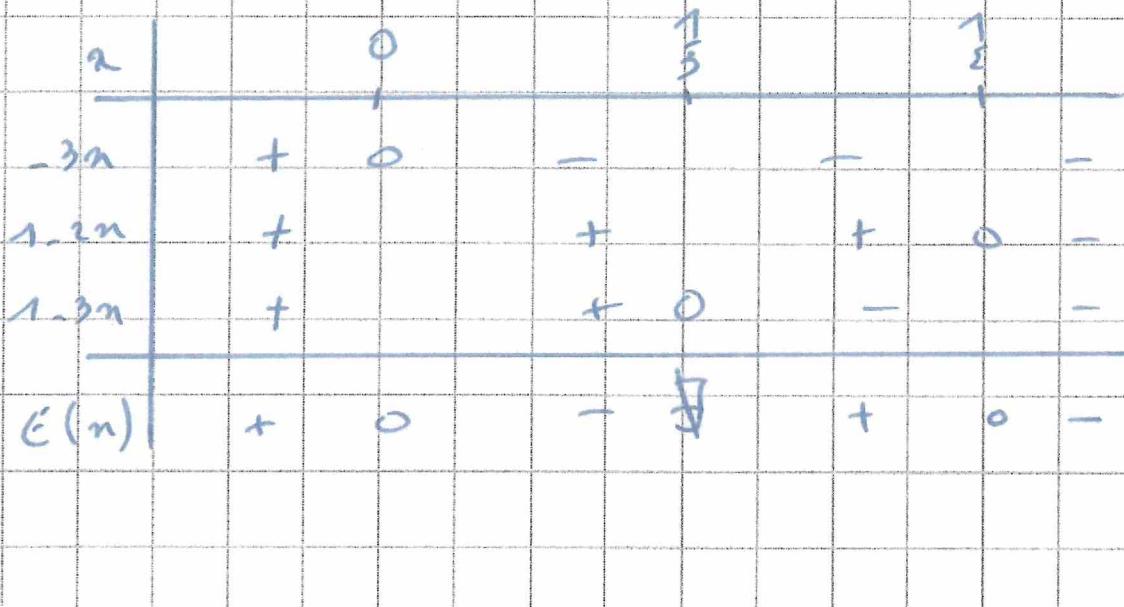
zéros:  $x = -\frac{4}{3}$  et  $x = -3$



$$(e) \frac{-3x(1-2x)}{1-3x}$$

zeros  $N: n=0$  at  $x = \frac{1}{2}$

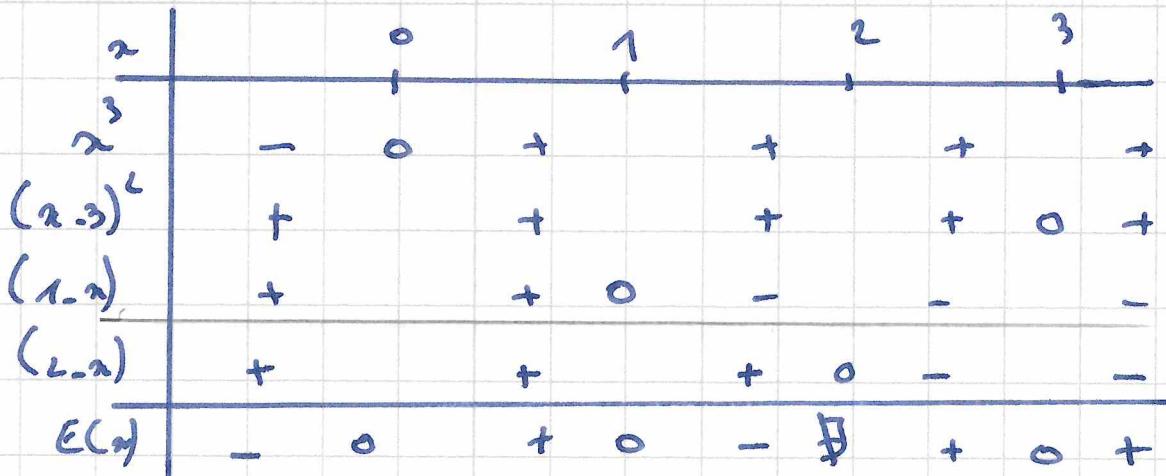
$$D: x = \frac{1}{3}$$



$$(f) \frac{x^3(x-3)^2(1-x)}{2-x}$$

zeros  $N: x=0, x=3, x=1$

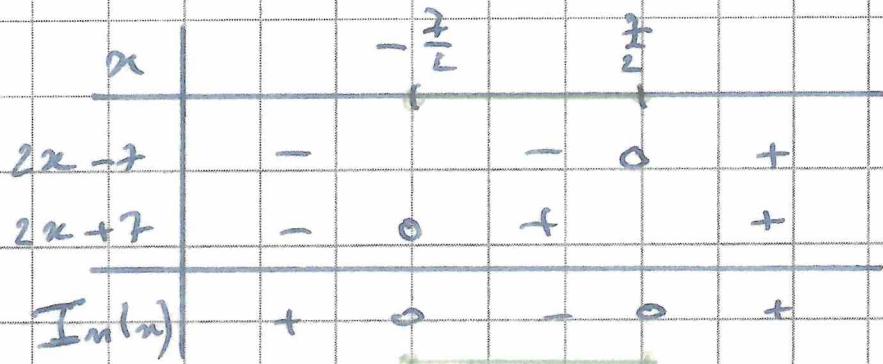
$$D: x=2$$



M. Résoudre les inéquations suivantes dans  $\mathbb{R}$

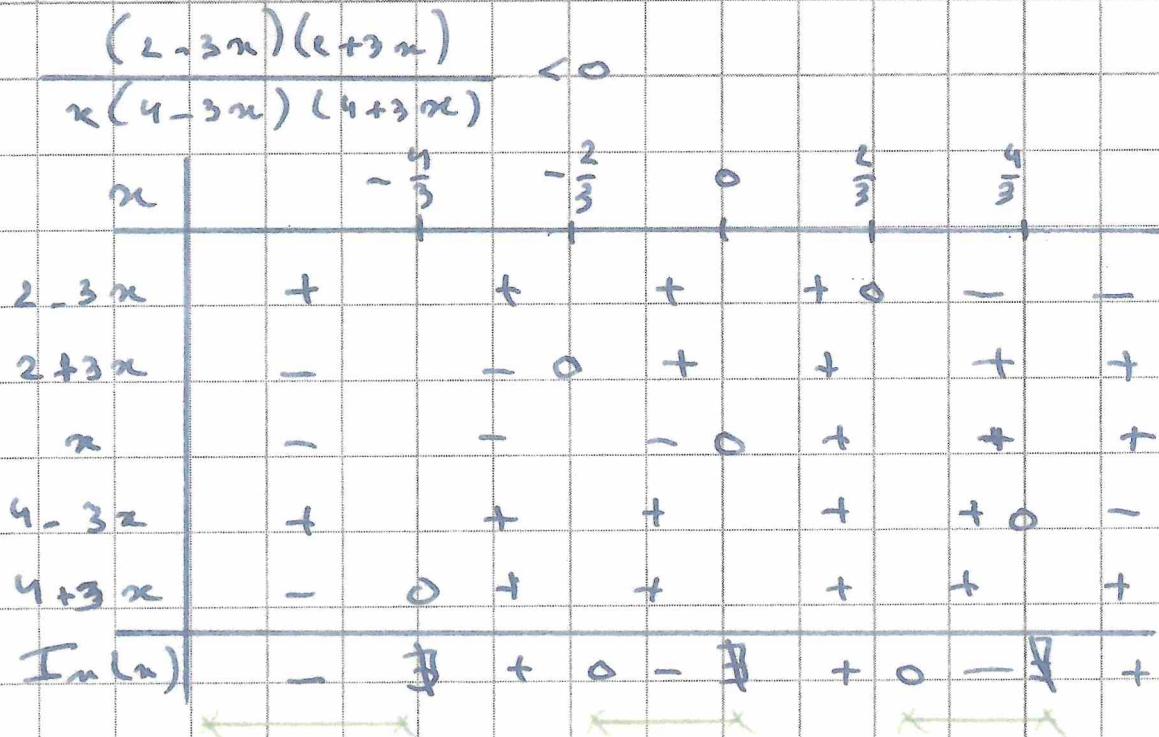
(a)  $4x^2 - 49 \leq 0$

$$\Leftrightarrow (2x-7)(2x+7) \leq 0$$



$$S : \left[ -\frac{7}{2}, \frac{7}{2} \right]$$

(b)  $\frac{(2-3x)(2+3x)}{x(16-9x^2)} < 0$



$$S : -\infty, -\frac{4}{3} \cup \left[ -\frac{2}{3}, 0 \right] \cup \left[ \frac{2}{3}, \frac{4}{3} \right]$$

$$(1) \frac{2x-1}{x+3} > \frac{2x}{x-4}$$

$$\Leftrightarrow \frac{2x-1}{x+3} - \frac{2x}{x-4} > 0$$

$$\Leftrightarrow \frac{(2x-1)(x-4) - 2x(x+3)}{(x+3)(x-4)} > 0$$

$$\Leftrightarrow \frac{2x^2 - 8x - x + 4 - (2x^2 + 6x)}{(x+3)(x-4)} > 0$$

D

$$\Leftrightarrow \frac{-15x + 4}{(x+3)(x-4)} > 0$$

Zeil 1: N:  $x = \frac{4}{15}$

D:  $x = -3, x = 4$

$$\begin{array}{c|ccccc} x & -3 & \frac{4}{15} & 4 \\ \hline + & + & 0 & - \\ - & 0 & + & + \\ 0 & - & - & 0 \\ \hline \end{array}$$

$$\begin{array}{c|ccccc} x & -3 & \frac{4}{15} & 4 \\ \hline + & + & 0 & - \\ - & 0 & + & + \\ 0 & - & - & 0 \\ \hline \end{array}$$

Ineq:  $\begin{array}{ccccccc} + & \# & - & 0 & + & \# & - \\ \times & \times & \times & \times & \times & \end{array}$

S:  $-\infty, -3 \cup \left] \frac{4}{15}, 4 \right[$

$$\textcircled{d} \quad \frac{x+3}{x^2-1} \geq \frac{3}{x-1}$$

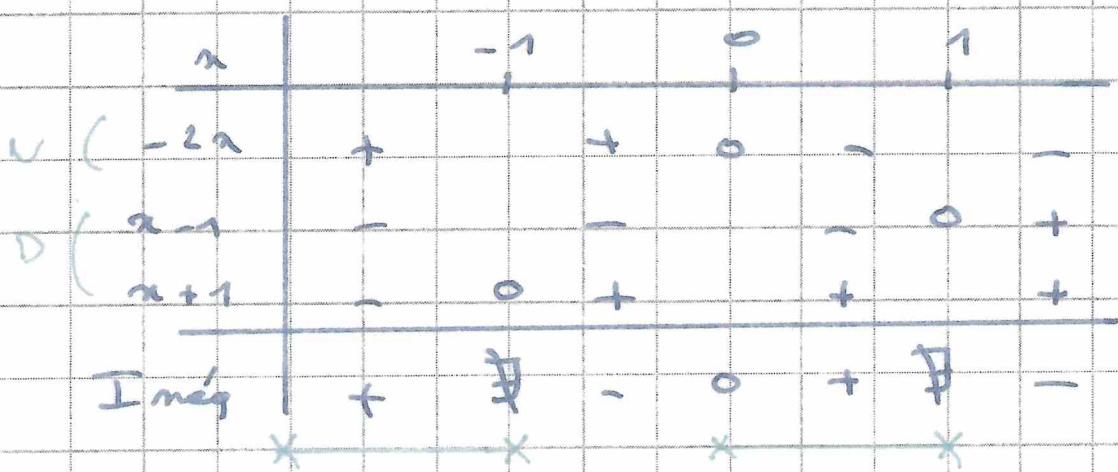
$$\Leftrightarrow \frac{x+3}{(x-1)(x+1)} - \frac{3}{x-1} \geq 0$$

$$\Leftrightarrow \frac{x+3 - 3(x+1)}{(x-1)(x+1)} \geq 0$$

$$\Leftrightarrow \frac{-2x}{(x-1)(x+1)} \geq 0$$

zéros N:  $x=0$

D:  $x=1, x=-1$



$$S: -\infty, -1] \cup [0, 1[$$

$$(2) \cdot \frac{x+1}{1-x} + \frac{x-2}{x+2} \leq \frac{-6}{x-1} + \frac{15}{x^2+x-2}$$

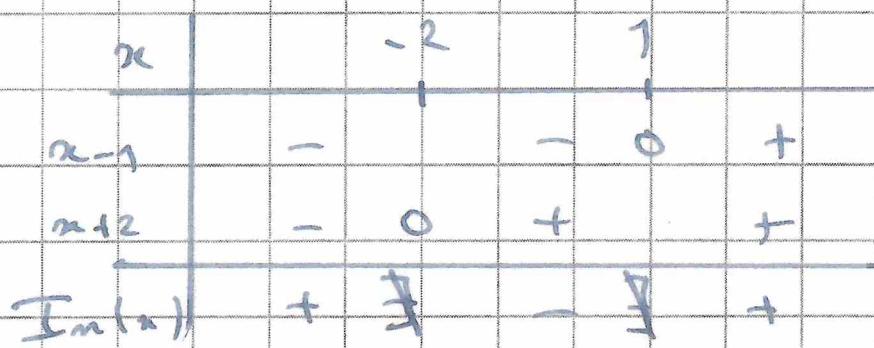
$$x^2 + x - 2 \stackrel{(1)}{=} (x+2)(x-1)$$

$$\frac{-(x+1)(x+2) + (x-2)(x-1) + 6(x+2) + 15}{(x-1)(x+2)} \leq 0$$

~~$$-(x^2 + 3x + 2) + (x^2 - 3x + 2) + 6x + 12 + 15 \leq 0$$~~

D

$$\frac{27}{(x-1)(x+2)} \leq 0$$



$$5. ]_{-2, 1}[$$

$$(f) \frac{x}{2-x} < \frac{2x+10}{x^2+3x-10}$$

$$x^2 + 3x - 10 = (x+5)(x-2)$$

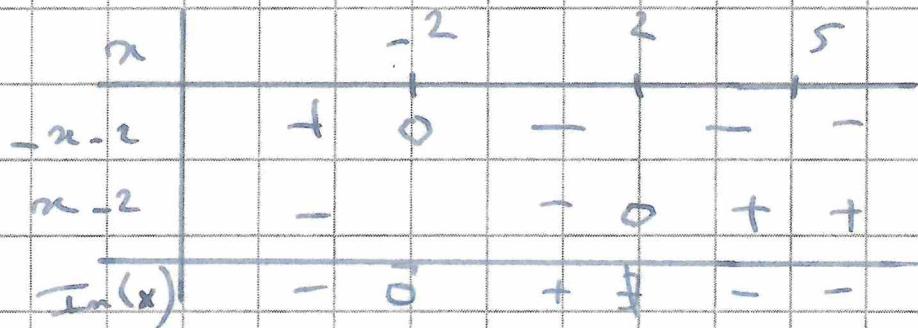
$$\frac{-x(x+5) - (2x+10)}{(x+5)(x-2)} < 0$$

$$\frac{-x^2 - 5x - 2x - 10}{(x+5)(x-2)} < 0$$

$$\frac{-x^2 - 7x - 10}{(x+5)(x-2)} < 0$$

$$\frac{-(x+2)(x+5)}{(x+5)(x-2)} < 0$$

CE :  $x \neq -5$



$$S : -\infty, -2 \cup ]2, 5[ \cup ]5, +\infty$$