



1. Realiza la operación:

1. $\frac{(2x^3)^3 x}{-2x \cdot 2}$	2. $\frac{-3(2x^2)^3}{3(-3x^2)}$	3. $\frac{(-x)^2(-2)}{(-x^2)^3(-1)}$	4. $\frac{(3x^2)^2 2}{-2x^3(-3x)}$	5. $\frac{(2x^2)^2(-2)}{-3x \cdot x}$	6. $\frac{(x^3)^2 3x^2}{(-2x)^3 3x^3}$
7. $\frac{2(-2)}{(-2x^3)^2 2x}$	8. $\frac{(3x^3)^2 3x^2}{-3(-3)}$	9. $\frac{(x^3)^2(-x^2)}{(-2x^2)^3(-3)}$	10. $\frac{(-x^2)^3(3x)^3}{(3x)^3(-2x^3)}$	11. $\frac{-2x^3(3x^3)^2}{-3x^2 \cdot 2}$	12. $\frac{(2x)^2(3x^3)^2}{(-2x^3)^2(-1)}$
13. $\frac{-2x^2(-2x^3)^3}{2(-2)}$	14. $\frac{2(x^2)^2}{(3x^2)^3(-2x)^2}$	15. $\frac{(3x^2)^3(2x^3)^2}{(2x^2)^3(3x^2)^2}$	16. $\frac{(-x^2)^2(-3x^3)^3}{-3(-2x^2)}$	17. $\frac{-2x}{(-2x^3)^2(-3x)^3}$	18. $\frac{(-3x^3)^2(-2x^2)}{3x(-2)}$
19. $\frac{(3x^2)^2(3x^2)^3}{(-x^3)^3(x^2)^3}$	20. $\frac{(-2x)^2(-2x^3)^2}{(-3x)^2(-x^2)^3}$	21. $\frac{-3x^2(-1)3x}{(x^2)^3 3(3x^2)^2}$	22. $\frac{-2(-x^3)^3(x^2)^2}{-2x(-3)}$	23. $\frac{(2x^2)^3(-3x^3)^2}{(3x)^3(3x)^2}$	24. $\frac{(-3x^3)^3(-2x^3)^2}{(2x)^3(-x^2)^3}$

2. Realiza la operación:

1. $\frac{-2(y^3)^2}{(-3y)^3 x}$	2. $\frac{3(-3xy)^2}{(2y^3)^2 3y^3}$	3. $\frac{(3x)^2(-2x)}{-x(-3)}$	4. $\frac{-2y \cdot 3}{-3y^2(-xy^2)}$	5. $\frac{xy \cdot xy}{-x(-3xy^3)^3}$	6. $\frac{-xy^2(3y^3)^2}{(y^3)^2(-1)}$
7. $\frac{-xy^2(3y^3)^3}{y(-2y^3)}$	8. $\frac{-3y}{2y^3(-3xy^3)}$	9. $\frac{(-xy)^3 3}{(-3y^3)^3(-3y)}$	10. $\frac{(2y^2)^2(-xy^2)}{-3(-2xy^2)}$	11. $\frac{(-3xy)^3(y^2)^3}{-y^3(3x)^2}$	12. $\frac{(-xy^2)^3(2x)^2}{(-x)^2(2y)^2}$
13. $\frac{-2y^3 y}{(-2y^3)^2(-y^2)^2}$	14. $\frac{y^3(2y^3)^3}{(3x)^2(2xy^3)^2}$	15. $\frac{2(2y^3)^3}{(-xy^3)^3(-2x)^2}$	16. $\frac{3(-2y)^2}{(-2xy^3)^2(-3y)}$	17. $\frac{2y^3(-y^2)}{(-xy^2)^2(xy^2)^3}$	18. $\frac{(2xy)^2 3x}{(-2x)^2(2xy^2)^3}$

3. Halla el valor numérico de la siguiente expresión:

1. $-2x^4 - 3x^2 - 2$; $x = 2$	2. $-3x^3 - 2x - 2$; $x = -1$	3. $2x^3 - 2x^2 - 1$; $x = -2$	4. $-3x^2 + x^2 + 2x$; $x = 2$
5. $x^3 + 3x^2 - x + 3$; $x = -2$	6. $x^4 + 3x^3 + 3x - 3$; $x = -1$	7. $3x^3 + 2x^2 + 3x - 2$; $x = 2$	8. $-x^4 - 3x^3 + x^2 + 2$; $x = -3$
9. $2x^4 + 2x^3 - 2x^2 - 3$; $x = 1$	10. $x^4 - 3x^3 + 2x^2 + 2x$; $x = 2$	11. $-x(2x+2) - 3x(x+1)$; $x = 1$	12. $-3(x+2) + x(3x-2)$; $x = -3$
13. $-3(2x-2) - 3(3x-1)$; $x = -1$	14. $-2x(x-3) + 3(2x+1)$; $x = -2$	15. $-3x(2x+3) - x(x-2)$; $x = -3$	16. $2x(2x+2) + 2(2x+1)$; $x = -2$
17. $-3(2x+3) - 3x(3x+1)$; $x = -1$	18. $-3x(3x-2) + x(3x+2)$; $x = -1$	19. $-2x - 2(x-3) + x(2x-3)$; $x = 2$	20. $-x - x(3x+1) - x(2x-3)$; $x = -2$

4. Realiza la operación:

1. $-x \cdot (2x^2 + x + 2)$	2. $2x \cdot (-4x^2 + x + 2)$	3. $-(3x+2) + (-4x+2)$	4. $(-x^2 - x) \cdot (-2x^2 - 2)$
5. $-(2x^2 + 4) \cdot (-3x + 1)$	6. $(-4x^2 - 4) + (-4x + 3)$	7. $-3x + (-4x^2 + 4x - 2)$	8. $3x^2 \cdot (-4x^2 - 3x + 3)$
9. $(3x^2 + x + 3) \cdot (-3x - 1)$	10. $-(2x - 3) \cdot (-4x^2 + 2x)$	11. $-(-3x + 1) + (-x^2 - 2x - 2)$	12. $(-3x - 2) + (2x^2 + 3x + 4)$
13. $-(-4x - 4) \cdot (-4x^2 - 3x + 3)$	14. $-(2x^2 + 4x + 2) + (-4x - 1)$	15. $(x^2 + 3x - 3) \cdot (-4x^2 + x + 2)$	16. $(2x^2 - 4x + 4) + (2x^2 + x + 1)$
17. $(-4x^2 - 3x - 4) \cdot (-4x^2 + x - 4)$	18. $-(4x^2 - 4x) + (-2x^2 - 3x - 4)$	19. $-(4x^2 - 4x + 1) \cdot (-x^2 + 2x - 1)$	20. $(2x^2 - 3x + 4) + (-3x^2 + 3x - 3)$

5. Realiza la operación:

1. $4x(-2x^2 - 2)$	2. $4x^2(x^2 - 3x)$	3. $-3x(2x^3 + 3)$	4. $(-4x^3 + x^2)(-x + 2)$	5. $(-3x + 4)(-3x^2 - 2x)$
6. $(4x^3 + 4x^2)(3x - 4x^2)$	7. $(2x^3 - 2x)(4x^2 + 4)$	8. $(-3x^3 + x^2)(-2x^2 - x)$	9. $(3x + 1)(3x - 1)$	10. $(4x - 3)(4x + 3)$
11. $(2x + 5)(2x - 5)$	12. $(x^2 + 1)(x^2 - 1)$	13. $(3x^2 + 3)(3x^2 - 3)$	14. $(2x^2 - 4x)(2x^2 + 4x)$	15. $(3x + 1)^2$
16. $(4x - 3)^2$	17. $(-2x - 3)^2$	18. $(x^2 - 2)^2$	19. $(2x^2 + 3)^2$	20. $(x^3 + 2x^2)^2$

6. Realiza la operación:

1. $x(2x+1) - 2(x-1)$	2. $x(x+1) + 2(3x-2)$	3. $3(2x-3) + 3(2x-1)$
4. $2x(3x-2) - 2(x-2)$	5. $2(x+2) \cdot (-x-3)^2$	6. $-2(3x^2-x) \cdot (-x-1)^2$
7. $-(x+1)(x-1) - (x-3)^2$	8. $3(x^2-2) - (x^2+3x)^2$	9. $-(2x-2)^2 + 3(2x+3)$
10. $-(x+2)(x-2) + (x^2-3)^2$	11. $-(x-2)(x+2) + (2x-3)^2$	12. $-(2x+1)^2 - 3x^2(2x-2)$
13. $-(x+2)(x-2) - 3x^2(x-3)$	14. $-2x - x^2(3x-3) + (x-3)^2$	15. $x^2 - 2(x+3) + (x+3)(x-3)$



16. $3x-2x(2x+2)-(3x-3)^2$

17. $-(x-2)^2+3x(2x^2+2x-2)$

18. $-2x^2+x^2(3x+1)-(2x+2)^2$

19. $-(2x+1)(2x-1)-(2x^2+2x)^2$

20. $3x^2-(2x+1)(2x-1)-(3x-1)^2$

21. $-(3x^2+1)(3x^2-1)+x^2(3x-2)$

22. $-x^2-(2x-1)(2x+1)+3(3x+2)$

23. $-3x-(3x+2)(3x-2)-(2x+1)^2$

24. $-x+(3x^2+2)^2-x(2x^2-3x+3)$

25. $-(3x^2-3x)(3x^2+3x)+3(x-2)$

26. $2x-(3x-3)(3x+3)+(2x^2-x)^2$

27. $3x+(2x-3)(2x+3)-(2x^2-3x)^2$

28. $3x^2+(3x-1)(3x+1)-2x^2(2x+1)$

29. $-2x(2x^2+2x-1)+(2x+2)(2x-2)$

30. $3x^2-(3x^2-3x)^2+(3x-3)(3x+3)$

7. Realiza la siguiente división:

1. $\begin{cases} D: 9-8x^2 \\ d: -4x-4 \end{cases}$

2. $\begin{cases} D: 8x^2+10x-1 \\ d: -4x-3 \end{cases}$

3. $\begin{cases} D: 9-6x-9x^2 \\ d: 2-3x \end{cases}$

4. $\begin{cases} D: -4x^3+2x^2-6 \\ d: -2x-2 \end{cases}$

5. $\begin{cases} D: 20x-8-12x^3 \\ d: 2-3x-3x^2 \end{cases}$

6. $\begin{cases} D: 9x^3+3x^2-5x+2 \\ d: 2-2x-3x^2 \end{cases}$

7. $\begin{cases} D: x^2-6x^3+20x-16 \\ d: 3-2x \end{cases}$

8. $\begin{cases} D: -x^4+11x^2+6x-4 \\ d: x^2-3x-2 \end{cases}$

9. $\begin{cases} D: 3x^3-9x^2+5x-1 \\ d: x^2-2x-1 \end{cases}$

10. $\begin{cases} D: 9x+x^2-3x^3-7 \\ d: 3-x^2 \end{cases}$

11. $\begin{cases} D: -16x^4-4x^3+10x^2+1 \\ d: 4x^2-x-2 \end{cases}$

12. $\begin{cases} D: -3x^3+21x-9-9x^2 \\ d: x^2+4x-3 \end{cases}$

8. Realiza, usando la regla de Ruffini, la división:

1. $\begin{cases} D: -1-3x^2 \\ d: 1+x \end{cases}$

2. $\begin{cases} D: x^2-3x-6 \\ d: x-4 \end{cases}$

3. $\begin{cases} D: 4x^2-16x+15 \\ d: x-3 \end{cases}$

4. $\begin{cases} D: 2+x-x^3 \\ d: x+1 \end{cases}$

5. $\begin{cases} D: -2x^3+7x-2 \\ d: x+2 \end{cases}$

6. $\begin{cases} D: 2x^3-7x^2-16 \\ d: x-4 \end{cases}$

7. $\begin{cases} D: 2x^2-4x^3-2x \\ d: x-1 \end{cases}$

8. $\begin{cases} D: 2x-7x^2-4x^3+2 \\ d: x+2 \end{cases}$

9. $\begin{cases} D: x^4-2x^3-x+6 \\ d: x-2 \end{cases}$

10. $\begin{cases} D: 5-4x+5x^2-2x^3 \\ d: x-2 \end{cases}$

11. $\begin{cases} D: -3x^4+10x^3-x^2-6x \\ d: x-3 \end{cases}$

12. $\begin{cases} D: 3x^2-11+9x^3+3x^4+5x \\ d: 3+x \end{cases}$

9. Calcula m, sabiendo que la división del polinomio x^2+x-2m por $x-2$ es exacta.

10. Dado el polinomio $-3mx^2+8x-1$, halla m sabiendo que el resto de su división por $x+3$ es 2.

11. Dado el polinomio $3x^2-2mx-2$, calcula el valor de m, sabiendo que es divisible por $x+2$.

12. Determina el valor de m, sabiendo que la división del polinomio $3x^2-x+3m$ por $x-1$ es exacta.

13. Dado el polinomio $3x^2-x-3m$, determina m, sabiendo que es divisible por $x-1$.

14. Dado el polinomio $x^2+6x+3m$, determina m sabiendo que el resto de su división por $x+3$ es 1.

15. Halla m para que el polinomio $-mx^2-x-2$ sea divisible por $x-2$.

16. Dado el polinomio $x^2+3x-3m$, halla m sabiendo que el resto de su división por $x+2$ es 4.

17. Dado el polinomio $x^2+2mx+6$, determina m para que su división por $x+3$ sea exacta.

18. Calcula m para que el polinomio x^2-x+3m sea divisible por $x-2$.

19. Descompón, al máximo, en producto de factores:

1. $3x+6$

2. x^2+2x

3. $3x^2-9x$

4. x^2-4

5. x^4-9

6. $9x^2-4$

7. x^2+6x+9

8. x^2-4x+4

9. x^4-4x^2+4

10. $4x^4-x^2$

11. $3x^3-3x$

12. $27x^2-3$

13. $-12x^2+3$

14. $9x^2-x^6$

15. $3-27x^4$

16. $18x^3-2x$

17. $27x^4-12$

18. $12x^5-3x$

19. $8x-2x^5$

20. $12x^2-27$

21. $2x^4-2x^2$

22. $18x-8x^3$

23. $8x-18x^3$

24. $3x^2-3x^4$

25. $8x^4-18x^2$

26. $27x^3-12x$

27. $3x-27x^3$

28. $2x^2-4x+2$

29. $3x^2+6x+3$

30. $-2x^2-4x-2$

31. $-3x^2+6x-3$

32. $-2x^2+8x-8$

33. $x^4-2x^3+x^2$

34. x^3-4x^2+4x

35. $8x^4-8x^2+2$

36. $9x^5+6x^3+x$



37. $4x^3+4x^2+x$ 38. $-x^4+2x^3-x^2$ 39. $18x^2-12x+2$ 40. $2x^2+12x+18$ 41. $18x^3-12x^2+2x$ 42. $-27x^2+36x-12$
 43. $12x^2-36x+27$ 44. $18x^5+12x^3+2x$ 45. $18x^3-24x^2+8x$ 46. $27x^4+36x^2+12$ 47. $-12x^3-12x^2-3x$ 48. $-3x^6+18x^4-27x^2$
 49. $27x^5+36x^3+12x$ 50. $-12x^4-36x^2-27$ 51. $18x^4+24x^3+8x^2$ 52. $12x^3+36x^2+27x$ 53. $12x^5+36x^3+27x$ 54. $27x^3-36x^2+12x$

20. Descompón, al máximo, en producto de factores:

1. y^3-xy^2 2. $3xy+9x$ 3. xy^2-2xy 4. $2xy-4x^2$ 5. $3xy^2-3xy$
 6. $y^2+2xy+x^2$ 7. $y^2-6xy+9x^2$ 8. $y^4-4xy^2+4x^2$ 9. $9x^2-12xy+4y^2$ 10. $y^4-6xy^2+9x^2$
 11. $x^2y^2-y^6$ 12. $9xy^3-x^3y$ 13. $12xy^5-3xy$ 14. $3y^4-3x^2y^2$ 15. $8xy^2-2x^3y^6$
 16. $8x^2y^2+8xy+2$ 17. $-y^3+2xy^2-x^2y$ 18. $xy^4-4x^2y^2+4x^3$ 19. $2x^2y^4+4xy^3+2y^2$ 20. $-2y^3+12xy^2-18x^2y$

21. Halla el M.c.d. y m.c.m. de los siguientes polinomios:

1. $\begin{cases} 9x-3 \\ 9x+3 \\ 9x^2-1 \end{cases}$ 2. $\begin{cases} 4x^2-2x \\ 4x^2+2x \\ 8x^3-2x \end{cases}$ 3. $\begin{cases} 2x^2+2x \\ 2x^3-2x \\ x^2-2x+1 \end{cases}$ 4. $\begin{cases} 3-9x \\ 3-27x^2 \\ 9x^2-6x+1 \end{cases}$ 5. $\begin{cases} x^4-9 \\ x^3+3x \\ x^4+6x^2+9 \end{cases}$ 6. $\begin{cases} 3-3x \\ 3-3x^2 \\ 3x^2+6x+3 \end{cases}$
 7. $\begin{cases} 2-2x^2 \\ x^2+2x+1 \\ 2x^2+4x+2 \end{cases}$ 8. $\begin{cases} 4x^2-1 \\ 2-8x^2 \\ 8x^2+8x+2 \end{cases}$ 9. $\begin{cases} 2-2x \\ 2-2x^2 \\ 2x^2-4x+2 \end{cases}$ 10. $\begin{cases} x^2+2x \\ x^2-4x+4 \\ x^3+4x^2+4x \end{cases}$ 11. $\begin{cases} 4x^2+4x+1 \\ 4x^2-4x+1 \\ 4x^3+4x^2+x \end{cases}$ 12. $\begin{cases} 6x+3 \\ 4x^2+4x+1 \\ 12x^2-12x+3 \end{cases}$
 13. $\begin{cases} 9x^4-4 \\ 4x-9x^5 \\ 9x^4-12x^2+4 \end{cases}$ 14. $\begin{cases} 6-9x^2 \\ 12-27x^4 \\ 9x^4+12x^2+4 \end{cases}$ 15. $\begin{cases} x^2-4 \\ x^3+2x^2 \\ x^4+4x^3+4x^2 \end{cases}$ 16. $\begin{cases} x^2-1 \\ 3x^3-3x \\ 3x^3-6x^2+3x \end{cases}$ 17. $\begin{cases} x^2-1 \\ 2x^3-2x \\ 2x^3+4x^2+2x \end{cases}$ 18. $\begin{cases} 8x^2-2 \\ 4x^2-4x+1 \\ -8x^2+8x-2 \end{cases}$
 19. $\begin{cases} 2x+6 \\ x^2+6x+9 \\ 2x^2+12x+18 \end{cases}$ 20. $\begin{cases} x^2-4 \\ x^2+4x+4 \\ 2x^3+8x^2+8x \end{cases}$ 21. $\begin{cases} 6x+4 \\ 8-18x^2 \\ 18x^2+24x+8 \end{cases}$ 22. $\begin{cases} -4x-6 \\ 4x^2-12x+9 \\ -8x^2-24x-18 \end{cases}$ 23. $\begin{cases} 2x^3-2x \\ 2x^3+4x^2+2x \\ 2x^4+4x^3+2x^2 \end{cases}$ 24. $\begin{cases} x^2-2x \\ x^2+2x+1 \\ 2x^4-4x^3+2x^2 \end{cases}$
 25. $\begin{cases} 6x^2-4 \\ 9x^4+12x^2+4 \\ 18x^4+24x^2+8 \end{cases}$ 26. $\begin{cases} 2x-3x^2 \\ 9x^2-12x+4 \\ -9x^3-12x^2-4x \end{cases}$ 27. $\begin{cases} 6x^3-4x \\ 6x^4-4x^2 \\ 18x^5+24x^3+8x \end{cases}$ 28. $\begin{cases} 3x^3-9x^2 \\ 3x^4-27x^2 \\ 3x^3+18x^2+27x \end{cases}$ 29. $\begin{cases} 3x^2+6 \\ x^4-4x^2+4 \\ 3x^4-12x^2+12 \end{cases}$ 30. $\begin{cases} 3x^3+6x \\ x^4-4x^2+4 \\ 3x^5+12x^3+12x \end{cases}$

22. Halla el M.c.d. y m.c.m. de los siguientes polinomios:

1. $\begin{cases} y-x \\ xy^2-x^2y \\ xy^2+x^2y \end{cases}$ 2. $\begin{cases} 2y \\ y^2-x^2 \\ y^2-2xy+y^2 \end{cases}$ 3. $\begin{cases} y+2x \\ xy^2+2x^2y \\ y^2+4xy+4x^2 \end{cases}$ 4. $\begin{cases} y^4-4x^2 \\ 3y^3-6xy \\ y^4-4xy^2+4x^2 \end{cases}$ 5. $\begin{cases} y^2-x^2 \\ xy^2+x^2y \\ xy^3-x^3y \end{cases}$ 6. $\begin{cases} x^2y^3-y \\ x^2y^4-y^2 \\ x^2y^3-2xy^2+y \end{cases}$
 7. $\begin{cases} 8y^2-2x^2 \\ 4y+2x \\ 8y^2+8xy+2x^2 \end{cases}$ 8. $\begin{cases} 3xy+3x \\ 3xy^2-6xy+3x \\ 3xy^2+6xy+3x \end{cases}$ 9. $\begin{cases} xy+x^2 \\ xy^2-2x^2y+x^3 \\ xy^2+2x^2y+x^3 \end{cases}$ 10. $\begin{cases} xy-x^2 \\ y^2-2xy+x^2 \\ xy^2-2x^2y+x^3 \end{cases}$ 11. $\begin{cases} x^2y^2-9 \\ x^3y^2-9x \\ x^2y^2+6xy+9 \end{cases}$ 12. $\begin{cases} x^2y^2-4 \\ x^2y^2-4xy+4 \\ 2x^2y^2+8xy+8 \end{cases}$

23. Simplifica, al máximo, la fracción:

1. $\frac{3x+3}{3x-3}$ 2. $\frac{x^2-2x+1}{x^2-1}$ 3. $\frac{3-3x}{3-3x^2}$ 4. $\frac{6x+3}{12x^2-3}$ 5. $\frac{x^3+2x^2}{x^4-4x^2}$ 6. $\frac{x^2-6x+9}{x^2-9}$
 7. $\frac{2x^3+2x^2}{2x^3-2x^2}$ 8. $\frac{9x^2+6x+1}{9x^2-1}$ 9. $\frac{4x^2-1}{3-12x^2}$ 10. $\frac{-2x^2-6x}{x^2-9}$ 11. $\frac{-2x^2+3x}{-2x^2-3x}$ 12. $\frac{2x^2-4x}{x^2-4}$
 13. $\frac{4x^2-1}{4x^2+4x+1}$ 14. $\frac{-x^2-2x}{x^2-4}$ 15. $\frac{2-32x^4}{2-8x^2}$ 16. $\frac{2x+2}{x^2+2x+1}$ 17. $\frac{3x^2-9x}{x^2-9}$ 18. $\frac{4x+4}{4x^2+8x+4}$
 19. $\frac{3x^2-9x}{x^2-6x+9}$ 20. $\frac{2x^2-2x}{x^2-1}$ 21. $\frac{2x-4}{x^2-4x+4}$ 22. $\frac{4x-4}{4x^2-4}$ 23. $\frac{2x^2-2x}{1-x^2}$ 24. $\frac{-2x^3-6x}{x^4+6x^2+9}$
 25. $\frac{-8x^2+8x-2}{4x^2-4x+1}$ 26. $\frac{-3x^2+6x-3}{-3x^2+3}$ 27. $\frac{x^2-3x}{x^3-6x^2+9x}$ 28. $\frac{-9x^5+6x^3-x}{-3x^3+x}$ 29. $\frac{9x^3+12x^2+4x}{9x^3-4x}$ 30. $\frac{2x^4+4x^3+2x^2}{2x^4-2x^2}$



$$31. \frac{18x^4+12x^3+2x^2}{18x^4-2x^2} \quad 32. \frac{3x^2-2x}{9x^3-12x^2+4x} \quad 33. \frac{18x^3-24x^2+8x}{18x^3-8x} \quad 34. \frac{-27x^3+18x^2-3x}{9x^2-6x+1} \quad 35. \frac{4x^2+4x+1}{-12x^4-12x^3-3x^2} \quad 36. \frac{27x^3+36x^2+12x}{9x^2+6x}$$

24. Halla el valor numérico de la siguiente fracción:

$$\begin{array}{lllll} 1. \frac{2x-2}{x^2-1}; x=1 & 2. \frac{3x-3}{x^2-1}; x=-1 & 3. \frac{2x}{2x^2+2x}; x=0 & 4. \frac{2x-2}{x^2-2x+1}; x=1 & 5. \frac{3x-6}{x^2-4}; x=2 \\ 6. \frac{3x+9}{x^2-9}; x=-3 & 7. \frac{2x^2-6x+4}{x^2-4x+4}; x=2 & 8. \frac{18x^3-18x^2}{9x^4-9x^2}; x=1 & 9. \frac{4x^3-12x^2}{4x^4-36x^2}; x=-3 & 10. \frac{18x^4+36x^3}{9x^4-36x^2}; x=-2 \\ 11. \frac{3x^2-6x+3}{x^2-1}; x=1 & 12. \frac{6x^2+18x}{3x^2+18x+27}; x=-1 & 13. \frac{3x^2+3x}{x^2-1}; x=\frac{1}{2} & 14. \frac{2x^2+6x}{x^2-9}; x=\frac{2}{3} & 15. \frac{6x^2+15x+9}{3x^2+6x+3}; x=\frac{-3}{2} \end{array}$$

25. Realiza la operación:

$$\begin{array}{llll} 1. \frac{1}{2} - \frac{x-4}{6x} - \frac{x+1}{3x} & 2. \frac{2}{3} - \frac{x-6}{6x} - \frac{x+1}{2x} & 3. \frac{1}{2x} + \frac{x+1}{3x^2} - \frac{5}{6x} & 4. \frac{4}{3x} - \frac{x+1}{3x^2} - \frac{x-1}{x^2} \\ 5. \frac{x-1}{x} - 2 + \frac{x^2+x+1}{x^2} & 6. \frac{x+1}{2x^2} + \frac{2x+1}{6x^2} - \frac{5}{6x} & 7. \frac{x+1}{x} + \frac{x+1}{3x} - \frac{5x+8}{6x} & 8. \frac{x}{x-1} - \frac{x-4}{2x-2} + 1 \\ 9. \frac{3}{x+1} - \frac{1}{x} - \frac{x-1}{x^2+x} & 10. \frac{x+1}{2x-6} + \frac{x-2}{x-3} - \frac{3}{2} & 11. \frac{5}{4} - \frac{x+2}{x+1} - \frac{x-7}{4x+4} & 12. \frac{x+4}{6x-3} - \frac{2}{3} + \frac{x+1}{2x-1} \\ 13. \frac{x^2+x+3}{x^2+x} - 1 + \frac{x-3}{x} & 14. \frac{x+1}{2x-1} + \frac{2x+1}{8x-4} - \frac{3}{4} & 15. \frac{1}{x} + \frac{x-2}{x^2+2x} + \frac{1}{x+2} & 16. \frac{2x+5}{4x+2} + \frac{2x+3}{8x+4} - \frac{1}{4} \\ 17. 4 - \frac{x^2+x-10}{x^2-4} - \frac{x-1}{x-2} & 18. \frac{x-1}{2x-3} + \frac{2x-1}{8x-12} - \frac{3}{4} & 19. 4 - \frac{x^2+x-42}{x^2-9} - \frac{x+2}{x-3} & 20. \frac{5}{6} + \frac{2x+7}{12x+6} + \frac{x+1}{2x+1} \\ 21. \frac{3x+2}{27x-9} - \frac{4}{9} + \frac{3x+1}{9x-3} & 22. \frac{4}{9} - \frac{3x+1}{27x-18} + \frac{x+1}{3x-2} & 23. \frac{19}{9x-9} - \frac{1}{x+1} - \frac{x+37}{9x^2-9} & 24. \frac{3x^2+3x+1}{3x^2+3x} - \frac{7}{9} + \frac{x-3}{9x} \\ 25. \frac{4}{3x-3} - \frac{1}{3x} - \frac{x+1}{3x^2-3x} & 26. \frac{x^2+x+1}{3x^2-x} - \frac{3x+1}{3x-1} + \frac{x+1}{x} & 27. \frac{9}{4} - \frac{4x^2+4x+5}{16x^2-4} - \frac{2x-3}{4x-2} & 28. \frac{4x+3}{4x} - \frac{3}{2} + \frac{4x^2+4x-9}{8x^2+12x} \\ 29. \frac{3x^3+3x+4}{3x^2-3} + \frac{x-16}{9x-9} - \frac{4}{9} & 30. \frac{5}{4x-6} - \frac{2x+27}{8x^2-18} - \frac{1}{2x+3} & 31. \frac{x^2+x+1}{3x^2-2x} + \frac{2x+1}{2x} - \frac{6x+3}{6x-4} & 32. \frac{5x+18}{x+2} - \frac{x^2+x-34}{x^2-4} - \frac{x+1}{x-2} \end{array}$$

26. Realiza la operación:

$$\begin{array}{llll} 1. \frac{2x+2}{6x} : \frac{x+1}{3x} & 2. \frac{3x+9}{9x^2} : \frac{x+3}{3x} & 3. \frac{x^2+3x}{3x-6} : \frac{x}{x-2} & 4. \frac{2x-6}{3x^2-6x} : \frac{x-3}{3x} \\ 5. \frac{x^2-4}{3x^2+3x} : \frac{3x}{x+2} & 6. \frac{3x^2+9x}{x^2+x} : \frac{x+3}{x+1} & 7. \frac{x^2-2x+1}{6x} : \frac{x-1}{3} & 8. \frac{x^2+2x}{3x^2+9x} : \frac{x}{x+3} \\ 9. \frac{9}{x^2-6x+9} : \frac{x-3}{3} & 10. \frac{x^2-1}{x^2-4x+4} : \frac{x+1}{x-2} & 11. \frac{2x^2-2x}{x^2-4x+4} : \frac{x-1}{x-2} & 12. \frac{x^2+6x+9}{2x^2} : \frac{2x}{x+3} \\ 13. \frac{x^2+4x+4}{3x^2} : \frac{x}{x+2} & 14. \frac{6x^2+18x}{6x^3-6x^2} : \frac{x+3}{x^2-x} & 15. \frac{x^4-4x^2}{x^3+2x^2} : \frac{x^2-2x}{x+2} & 16. \left(\frac{6x^3-6x}{9x^2-9}\right)^2 : \frac{4x^2}{9} \\ 17. \left(\frac{9x-18}{9x^2-18x}\right)^2 : \frac{3x^2}{2} & 18. \left(\frac{6x^2+6x}{9x^2+9x}\right)^2 : \frac{9}{4x-8} & 19. \frac{6x+6}{4x^2-36} : \frac{2x^2-18}{3x+3} & 20. \frac{3x^2-9x}{9x^2-36} : \frac{3x^2-12}{x-3} \\ 21. \frac{9x^2-36x+36}{9x+9} : \frac{x+1}{3x-6} & 22. \frac{3x^2+18x+27}{x^3-x^2} : \frac{3x+9}{x^2-x} & 23. \left(\frac{6x^3+12x^2+6x}{9x^2+18x+9}\right)^2 : \frac{9}{4x} & 24. \left(\frac{9x^2-9x}{6x-6}\right)^2 : \frac{4}{9x^3-27x^2} \\ 25. \left(\frac{2x^2-8x+8}{4x^2-16x+16}\right)^2 : \frac{x}{2x-6} & 26. \frac{4x^2-24x+36}{9x^4-54x^3+81x^2} : \frac{9x^2}{4} & 27. \left(\frac{6x^2-36x+54}{9x^2-54x+18}\right)^2 : \frac{2x-6}{9} & 28. \frac{x^2-9}{3x^3+6x^2+3x} : \frac{x+3}{3x^2+3x} \\ 29. \frac{3x^2-9x}{3x^3+12x^2+12x} : \frac{x^2+2x}{x-3} & 30. \frac{2x^2+4x}{4x^2-24x+36} : \frac{x^2-6x+9}{x+2} & 31. \left(\frac{4x+8}{6x^2+12x}\right)^2 : \frac{4x-4}{9x^3-27x^2} & 32. \left(\frac{2x^3+12x^2+18x}{x^4+6x^3+9x^2}\right)^2 : \frac{x^2+2x}{4} \end{array}$$



27. Realiza la operación:

1. $\left(\frac{1}{x} + \frac{x+6}{2x^2} - \frac{3}{2x}\right) : \frac{3}{2x}$
2. $\left(\frac{x-1}{x^2} - \frac{2}{x} + \frac{x^2+x+3}{x^3}\right) : \left(\frac{x+1}{x} - 1\right)$
3. $\left(\frac{2x-1}{2x-4} + \frac{2x+1}{2x+4} - 2\right) : \frac{3}{x-2}$
4. $\left(4 - \frac{x+2}{x+1} - \frac{x-2}{x-1}\right) : \left(1 + \frac{x+1}{x-1}\right)$
5. $\left(\frac{x+2}{x+1} - 2 + \frac{x^2+x-3}{x^2+x}\right) : \frac{3x}{x-3}$
6. $\left(\frac{x^2+x+3}{x^2-x} - 2 + \frac{x-2}{x-1}\right) : \frac{x}{x+3}$
7. $\left(\frac{x+2}{x+1} - 2 + \frac{x^2+x+6}{x^2-1}\right) : \frac{x-1}{x+3}$
8. $\left(4 - \frac{x+4}{x+3} - \frac{x-8}{x-3}\right) : \left(2 - \frac{x+4}{x+3}\right)$
9. $\left(\frac{x^2+x-8}{x^2-4} + \frac{x}{x-2} - 2\right) : \frac{1}{x-2}$
10. $\left(\frac{x^2+x+3}{x^2-3x} + \frac{x+1}{x-3} + \frac{x+1}{x}\right) : 3$
11. $\left(\frac{x^2+x-18}{x^2-9} + \frac{x-1}{x-3} - 2\right) : \frac{x+3}{x-1}$
12. $\left(\frac{x+5}{x+3} + \frac{x^2+x+3}{x^2-9} - 2\right) : \frac{x+2}{x+3}$
13. $\left(\frac{x-18}{x^2-9} + \frac{7}{x-3} + \frac{1}{x+3}\right) : \frac{x+3}{3}$
14. $\left(\frac{2x-1}{2x-4} + \frac{2x+7}{2x+4} - 2\right) : \left(\frac{x-1}{x-2} - 1\right)$
15. $\left(\frac{2x+1}{2x-2} + \frac{2x+3}{2x+2} - 1\right) : \left(2 - \frac{x-4}{x-1}\right)$
16. $\left(\frac{x+3}{x+1} + \frac{x^2+x-8}{x^2-1} - 2\right) : \left(2 - \frac{x-5}{x-3}\right)$
17. $\left(\frac{x+8}{x+3} + \frac{x^2+x+9}{x^2+3x} - 2\right) : \left(2 - \frac{x+6}{x+3}\right)$
18. $\left(\frac{x-1}{x^2+2x} - \frac{1}{x+2} + \frac{1}{x}\right) : \left(2 - \frac{x-1}{x}\right)$
19. $\left(2 - \frac{x+1}{x+3} - \frac{x^2+x-13}{x^2-9}\right) : \left(2 - \frac{x-7}{x-2}\right)$
20. $\left(\frac{x+1}{x+2} + \frac{x^2+x+10}{x^2-4} + 2\right) : \left(1 - \frac{x+2}{2x}\right)$
21. $\left(\frac{x^2+x+12}{x^2-9} + \frac{x-1}{x-3} + 1\right) : \left(2 - \frac{x+5}{x+3}\right)$
22. $\left(\frac{1}{x+2} + \frac{x}{x^2-4} + \frac{1}{x-2}\right) : \left(2 - \frac{x+4}{x+2}\right)$
23. $\left(4 - \frac{x-4}{x+3} - \frac{x^2+x-48}{x^2-9}\right) : \left(2 - \frac{x-9}{x-3}\right)$
24. $\left(\frac{1}{x} - \frac{1}{3x} - \frac{x+1}{3x^2}\right)^2 : \frac{18x^4}{x^2-2x+1}$
25. $\left(\frac{2}{3} + \frac{x-3}{3x} + \frac{x+1}{x}\right)^2 : \left(\frac{x+5}{x-1} + 5\right)$
26. $\left(\frac{x+3}{3x} - \frac{1}{3} + \frac{x+1}{x}\right)^2 : \left(\frac{x+7}{x} + \frac{x^2+x+8}{x^2}\right)$
27. $\left(\frac{x-4}{6x^2} - \frac{7}{6x} + \frac{x+1}{x^2}\right)^2 : (9x^4+9x^3)$
28. $\left(\frac{x+4}{x+3} + \frac{x^2+x}{x^2-9} - 2\right)^2 : \frac{x^2+6x+9}{12}$
29. $\left(4 - \frac{x-4}{x} - \frac{x^2+x-4}{x^2-x}\right)^2 : \frac{x^2-2x+1}{8x^2}$
30. $\left(\frac{3}{2} + \frac{x-11}{2x+6} + \frac{x+1}{x+3}\right)^2 : \frac{9x^3}{x^2+6x+9}$

28. Realiza la operación:

1. $1 + \frac{y+6x-2}{3xy-6x} - \frac{1}{3x}$
2. $\frac{y+2x^2-1}{x^2y-x^2} + 1 - \frac{1}{x^2}$
3. $\frac{y+11x-3}{3y-3x} + \frac{2}{3} + \frac{y+1}{y-x}$
4. $\frac{1}{3} - \frac{x+3}{3x} + \frac{3y+2x+3}{3xy+3x}$
5. $\frac{xy+3x^2-3}{x^3y-3x^2} + 1 - \frac{x^2+1}{x^2}$
6. $\frac{y+5x-3}{xy-3x} + \frac{y+1}{y-3} + \frac{2x+1}{x}$
7. $\frac{xy+4x^3-1}{4x^3y-4x^2} - \frac{x^2+1}{4x^2} + \frac{1}{4}$
8. $\frac{3x-4}{3x} + \frac{y-9x^2+2x}{3xy+6x^2} + \frac{1}{x}$
9. $\frac{3y+18x^2-1}{18xy-6x} - \frac{3x+1}{6x} + \frac{1}{2}$
10. $\frac{2xy+3x-2}{2x^2y^2-2xy} + \frac{x-1}{xy} + \frac{1}{2y}$
11. $\left(\frac{y^2+y+3x}{y^2-x^2} + \frac{y-x-3}{y-x} - 1\right) : \frac{y-2}{y+x}$
12. $\left(\frac{1}{x} - \frac{1}{3x}\right) 3x - \frac{1}{y} : \left(\frac{y+3x+1}{y+3x} - 1\right)$
13. $\left(\frac{y+1}{y^2-4} + \frac{4x-1}{4y+8} - \frac{3}{4y-8}\right)^2 : \frac{y^2+4y+4}{x^3}$
14. $\left(\frac{2y-6x+9}{2y-6x} - 2 + \frac{2y+6x+9}{2y+6x}\right) : \left(2 + \frac{y-6x}{y+3x}\right)$
15. $\left(1 - \frac{y-3x^2+x}{2y}\right) : \frac{y-x}{2} + \frac{3x}{y} : \left(1 + \frac{1}{3x-1}\right)$

— Soluciones —

- 1.1. $-2x^9$ 1.2. $\frac{8x^4}{3}$ 1.3. $\frac{-2}{x^4}$ 1.4. 3 1.5. $\frac{8x^2}{3}$ 1.6. $\frac{-x^2}{8}$ 1.7. $\frac{-1}{2x^7}$ 1.8. $3x^8$ 1.9. $\frac{-x^2}{24}$ 1.10. $\frac{x^3}{2}$ 1.11. $3x^7$ 1.12. $-9x^2$ 1.13. $-4x^{11}$ 1.14. $\frac{1}{54x^4}$ 1.15. $\frac{3x^2}{2}$ 1.16. $\frac{-9x^{11}}{2}$ 1.17. $\frac{1}{54x^8}$ 1.18. $3x^7$ 1.19. $\frac{-243}{x^5}$ 1.20. $\frac{-16}{9}$ 1.21. $\frac{1}{3x^7}$ 1.22. $\frac{x^{12}}{3}$ 1.23. $\frac{8x^7}{27}$ 1.24. $\frac{27x^6}{2}$ 2.1. $\frac{2y^3}{27x}$ 2.2. $\frac{9x^2}{4y^7}$ 2.3. $-6x^2$ 2.4. $\frac{-2}{xy^3}$ 2.5. $\frac{1}{27x^2y^7}$ 2.6. $9xy^2$ 2.7. $\frac{27xy^7}{2}$ 2.8. $\frac{1}{2xy^5}$ 2.9. $\frac{-x^3}{27y^7}$ 2.10. $\frac{-2y^4}{3}$ 2.11. $3xy^6$ 2.12. $-x^3y^4$ 2.13. $\frac{-1}{2y^6}$ 2.14. $\frac{2y^6}{9x^4}$ 2.15. $\frac{-4}{x^5}$ 2.16. $\frac{-1}{x^2y^5}$ 2.17. $\frac{-2}{x^5y^5}$ 2.18. $\frac{3}{8x^2y^4}$ 3.1. -46 3.2. 3 3.3. -25 3.4. -16 3.5. 9 3.6. -8 3.7. 36 3.8. 11 3.9. -1 3.10. 4 3.11. -10 3.12. 36 3.13. 24 3.14. -29 3.15. -42 3.16. 2 3.17. -9 3.18. -14 3.19. 0 3.20. -22 4.1. $-2x^2-2x-2$ 4.2. $4x^2+x-2$ 4.3. $-7x$ 4.4. $-3x^2-x+2$ 4.5. $-2x^2+3x-5$ 4.6. $-4x^2-4x-1$ 4.7. $-4x^2+x-2$ 4.8. $7x^2+3x-3$ 4.9. $3x^2+4x+4$ 4.10. $4x^2-4x+3$ 4.11. $-x^2+x-3$ 4.12. $2x^2+2$ 4.13. $-4x^2+7x+1$ 4.14. $-2x^2-8x-3$ 4.15. $5x^2+2x-5$ 4.16. $4x^2-3x+5$ 4.17. $-8x^2-4x$ 4.18. $-6x^2+x-4$ 4.19. $-3x^2+2x$ 4.20. $-x^2+1$ 5.1. $-8x^3-8x$ 5.2. $4x^4-12x^3$ 5.3. $-6x^4-9x$ 5.4. $4x^4-9x^3+2x^2$ 5.5. $9x^3-6x^2-8x$ 5.6. $-16x^5-4x^4+12x^3$ 5.7. $8x^5-8x$ 5.8. $6x^5+x^4-x^3$ 5.9. $9x^2-1$ 5.10. $16x^2-9$ 5.11. $4x^2-25$ 5.12. x^4-1 5.13. $9x^4-9$ 5.14. $4x^4-16x^2$ 5.15. $9x^2+6x+1$ 5.16. $16x^2-24x+9$ 5.17. $4x^2+12x+9$ 5.18. x^4-4x^2+4 5.19. $4x^4+12x^2+9$ 5.20. $x^6+4x^5+4x^4$ 6.1. $2x^2-x+2$ 6.2. x^2+7x-4 6.3. $12x-12$ 6.4. $6x^2-6x+4$ 6.5. $-x^4-2x^3-x^2+2x+4$ 6.6. $-7x^2+4x-1$ 6.7. $-2x^2+6x-8$



- 6.8. $-x^4-6x^3-6x^2-6$ 6.9. $-4x^2+14x+5$ 6.10. x^4-7x^2+13 6.11. $3x^2-12x+13$ 6.12. $-6x^3+5x^2-4x-1$ 6.13. $-3x^3+8x^2+4$ 6.14. $-3x^3+4x^2-8x+9$ 6.15. $2x^2-2x-15$
6.16. $-13x^2+17x-9$ 6.17. $6x^3+5x^2-2x-4$ 6.18. $3x^3-5x^2-8x-4$ 6.19. $-4x^4-8x^3-8x^2+1$ 6.20. $-10x^2+6x$ 6.21. $-9x^4+3x^3-2x^2+1$ 6.22. $-5x^2+9x+7$ 6.23. $-13x^2-7x+3$
6.24. $9x^4-2x^3+15x^2-4x+4$ 6.25. $-9x^4+9x^2+3x-6$ 6.26. $4x^4-4x^3-8x^2+2x+9$ 6.27. $-4x^4+12x^3-5x^2+3x-9$ 6.28. $-4x^3+10x^2-1$ 6.29. $-4x^3+2x-4$ 6.30.
 $-9x^4+18x^3+3x^2-9$ 7.1. $\begin{cases} C: 2x-2 \\ r: 1 \end{cases}$ 7.2. $\begin{cases} C: -2x-1 \\ r: -4 \end{cases}$ 7.3. $\begin{cases} C: 3x+4 \\ r: 1 \end{cases}$ 7.4. $\begin{cases} C: 2x^2-3x+3 \\ r: 0 \end{cases}$ 7.5. $\begin{cases} C: 4x-4 \\ r: 0 \end{cases}$ 7.6. $\begin{cases} C: -3x+1 \\ r: 3x \end{cases}$ 7.7. $\begin{cases} C: 3x^2+4x-4 \\ r: -4 \end{cases}$ 7.8. $\begin{cases} C: -x^2-3x \\ r: -4 \end{cases}$ 7.9.
 $\begin{cases} C: 3x-3 \\ r: 2x-4 \end{cases}$ 7.10. $\begin{cases} C: 3x-1 \\ r: -4 \end{cases}$ 7.11. $\begin{cases} C: -4x^2-2x \\ r: -4x+1 \end{cases}$ 7.12. $\begin{cases} C: -3x+3 \\ r: 0 \end{cases}$ 8.1. $\begin{cases} C: -3x+3 \\ r: -4 \end{cases}$ 8.2. $\begin{cases} C: x+1 \\ r: -2 \end{cases}$ 8.3. $\begin{cases} C: 4x-4 \\ r: 3 \end{cases}$ 8.4. $\begin{cases} C: -x^2+x \\ r: 2 \end{cases}$ 8.5. $\begin{cases} C: -2x^2+4x-1 \\ r: 0 \end{cases}$ 8.6.
 $\begin{cases} C: 2x^2+x+4 \\ r: 0 \end{cases}$ 8.7. $\begin{cases} C: -4x^2-2x-4 \\ r: -4 \end{cases}$ 8.8. $\begin{cases} C: -4x^2+x \\ r: 2 \end{cases}$ 8.9. $\begin{cases} C: x^3-1 \\ r: 4 \end{cases}$ 8.10. $\begin{cases} C: -2x^2+x-2 \\ r: 1 \end{cases}$ 8.11. $\begin{cases} C: -3x^3+x^2+2x \\ r: 0 \end{cases}$ 8.12. $\begin{cases} C: 3x^3+3x-4 \\ r: 1 \end{cases}$ 9. 3 10. -1 11. $\frac{-5}{2}$ 12.
 $\frac{-2}{3}$ 13. $\frac{2}{3}$ 14. $\frac{10}{3}$ 15. -1 16. -2 17. $\frac{5}{2}$ 18. $\frac{-2}{3}$ 19.1. $3(x+2)$ 19.2. $x(x+2)$ 19.3. $3x(x-3)$ 19.4. $(x+2)(x-2)$ 19.5. $(x^2-3)(x^2+3)$ 19.6. $(3x+2)(3x-2)$ 19.7.
 $(x+3)^2$ 19.8. $(x-2)^2$ 19.9. $(x^2-2)^2$ 19.10. $x^2(2x+1)(2x-1)$ 19.11. $3x(x+1)(x-1)$ 19.12. $3(3x+1)(3x-1)$ 19.13. $-3(2x+1)(2x-1)$ 19.14. $-x^2(x^2+3)(x^2-3)$ 19.15.
 $-3(3x^2+1)(3x^2-1)$ 19.16. $2x(3x+1)(3x-1)$ 19.17. $3(3x^2+2)(3x^2-2)$ 19.18. $3x(2x^2+1)(2x^2-1)$ 19.19. $-2x(x^2+2)(x^2-2)$ 19.20. $3(2x+3)(2x-3)$ 19.21.
 $2x^2(x+1)(x-1)$ 19.22. $-2x(2x+3)(2x-3)$ 19.23. $-2x(3x+2)(3x-2)$ 19.24. $-3x^2(x+1)(x-1)$ 19.25. $2x^2(2x+3)(2x-3)$ 19.26. $3x(3x+2)(3x-2)$ 19.27. $-3x(3x+1)(3x-1)$
19.28. $2(x-1)^2$ 19.29. $3(x+1)^2$ 19.30. $-2(x+1)^2$ 19.31. $-3(x-1)^2$ 19.32. $-2(x-2)^2$ 19.33. $x^2(x-1)^2$ 19.34. $x(x-2)^2$ 19.35. $2(2x^2-1)^2$ 19.36. $x(3x^2+1)^2$
19.37. $x(2x+1)^2$ 19.38. $-x^2(x-1)^2$ 19.39. $2(3x-1)^2$ 19.40. $2(x+3)^2$ 19.41. $2x(3x-1)^2$ 19.42. $-3(3x-2)^2$ 19.43. $3(2x-3)^2$ 19.44. $2x(3x^2+1)^2$ 19.45. $2x(3x-2)^2$
19.46. $3(3x^2+2)^2$ 19.47. $-3x(2x+1)^2$ 19.48. $-3x^2(x^2-3)^2$ 19.49. $3x(3x^2+2)^2$ 19.50. $-3(2x^2+3)^2$ 19.51. $2x^2(3x+2)^2$ 19.52. $3x(2x+3)^2$ 19.53. $3x(2x^2+3)^2$
19.54. $3x(3x-2)^2$ 20.1. $y^2(y-x)$ 20.2. $3x(y+3)$ 20.3. $xy(y-2)$ 20.4. $2x(y-2x)$ 20.5. $3xy(y-1)$ 20.6. $(y+x)^2$ 20.7. $(y-3x)^2$ 20.8. $(y^2-2x)^2$ 20.9. $(3x-2y)^2$
20.10. $(y^2-3x)^2$ 20.11. $y^2(x+y^2)(x-y^2)$ 20.12. $xy(3y+x)(3y-x)$ 20.13. $3xy(2y^2+1)(2y^2-1)$ 20.14. $3y^2(y+x)(y-x)$ 20.15. $2xy^2(2+xy^2)(2-xy^2)$ 20.16.
 $2(2xy+1)^2$ 20.17. $-y(y-x)^2$ 20.18. $x(y^2-2x)^2$ 20.19. $2y^2(xy+1)^2$ 20.20. $-2y(y-3x)^2$ 21.1. 1; $3(3x-1)(3x+1)$ 21.2. $2x$; $2x(2x+1)(2x-1)$ 21.3. 1; $2x(x+1)(x-1)^2$
21.4. $3x-1$; $3(3x+1)(3x-1)^2$ 21.5. x^2+3 ; $x(x^2-3)(x^2+3)^2$ 21.6. 3; $3(x-1)(x+1)^2$ 21.7. $x+1$; $2(x-1)(x+1)^2$ 21.8. $2x+1$; $2(2x-1)(2x+1)^2$ 21.9. $2(x-1)$; $2(x+1)(x-1)^2$
21.10. 1; $x(x+2)^2(x-2)^2$ 21.11. 1; $x(2x+1)^2(2x-1)^2$ 21.12. 1; $3(2x+1)^2(2x-1)^2$ 21.13. $3x^2-2$; $x(3x^2+2)(3x^2-2)^2$ 21.14. 1; $3(3x^2-2)(3x^2+2)^2$ 21.15. $x+2$;
 $x^2(x-2)(x+2)^2$ 21.16. $x-1$; $3x(x+1)(x-1)^2$ 21.17. $x+1$; $2x(x-1)(x+1)^2$ 21.18. $2x-1$; $2(2x+1)(2x-1)^2$ 21.19. $x+3$; $2(x+3)^2$ 21.20. $x+2$; $2x(x-2)(x+2)^2$ 21.21. $2(3x+2)$;
 $2(3x-2)(3x+2)^2$ 21.22. 1; $2(2x-3)^2(2x+3)^2$ 21.23. $2x(x+1)$; $2x^2(x-1)(x+1)^2$ 21.24. 1; $2x^2(x-1)^2(x+1)^2$ 21.25. 1; $2(3x^2-2)(3x^2+2)^2$ 21.26. 1; $x(3x-2)^2(3x+2)^2$
21.27. $2x$; $2x^2(3x^2-2)(3x^2+2)^2$ 21.28. $3x$; $3x^2(x-3)(x+3)^2$ 21.29. 1; $2(x^2+2)(x^2-2)^2$ 21.30. 1; $3x(x^2+2)^2(x^2-2)^2$ 22.1. 1; $xy(y-x)(y+x)$ 22.2. 1; $2y(y+x)y-x)^2$
22.3. $y+2x$; $xy(y+2x)^2$ 22.4. y^2-2x ; $3y(y^2+2x)(y^2-2x)^2$ 22.5. $y+x$; $xy(y+x)(y-x)$ 22.6. $y(xy-1)$; $y^2(xy+1)(xy-1)^2$ 22.7. $2(2y+x)$; $2(2y-x)(2y+x)^2$ 22.8. $3x$;
 $3x(y-1)^2(y+1)^2$ 22.9. x ; $x(y+x)^2(y-x)^2$ 22.10. $y-x$; $x(y-x)^2$ 22.11. $xy+3$; $x(xy-3)(xy+3)^2$ 22.12. 1; $2(xy+2)^2(xy-2)^2$ 23.1. $\frac{x+1}{x-1}$ 23.2. $\frac{x-1}{x+1}$ 23.3. $\frac{1}{x+1}$ 23.4. $\frac{1}{2x-1}$
23.5. $\frac{1}{x-2}$ 23.6. $\frac{x-3}{x+3}$ 23.7. $\frac{x+1}{x-1}$ 23.8. $\frac{3x+1}{3x-1}$ 23.9. $\frac{-1}{3}$ 23.10. $\frac{-2x}{x-3}$ 23.11. $\frac{2x-3}{2x+3}$ 23.12. $\frac{2x}{x+2}$ 23.13. $\frac{2x-1}{2x+1}$ 23.14. $\frac{-x}{x-2}$ 23.15. $4x^2+1$ 23.16. $\frac{2}{x+1}$ 23.17.
 $\frac{3x}{x+3}$ 23.18. $\frac{1}{x+1}$ 23.19. $\frac{3x}{x-3}$ 23.20. $\frac{2x}{x+1}$ 23.21. $\frac{2}{x-2}$ 23.22. $\frac{1}{x+1}$ 23.23. $\frac{-2x}{x+1}$ 23.24. $\frac{-2x}{x^2+3}$ 23.25. -2 23.26. $\frac{x-1}{x+1}$ 23.27. $\frac{1}{x-3}$ 23.28. $3x^2-1$ 23.29.
 $\frac{3x+2}{3x-2}$ 23.30. $\frac{x+1}{x-1}$ 23.31. $\frac{3x+1}{3x-1}$ 23.32. $\frac{1}{3x-2}$ 23.33. $\frac{3x-2}{3x+2}$ 23.34. $-3x$ 23.35. $\frac{-1}{3x^2}$ 23.36. $3x+2$ 24.1. 1 24.2. no tiene 24.3. 1 24.4. no tiene 24.5. $\frac{3}{4}$
24.6. $\frac{-1}{2}$ 24.7. no tiene 24.8. 1 24.9. no tiene 24.10. 1 24.11. 0 24.12. -1 24.13. -3 24.14. $\frac{-4}{7}$ 24.15. 0 25.1. $\frac{1}{3x}$ 25.2. $\frac{1}{2x}$ 25.3. $\frac{1}{3x^2}$ 25.4. $\frac{2}{3x^2}$
25.5. $\frac{1}{x^2}$ 25.6. $\frac{2}{3x^2}$ 25.7. $\frac{1}{2}$ 25.8. $\frac{3x+2}{2x-2}$ 25.9. $\frac{1}{x+1}$ 25.10. $\frac{3}{x-3}$ 25.11. $\frac{1}{x+1}$ 25.12. $\frac{3}{2x-1}$ 25.13. $\frac{x-2}{x+1}$ 25.14. $\frac{2}{2x-1}$ 25.15. $\frac{3}{x+2}$ 25.16. $\frac{x+3}{2x+1}$ 25.17.
 $\frac{2x+2}{x+2}$ 25.18. $\frac{1}{2x-3}$ 25.19. $\frac{2x}{x+3}$ 25.20. $\frac{3x+3}{2x+1}$ 25.21. $\frac{1}{3x-1}$ 25.22. $\frac{2x}{3x-2}$ 25.23. $\frac{1}{x+1}$ 25.24. $\frac{x}{3x+3}$ 25.25. $\frac{2}{3x-3}$ 25.26. $\frac{x+2}{3x-1}$ 25.27. $\frac{3x+2}{2x+1}$ 25.28. $\frac{1}{2x+3}$
25.29. $\frac{2x}{3x+3}$ 25.30. $\frac{1}{2x+3}$ 25.31. $\frac{x-1}{3x-2}$ 25.32. $\frac{3x-2}{x-2}$ 26.1. 1 26.2. $\frac{1}{x}$ 26.3. $\frac{x+3}{3}$ 26.4. $\frac{2}{x-2}$ 26.5. $\frac{x-2}{x+1}$ 26.6. 3 26.7. $\frac{x-1}{2x}$ 26.8. $\frac{x+2}{3x}$ 26.9. $\frac{3}{x-3}$
26.10. $\frac{x-1}{x-2}$ 26.11. $\frac{2x}{x-2}$ 26.12. $\frac{x+3}{x}$ 26.13. $\frac{x+2}{3x}$ 26.14. 1 26.15. $\frac{x+2}{x}$ 26.16. 1 26.17. $\frac{3}{2}$ 26.18. $\frac{1}{x-2}$ 26.19. 1 26.20. x 26.21. $\frac{x-2}{3}$ 26.22. $\frac{x+3}{x}$
26.23. x 26.24. $\frac{1}{x-3}$ 26.25. $\frac{x-3}{2x}$ 26.26. 1 26.27. $\frac{2}{x-3}$ 26.28. $\frac{x-3}{x+1}$ 26.29. $\frac{x}{x+2}$ 26.30. $\frac{x}{2}$ 26.31. $\frac{x-3}{x-1}$ 26.32. $\frac{x+2}{x}$ 27.1. $\frac{2}{x}$ 27.2. $\frac{3}{x^2}$ 27.3. $\frac{2}{x+2}$ 27.4.
 $\frac{x}{x+1}$ 27.5. $\frac{3}{x+1}$ 27.6. $\frac{1}{x-1}$ 27.7. $\frac{2}{x+1}$ 27.8. $\frac{2x}{x-3}$ 27.9. $\frac{3x}{x+2}$ 27.10. $\frac{x}{x-3}$ 27.11. $\frac{3}{x-3}$ 27.12. $\frac{3}{x-3}$ 27.13. $\frac{3x}{x-3}$ 27.14. $\frac{3x}{x+2}$ 27.15. $\frac{x}{x+1}$ 27.16. $\frac{3}{x+1}$ 27.17.
 $\frac{3}{x+3}$ 27.18. $\frac{1}{x+2}$ 27.19. $\frac{1}{x-3}$ 27.20. $\frac{2x}{x+2}$ 27.21. $\frac{3x}{x-3}$ 27.22. $\frac{3}{x-2}$ 27.23. $\frac{2x}{x+3}$ 27.24. 2 27.25. $\frac{2x-2}{3x}$ 27.26. $\frac{1}{2}$ 27.27. $\frac{x+1}{x}$ 27.28. $\frac{1}{3}$ 27.29. $\frac{1}{2}$
27.30. x 28.1. $\frac{y}{y-2}$ 28.2. $\frac{y+1}{y-1}$ 28.3. $\frac{2y+3x}{y-x}$ 28.4. $\frac{2}{3y+3}$ 28.5. $\frac{3}{xy-3}$ 28.6. $\frac{3y}{y-3}$ 28.7. $\frac{x}{xy-1}$ 28.8. $\frac{y-x}{y+2x}$ 28.9. $\frac{3x}{3y-1}$ 28.10. $\frac{3x}{2xy-2}$ 28.11. $\frac{y}{y-x}$ 28.12.
 $\frac{y-3x}{y}$ 28.13. $\frac{1}{x}$ 28.14. $\frac{3}{y-3x}$ 28.15. $\frac{3x}{y-x}$