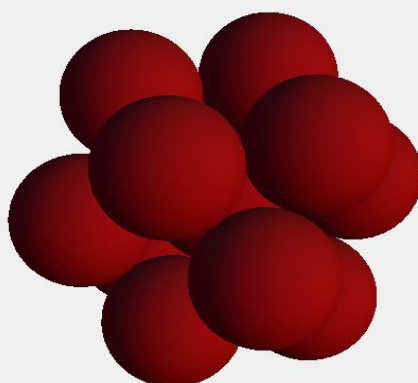


# MathCon

*The Mathematics Firm*

## Factorización

Problemas sobre factorización



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# Capítulo 1

## Factorización

### 1.1. Factorizar las siguientes expresiones algebraicas como producto de dos trinomios.

- |  |                                    |
|--|------------------------------------|
| 1. $1 - x - 2xy + x^2y + x^2y^2 - z + xz + xyz.$           | Sol: $(-1 + x + xy)(-1 + xy + z).$ |
| 2. $-24 + 3b - 8x^2 + bx^2 - 8xy + bxy + 3z + x^2z + xyz.$ | Sol: $(3 + x^2 + xy)(-8 + b + z).$ |
| 3. $ac + c^2 + ax + cx + ay + cy + cz + xz + yz.$          | Sol: $(c + x + y)(a + c + z).$     |
| 4. $15 - 5c - 8x + cx + x^2 - 3z + cz + xz.$               | Sol: $(-3 + c + x)(-5 + x + z).$   |
| 5. $-6 + 2a + 2x - 3x^2 + ax^2 + x^3 - 3y + ay + xy.$      | Sol: $(-3 + a + x)(2 + x^2 + y).$  |
| 6. $-3a + ab - 3c + bc + ax + cx - 3y + by + xy.$          | Sol: $(-3 + b + x)(a + c + y).$    |
| 7. $9 + 3b + 3x + bx + 3x^2 + x^3 + 3z + bz + x^2z.$       | Sol: $(3 + b + x^2)(3 + x + z).$   |
| 8. $-a + ay - xy + xy^2 - z + az + yz + xyz + z^2.$        | Sol: $(-1 + y + z)(a + xy + z).$   |
| 9. $20 - 5a - 5b - 4y + ay + by - 4z + az + bz.$           | Sol: $(-4 + a + b)(-5 + y + z).$   |
| 10. $-6 - b + b^2 - 3c + bc + 2xy + bxy + cxy.$            | Sol: $(2 + b + c)(-3 + b + xy).$   |
| 11. $-a + ax - y + xy - z + az + xz + yz + z^2.$           | Sol: $(-1 + x + z)(a + y + z).$    |
| 12. $9 - 3a - 3b + ab - 3y + by - 3xy + axy + xy^2.$       | Sol: $(-3 + a + y)(-3 + b + xy).$  |
| 13. $3 - 3a - 4b + ab + b^2 - z + az + bz.$                | Sol: $(-1 + a + b)(-3 + b + z).$   |
| 14. $bc + cx^2 + by + cy + x^2y + y^2 + bz + x^2z + yz.$   | Sol: $(b + x^2 + y)(c + y + z).$   |
| 15. $-3 + 3a + 2b + ab + b^2 - x + ax + bx.$               | Sol: $(-1 + a + b)(3 + b + x).$    |
| 16. $4 - a - 5xy + axy + x^2y^2 - 4z + az + xyz.$          | Sol: $(-4 + a + xy)(-1 + xy + z).$ |
| 17. $ab + b^2 + ax + bx + axy + bxy + bz + xz + xyz.$      | Sol: $(b + x + xy)(a + b + z).$    |
| 18. $2 - 2a - 2b - c + ac + bc - xy + axy + bxy.$          | Sol: $(-1 + a + b)(-2 + c + xy).$  |
| 19. $-2b + b^2 - 2c + 2bc + c^2 - 2x + bx + cx.$           | Sol: $(-2 + b + c)(b + c + x).$    |
| 20. $-6 + 3a - 2b + ab + 3x^2 + bx^2 - 2y + ay + x^2y.$    | Sol: $(-2 + a + x^2)(3 + b + y).$  |
| 21. $-10 - 5a + 2x + ax + 2y + ay - 5xy + x^2y + xy^2.$    | Sol: $(-5 + x + y)(2 + a + xy).$   |

22.  $4 - a - 4b + ab - x^2 + bx^2 - 4z + az + x^2z$ . Sol:  $(-4 + a + x^2)(-1 + b + z)$ .
23.  $-8 - 4a - 4x + 2x^2 + ax^2 + x^3 + 2z + az + xz$ . Sol:  $(2 + a + x)(-4 + x^2 + z)$ .
24.  $-9 - 3b + 3c + bc + 3x + bx - 3y + cy + xy$ . Sol:  $(-3 + c + x)(3 + b + y)$ .
25.  $-3 + 2x + x^2 + 3xy + x^2y - z + xz + xyz$ . Sol:  $(-1 + x + xy)(3 + x + z)$ .
26.  $2 - 2x - 2x^2 - xy + x^2y + x^3y - z + xz + x^2z$ . Sol:  $(-1 + x + x^2)(-2 + xy + z)$ .
27.  $4 - b - 4x^2 + bx^2 - y + x^2y - 4z + bz + yz$ . Sol:  $(-4 + b + y)(-1 + x^2 + z)$ .
28.  $5 - 6b + b^2 - x^2 + bx^2 - 5z + bz + x^2z$ . Sol:  $(-5 + b + x^2)(-1 + b + z)$ .
29.  $-4 + 2b + 2c - 2x^2 + bx^2 + cx^2 - 2z + bz + cz$ . Sol:  $(-2 + b + c)(2 + x^2 + z)$ .
30.  $12 - 3a - 3x^2 - 4y + ay - 4xy + axy + x^2y + x^3y$ . Sol:  $(-4 + a + x^2)(-3 + y + xy)$ .
31.  $4 - 2b - 2c - 2x^2 + bx^2 + cx^2 - 2y + by + cy$ . Sol:  $(-2 + b + c)(-2 + x^2 + y)$ .
32.  $-6 - 3a - 3b + 2x + ax + bx + 2y + ay + by$ . Sol:  $(2 + a + b)(-3 + x + y)$ .
33.  $-3a + ab - 3c + bc - 3x + bx + ay + cy + xy$ . Sol:  $(a + c + x)(-3 + b + y)$ .
34.  $-3 - b + 3xy + bxy + 2z + bz + xyz + z^2$ . Sol:  $(3 + b + z)(-1 + xy + z)$ .
35.  $20 - 5x^2 - 9xy + x^3y + x^2y^2 - 4z + x^2z + xyz$ . Sol:  $(-4 + x^2 + xy)(-5 + xy + z)$ .
36.  $4 - a - x - 4x^2 + ax^2 + x^3 - 4xy + axy + x^2y$ . Sol:  $(-4 + a + x)(-1 + x^2 + xy)$ .
37.  $bc + bx^2 + cxy + x^3y + bz + cz + x^2z + xyz + z^2$ . Sol:  $(c + x^2 + z)(b + xy + z)$ .
38.  $-8 - 4b - 2x + bx + x^2 + 2xy + bxy + x^2y$ . Sol:  $(2 + b + x)(-4 + x + xy)$ .
39.  $-5a - 5b - 5c + ax + bx + cx + ax^2 + bx^2 + cx^2$ . Sol:  $(a + b + c)(-5 + x + x^2)$ .
40.  $-2a + a^2 + ax^2 - 2xy + axy + x^3y - 2z + az + x^2z$ . Sol:  $(-2 + a + x^2)(a + xy + z)$ .
41.  $-6 + 2a - 3y + ay + 2xy + xy^2 - 3z + az + xyz$ . Sol:  $(-3 + a + xy)(2 + y + z)$ .
42.  $-4a - 4b - 4c + ac + bc + c^2 + axy + bxy + cxy$ . Sol:  $(a + b + c)(-4 + c + xy)$ .
43.  $-b + b^2 - c + bc - xy + bxy + bz + cz + xyz$ . Sol:  $(b + c + xy)(-1 + b + z)$ .
44.  $3 - a - 4x^2 + ax^2 + x^4 - 3z + az + x^2z$ . Sol:  $(-3 + a + x^2)(-1 + x^2 + z)$ .
45.  $4 - 4b - 4x - x^2 + bx^2 + x^3 - z + bz + xz$ . Sol:  $(-1 + b + x)(-4 + x^2 + z)$ .
46.  $ay + by + axy + bxy + x^2y + x^3y + az + bz + x^2z$ . Sol:  $(a + b + x^2)(y + xy + z)$ .
47.  $x^3 + x^4 + 2x^2y + x^3y + xy^2 + xz + x^2z + yz$ . Sol:  $(x + x^2 + y)(x^2 + xy + z)$ .
48.  $-10 - 5a - 5x^2 + 2y + ay + 2xy + axy + x^2y + x^3y$ . Sol:  $(2 + a + x^2)(-5 + y + xy)$ .
49.  $15 - 5a - 3b + ab - 5x^2 + bx^2 - 3z + az + x^2z$ . Sol:  $(-3 + a + x^2)(-5 + b + z)$ .
50.  $-3a - 3c + ay + cy - 3xy + axy + cxy + xy^2 + x^2y^2$ . Sol:  $(a + c + xy)(-3 + y + xy)$ .
51.  $-2 + 2x + 2y - xy + x^2y + xy^2 - bz^2 + bxz^2 + byz^2$ . Sol:  $(-1 + x + y)(2 + xy + bz^2)$ .
52.  $8 - 6bx - 4x^2 + b^2x^2 + bx^3 - 2az^2 + abxz^2 + ax^2z^2$ . Sol:  $(-2 + bx + x^2)(-4 + bx + az^2)$ .
53.  $3b + ab + b^2x + 3ay + a^2y + 3by + aby + abxy + b^2xy$ . Sol:  $(3 + a + bx)(b + ay + by)$ .
54.  $3a + ab + ac + 3y + 4by + b^2y + cy + bcy$ . Sol:  $(3 + b + c)(a + y + by)$ .

55.  $6 - 2ay - 2by - 3z - 3bz + ayz + byz + abyz + b^2yz$ . Sol:  $(-3 + ay + by)(-2 + z + bz)$ .
56.  $-2 - a - by + 2bz + abz + b^2yz + 2az^2 + a^2z^2 + abyz^2$ . Sol:  $(2 + a + by)(-1 + bz + az^2)$ .
57.  $1 - bx^2 - y + bx^2y - az + abx^2z - bz^2 + byz^2 + abz^3$ . Sol:  $(-1 + y + az)(-1 + b(x^2 + z^2))$ .
58.  $5 - b - 5y - 4by + b^2y - yz + y^2z + by^2z$ . Sol:  $(-1 + y + by)(-5 + b + yz)$ .
59.  $-2bx + abx^2 - 2ay + a^2xy - 2ay^2 + a^2xy^2 + bxz + ayz + ay^2z$ . Sol:  $(bx + ay(1 + y))(-2 + ax + z)$ .
60.  $9 - 3x^2 - 3xy + x^3y - 3ay^2 + axy^3 - 3z + x^2z + ay^2z$ . Sol:  $(-3 + x^2 + ay^2)(-3 + xy + z)$ .
61.  $-4xy + x^2y + bxy^2 - 4z - 4bz + xz + bxz + byz + b^2yz$ . Sol:  $(-4 + x + by)(xy + z + bz)$ .
62.  $bx + b^2x + axy + abxy + byz + xyz + bxyz + ay^2z + y^2z^2$ . Sol:  $(x + bx + yz)(b + y(a + z))$ .
63.  $6 - 2b - 3c + bc - 3x^2 + bx^2 - 2az^2 + acz^2 + ax^2z^2$ . Sol:  $(-2 + c + x^2)(-3 + b + az^2)$ .
64.  $x^2z + bx^2z + ay^2z + aby^2z + z^2 + bz^2 + bx^2z^2 + aby^2z^2 + bz^3$ . Sol:  $z(x^2 + ay^2 + z)(1 + b + bz)$ .
65.  $20 - 4a - 4y - 5by^2 + aby^2 + by^3 - 5az^2 + a^2z^2 + ayz^2$ . Sol:  $(-5 + a + y)(-4 + by^2 + az^2)$ .
66.  $-8 + 2a - 4b + ab + 2ay + aby - 4ay^2 + a^2y^2 + a^2y^3$ . Sol:  $(-4 + a + ay)(2 + b + ay^2)$ .
67.  $-ax + a^2x^2 + abxy - az + a^2xz + abyz - bz^2 + abxz^2 + b^2yz^2$ . Sol:  $(-1 + ax + by)(bz^2 + a(x + z))$ .
68.  $3ax + 3bx^2 + ax^3 + bx^4 + axz + bx^2z + 3az^2 + ax^2z^2 + az^3$ . Sol:  $(3 + x^2 + z)(bx^2 + a(x + z^2))$ .
69.  $-8 + 2x - 4ax^2 + ax^3 + 2by + abx^2y - 4z + xz + byz$ . Sol:  $(-4 + x + by)(2 + ax^2 + z)$ .
70.  $-9 - 3a + 3y + ay - 3xy + xy^2 + 3z + az + xyz$ . Sol:  $(3 + a + xy)(-3 + y + z)$ .
71.  $2y + xy + xy^2 + 2yz + xyz + xy^2z + 2az^2 + axz^2 + axyz^2$ . Sol:  $(2 + x + xy)(y + yz + az^2)$ .
72.  $3c + 3ax^2 + cx^2 + ax^4 + acy^2 + a^2x^2y^2 + 3bz^2 + bx^2z^2 + aby^2z^2$ . Sol:  $(3 + x^2 + ay^2)(c + ax^2 + bz^2)$ .
73.  $5 - 5bx - az + abxz - 6yz + bxyz + ayz^2 + y^2z^2$ . Sol:  $(-1 + bx + yz)(-5 + az + yz)$ .
74.  $-3c - 3xy + cxy + x^2y^2 - 3yz + cyz + 2xy^2z + y^2z^2$ . Sol:  $(-3 + xy + yz)(c + y(x + z))$ .
75.  $-3a - 3c + abx^2 + bcx^2 + a^2z^2 - 3bz^2 + acz^2 + b^2x^2z^2 + abz^4$ . Sol:  $(-3 + bx^2 + az^2)(a + c + bz^2)$ .
76.  $-2x - 2bx + cx + bcx + ax^2 + abx^2 - 2z + cz + axz$ . Sol:  $(-2 + c + ax)(x + bx + z)$ .
77.  $-2by - 2ay^2 - by^2 + ay^3 + by^3 + b^2yz + aby^2z + b^2y^2z$ . Sol:  $y(b + ay + by)(-2 + y + bz)$ .
78.  $-5y - 5ay + bxy + abxy + by^2 + aby^2 - 5az + abxz + abyz$ . Sol:  $(-5 + b(x + y))(y + ay + az)$ .
79.  $3b + 3bx + aby + b^2y + abxy + b^2xy + 3az + a^2yz + abyz$ . Sol:  $(3 + ay + by)(b + bx + az)$ .
80.  $-a + ax^2 - y - by + x^2y + bx^2y + ayz + y^2z + by^2z$ . Sol:  $(a + y + by)(-1 + x^2 + yz)$ .
81.  $8 - 2b - 2y - 4ay^2 + aby^2 + ay^3 - 4yz + byz + y^2z$ . Sol:  $(-4 + b + y)(-2 + ay^2 + yz)$ .
82.  $-b + bx^2 - by + b^2y + bx^2y + b^2y^2 - az + ax^2z + abyz$ . Sol:  $(-1 + x^2 + by)(b + by + az)$ .
83.  $3y + by + bxy + 3yz + byz + bxyz + 3bz^2 + b^2z^2 + b^2xz^2$ . Sol:  $(3 + b + bx)(y + yz + bz^2)$ .

84.  $12 - 4x - 3bz + bxz - 3yz + xyz - 4bz^2 + b^2z^3 + byz^3$ . Sol:  $(-4 + bz + yz)(-3 + x + bz^2)$ .
85.  $6 - 3b - 2x^2 + bx^2 - 2xy + bxy - 3az + ax^2z + axyz$ . Sol:  $(-3 + x^2 + xy)(-2 + b + az)$ .
86.  $-4ax^2 + ax^3 + ax^2y - 4z + xz - 3yz + xyz + y^2z$ . Sol:  $(-4 + x + y)(ax^2 + z + yz)$ .
87.  $5 - b - 5ax^2 + abx^2 - 5z + bz - az^2 + a^2x^2z^2 + az^3$ . Sol:  $(-1 + ax^2 + z)(-5 + b + az^2)$ .
88.  $-ax^2 + a^2x^2 + acx^2 - y + ay + cy - bz + abz + bcz$ . Sol:  $(-1 + a + c)(ax^2 + y + bz)$ .
89.  $-4ax - 4bx^2 + a^2xz + abx^2z - 4yz + abxz^2 + b^2x^2z^2 + ayz^2 + byz^3$ . Sol:  $(ax + bx^2 + yz)(-4 + az + bz^2)$ .
90.  $-8 - 4ax + 2bx^2 + abx^3 - 4xy + bx^3y + 2by^2 + abxy^2 + bxy^3$ . Sol:  $(2 + ax + xy)(-4 + b(x^2 + y^2))$ .
91.  $-x^2 + ax^2 - y + ay - bz + abz + ax^2z + ayz + abz^2$ . Sol:  $(-1 + a + az)(x^2 + y + bz)$ .
92.  $-6 - bx^2 + b^2x^4 + 2xy + bx^3y - 3bz + b^2x^2z + bxyz$ . Sol:  $(-3 + bx^2 + xy)(2 + b(x^2 + z))$ .
93.  $2c + 2x^3 + cx^2yz + x^5yz + 2y^3z + cxz^2 + x^4z^2 + x^2y^4z^2 + xy^3z^3$ . Sol:  $(c + x^3 + y^3z)(2 + x^2yz + xz^2)$ .
94.  $-3 + 3b - x^2z^2 + bx^2z^2 + 2xyz^2 + bxyz^2 + x^3yz^4 + x^2y^2z^4$ . Sol:  $(-1 + b + xyz^2)(3 + x^2z^2 + xyz^2)$ .
95.  $x^4y^2 + x^2y^2z + ax^2y^2z + bx^2z^2 + x^3z^2 + bz^3 + abz^3 + xz^3 + axz^3$ . Sol:  $(x^2 + z + az)(x^2y^2 + bz^2 + xz^2)$ .
96.  $16 - 4bx - 4ay^2 - 4yz + bxyz - 4y^3z + ay^3z + bxy^3z + ay^5z$ . Sol:  $(-4 + bx + ay^2)(-4 + yz + y^3z)$ .
97.  $ax^4y + bx^2y^2 + ax^2z + byz + ax^4yz + bx^2y^2z + x^2yz^3 + z^4 + x^2yz^4$ . Sol:  $(ax^2 + by + z^3)(z + x^2y(1 + z))$ .
98.  $12 - 4b - 4az - 3bz + b^2z - 3x^2z + bx^2z + abz^2 + ax^2z^2$ . Sol:  $(-3 + b + az)(-4 + bz + x^2z)$ .
99.  $-2yz + xy^4z + y^5z - 2z^3 - 2yz^3 + xy^3z^3 + y^4z^3 + xy^4z^3 + y^5z^3$ . Sol:  $(-2 + xy^3 + y^4)z(y + z^2 + yz^2)$ .
100.  $bxy^2 + x^2y^3 + aby^2z + axy^3z + axz^2 + a^2z^3 + by^2z^3 + xy^3z^3 + az^5$ . Sol:  $(by^2 + xy^3 + az^2)(x + az + z^3)$ .