

I- Factorize, by taking a common factor or term:

1)  $x^{13} - x^{12}$ .

2)  $(x - 2)(2a - b) - 3(b - a)(x - 2)$ .

3)  $-5a^4 - 15a^3 - 25a^2$ .

4)  $x(3x - 1) - 3(1 - 3x)$ .

5)  $x^2y^3 - x^3y^4$ .

6)  $24nr + 20n^2$ .

II- Factorize, using remarkable identities:

1)  $4r^2 - 9(1 - r)^2$ .

2)  $x^2 + 18x + 81$ .

3)  $25 - 80x + 64x^2$ .

4)  $9(2n - r)^2 - 16(n - 2r)^2$ .

5)  $a^3 + 6a^2 + 12a + 8$ .

6)  $(a^2 + b^2 - c^2)^2 - 4a^2b^2$ .

7)  $x^3 - 9x^2 + 27x - 27$ .

8)  $x^3 + 27$ .

9)  $8x^6 + 27y^9$ .

10)  $3y^3z - 24z^4$ .

III- Write the following expressions as a product of two or more factors:

a)  $a^3b^2 + ab^4 + 2a^2b^3$ .

b)  $(x^2 + y^2)(x - y) + 2xy(y - x)$ .

c)  $x^6y^3 - x^2y^9$ .

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

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

f)  $x^2(m - n) - 2x(m - n) - (n - m)$ .

g)  $x^{2n} - 4y^{4n}$ .

h)  $n^4 - r^4$ .

i)  $x^8 - 1$ .

j)  $(ab + ac) - (bx + cx)$ .

IV- Group, then factorize the following expressions:

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

2)  $(x + 2)^2 - a^2 - 10a - 25$ .

3)  $1 - 9x^2 - y^2 - 6xy$ .

4)  $x^6 - x^2y^2 - x^4y^4 + y^6$ .

5)  $x^2 - 6ax + 9a^2 - 16b^2$ .

6)  $x^4 - 2a^2x^2 + a^4 - x^2 + 2ax - a^2$ .

V- Use trial and error or perfect squaring to factorize the following expressions:

a)  $x^2 + 9x - 36$ .

b)  $x^2 + 10x - 39$ .

c)  $p^2 - 12p - 45$ .

d)  $k^2 - 14k + 48$ .

e)  $17 - 18x + x^2$ .

f)  $20 - 12n + n^2$ .

*VI-* Factorize the following expressions:

i)  $5n^2 + 7n - 12$ .

iii)  $5n^2 - 6n + 1$ .

v)  $3x^2 - 9x + 6$ .

ii)  $3r^2 - 7r + 4$ .

iv)  $-7z^2 + 10z - 3$ .

vi)  $\frac{3}{4}p^2 - p + \frac{1}{4}$ .

*VII-* Factorize the following expressions to simplify:

1)  $\frac{5^{n+2} - 5^n}{24(2^{n+1} - 2^n)}$ .

2)  $\frac{8^n + 2^n}{20^n + 5^n}$ .

3)  $\frac{3^{n+4} - 6 \times 3^{n+1}}{7 \times 3^{n+1}}$ .

4)  $\frac{a^{3n} - a^{n+2}}{a^{2n} - a^{n+1}}$ .

5)  $\sqrt{\frac{8^{20} + 4^{10}}{4^{-7} + 4^{13}}}$ .

6)  $\frac{4^{n+2} - 4^n}{2^{n+2} - 2^{n-1}}$ .

*VIII-* Expand each of the following binomials using Pascal's triangle.

a)  $(a + 3)^4$ .

b)  $(3n + z)^6$ .

c)  $(x + 2y)^5$ .

*IX-* How many terms are there in the expansion of  $(m - p)^n$  such that  $n$  is a natural number.

*X-* Consider the numerical expression:  $S = \frac{4^n + 4 \cdot 2^n + 3}{4^n + 2^n}$ .

a. Show that:  $S - 1 = \frac{3}{2^n}$ .

b. Find the value of  $n$ , so that:  $S = 25$ .