An identity is an equality statement that is true for any value you give to the variable present in it.

Identities

1. $(a + b)^2 = a^2 + b^2 + 2ab$
2. $(a - b)^2 = a^2 + b^2 - 2ab$
3. $(a + b)(a - b) = a^2 - b^2$
4. $(x + a)(x + b) = x^2 + (a + b)x + ab$
5. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
6. $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$ or $a^3 + b^3 + 3a^2b + 3ab^2$
7. $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$ or $a^3 - b^3 - 3a^2b + 3ab^2$
8. $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$
9. if $(a = b = c) = 0$ then $a^3 + b^3 + c^3 = 3abc$
10. $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
11. $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Exercise I

Q1. Factorize the following polynomials

(a) $x^3 - 2x^2 - 5x + 6$ [(x-1)(x+2)(x-3)]

(b) $x^3 + 2x^2 - 13x + 10$ [(x-1)(x-2)(x+5)]

Exercise II

Q1. Check whether the following trinomials are perfect squares or not. If yes, factorize them.

(a) $36y^2 + 36y + 36$ [Not a perfect square]

(b) $x^2 - x + \frac{1}{4}$ $[(x - \frac{1}{2})^2]$

(c) $25y^2 + 100xy + 100x^2$ $[(5x + 10y)^2]$

(d) $144x^4y^2 + x^2y^2 + 24x^3y^2$ $[(12x^2y + xy)^2]$

(e) $x^2 + 4x + 4$ $[(x+2)^2]$

Exercise III

Q1 Factorize the following

(a) $x^2 - 1$ [(x+1)(x-1)]

(b) $4x^2y^2 - \frac{1}{4}$ $[(2xy + \frac{1}{2})(2xy - \frac{1}{2})]$

(c) $\frac{16}{49}x^4 - \frac{49}{64}y^6$ $[(\frac{4}{7}x^2 + \frac{7}{8}y^3)(\frac{4}{7}x^2 - \frac{7}{8}y^3)]$

(d) $0.81a^2b^4 - 0.01a^6b^6$ $[(0.9ab^2 + 0.1a^3b^3)(0.9ab^2 - 0.1a^3b^3)]$

(e) $\frac{1}{4}a^2b^2c^2 - \frac{1}{16}x^2y^2z^2$ $[(\frac{1}{2}abc + \frac{1}{4}xyz)(\frac{1}{2}abc - \frac{1}{4}xyz)]$

Exercise IV

Q1. Factorize the following polynomials.

(a) $x^2 + 4y^2 + 16z^2 + 4xy + 16yz + 8zx$ $[(x+2y+4z)^2]$

(b) $8x^3 + 12x^2 + 6x + 1$ $[(2x+1)^3]$

(c) $8a^3 - b^3 - 12a^2b + 6ab^2$ $[(2a-b)^3]$

(d) $27p^3 + 27q^3 + r^3 - 27pqr$ [(3p+3q+r)(9p2+9q2+r2-9pq-3qr-3pr)]

Q2. Evaluate the following using appropriate identities.

(a) 97^2 [9409] (b) 105^3 [1157625] (c) 97 X 103 [9991]

(d) 105 X 95 [9975] (e) $5^3 - 15^3 + 10^3$ [-2250] (f) $108^2 - 92^2$ [3200]

Practice Session I

Q1. Factorize:

(1) $x^4 + 4$ $[(x^2 - 2x + 2)(x^2 + 2x + 2)]$

(2) a^4+324 [$(a^2+6a+18)(a^2-6a+18)$]
(3) x^4+4x^2+3 [$(x^2+3)(x^2+1)$]
Q2. Express $(x^2 - 5x + 7)(x^2 + 5x -7)$ as a difference of two squares.
[$(x^2)^2 - (5x-7)^2$]
Q3. Factorize: $x^3 + 7x^2 + 14x + 8$. [$(x+2)(x+1)(x+4)$]
Q4. Factorize:
(1) $8a^3 + 27b^3$ [$(2a+3b)(4a^2-6ab+9b^2)$]
(2) $a^6/125 + 125/a^6$ [$(a^2/5 + 5/a^2)(a^4/25 -1 + 25/a^4)$]
(3) $64a^3 - b^3$ [$(4a-b^2)(16a^2+4ab^2+b^4)$]
(4) $8x^3 - 1/27$ [$(2x-1/3)(4x^2+\frac{2}{3}x+\frac{1}{9})$]
(5) $a^3+ b^3 + a + b$ [$(a+b)(a^2-ab+b^2+1)$]
(6) $8x^3 - (2x - y)^3$ [$y(12x^2+y^2-6xy)$]
Q5. Factorize each of the following cubic polynomials.
(i) $a^3 - b^3 + 1 + 3ab$ [$(a-b+1)(a2+b2+ab-a+b+1)$]
(ii) $2\sqrt{2}\,a^3 + 8b^3 - 27c^3 + 18\sqrt{2}abc$ [$(\sqrt{2}a+2b-3c)(2a2+4b2+9c2-2\sqrt{2}ab+6bc+3\sqrt{2}ac)$]
(iii) $(x - y)^3 + (y - z)^3 + (z - x)^3$ [$3(x-y)(y-z)(z-x)$]
(iv) $a^3(b - c)^3 + b^3(c - a)^3 + c^3(a - b)^3$ [$3abc(a-b)(b-c)(c-a)$]

Q6. Divide the polynomial $x^3 - 27x^2 + 8x + 18$ by $x - 1$ by long division method.
[$Q=x^2-26x-18, R=0$]

Q7. Find the remainder when $5x^2 + 3x + 1$ is divided by $2x$, using long division method. [$Q=\frac{5}{2}x+\frac{3}{2}$, R =1]
Q8. Divide $x^4- a^4$ by $x - a$. [$Q=x^3+ax^2+a^2x+a^3$, R=0]
Q9. What must be subtracted from $x^3- 6x^2 - 15x + 80$, such that it is exactly divisible by $x^2 +x - 12$? [4x-4]
Q10. Find the remainder when $f(x) = x^3 - 6x^2 + 2x - 4$ is divided by $g(x) = 1- 2x$.
[-35/8]
Q11. If the polynomials $ax^3 + 3x^2 - 13$ and $2x^3 - 5x + a$ when divided by $(x - 2)$ leave the same remainder, find the value of a. [1]
Q12. The polynomials $ax^3 + 3x^2 - 13$ and $2x^3 - 5x + a$ are divided by $(x + 2)$. If the remainder in each case is the same, find the value of a. [5/9]
Q13. What must be subtracted from $4x^4 - 2x^3 - 6x^2 + x - 5$, so that the result is exactly divisible by $2x^2 + x - 1$? Use long division method. [-6]
Q14. If $ax^3 + bx^2 - x - 6$ has $x + 2$ as a factor and leaves a remainder 4 when divided by x-2, find the values of a and b. [a=0,b=2]
Q15. What must be added to $x^4 + 2x^3- 2x^2 + x - 1$, so that the result is exactly divisible be $x^2 + 2x - 3$? Use long division method. [x-2]

Practice Session II

Q1. Factorize the following polynomials.
(1) $x^2 - 6x + 63$ [$(x-9)(x-7)$]
(2) $3 -2x^2+5x$ [$-(2x+1)(x-3)$]
(3) $15k^2- 4k - 3$ [$5k-3)(3k+1)$]
(4) $2x^2 + 3\sqrt{3}x + 3$ [$(2x+\sqrt{3})(2x-\sqrt{3})$]
(5) $2(x + y)^2 + 9(x + y)(x - y) - 5(x - y)^2$ [$2(x-3y)(3x-2y)$]
(6) $5- 20x^2$ [$5(1+2x)(1-2x)$]
(7) $x(x- 1) - y(y- 1)$ [$(x-y)(x+y-1)$]

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(8) $x^{10}-y^4$ $[(x^5-y^2)(x^5+y^2)]$

(9) $x^2-(z+y)^2$ $[(x-y-z)(x+y+z)]$

(10) $a^2+b^2-c^2-d^2+2ab-2cd$ $[(a+b+c+d)(a+b-c-d)]$

Q2. Factorize the following using factor theorem.

(i) x^3-3x^2-9x-5 $[(x+1)^2(x-5)]$

(ii) $2x^3+x^2-2x-1$ $[(2x+1)(x+1)(x-1)]$

Q3. If a + b + c = 0, find the value of $\frac{(b+c)^2}{bc}+\frac{(c+a)^2}{ca}+\frac{(a+b)^2}{ab}$. [3]

Q4. The polynomial $p(x) = 2x^3 + 6x^2 + bx + 9$ leaves a remainder 15, when divided by (x + 1). Find the value of b. [-2]

Q5. Find the values of m and n for which (x - 1) and (x + 2) are both factors of the polynomial $2x^3 + mx^2 + nx - 10$. [m=7, n=-1]

Q6. The volume of a cuboid is $x^3 + 7x^2 - 8$. Write the possible expressions for its dimensions. $[(x-1),(x+1),(x^2+8)]$

Q7. If $ax^3 + bx^2 + x - 6$ has (x + 2) as a factor and leaves a remainder 4, when divided by (x - 2). Find the values of a and b. [a=0, b=2]

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