MATHS

NCERT - NCERT MATHEMATICS(TAMIL ENGLISH)

POLYNOMIALS AND FACTORISATION

Example

1. $p(x) = x + 2$. Find $p(1), p(2), p(-1)$ and $p(-2)$. Which among $1, 2, -1$ and -2 becomes the zero of $p(x)$?

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2. Find zero of the polynomial$p(x) = 3x + 1$

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3. Find zero of the polynomial $2x - 1$.

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4. Verify whether 2 and 1 are zeros of the polynomial $x^2 - 3x + 2$ or not ?

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5. If 3 is a zero of the polynomial $x^2 + 2x - a,$ then find a.

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6. Divide $3x^2 + x - 1byx + 1$

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7. Divide the polynomial $2x^4 - 4x^3 - 3x - 1$ by (x-1) and find its quotient and remainder.

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8. Find the remainder when $x^3 + 1$ devided by $(x + 1)$

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9. Check whether $(x - 2)$ is a factor of $x^3 - 2x^2 - 5x + 4$

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10. Check whether the polynomial $p(y) = 4y^3 + 4y^2 - y - 1$ is a multiple of $(2y + 1)$.

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11. If the polynomials $ax^3 + 3x^2 - 13$ and $2x^3 - 5x + a$ arfe divided by $(x - 2)$ leave the same remainder, find the value of a.

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12. Examine whether $x + 2$ is a factor of$x^3 + 2x^2 + 3x + 6$

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13. Show that, $x - 2$ is a factor of $x^3 - 2x^2 + 3x - 6$.

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14. Show that $(x - 1)$ is a factor of $x^{10} - 1$ and also of $x^{11} - 1$.

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15. Factorise $3x^2 + 11x + 6$

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16. Verify whether $2x^4 - 6x^3 + 3x^2 + 3x - 2$ is divisible by $x^2 - 3x + 2$ or not ?

How can you verify using Factor Theorem ?

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17. Factorise $x^3 - 23x^2 + 142x - 120$

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18. Factorise

$x^2 + 5x + 4$

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19. Find $(2a + 3b + 5)^2$ using identity.

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20. Find the product of $(5x - y + z)(5x - y + z)$

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21. Factorise $4x^2 + 9y^2 + 25z^2 - 12xy - 30yz + 20zx$

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22. Write the following cubes in the expended from

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

(ii) $(2p - 5)^3$

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23. Evaluate each of the following using suitable identities

(i)$(103)^3$

(ii)$(99)^3$

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24. Factorise $8x^3 + 36x^2y + 54xy^2 + 27y^3$.

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25. Find the product

$(2a + b + c)\left(4a^2 + b^2 + c^2 - 2ab - bc - 2ca\right)$

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26. Fractorise $a^3 - 8b^3 - 64c^3 - 24abc$

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27. Give possible values for length and breadth of the rectangle whose area is $2x^2 + 9x - 5$.

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Exercise 2 1

1. Find the degree of each of the polynomials given below

$(i) x^5 - x^4 + 3$

(ii) $x^2 + x - 5$

(iii) 5

(iv) $3x^6 + 6y^3 - 7$

(v) $4 - y^2$

(vi) $5t - \sqrt{3}$

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2. Which of the following expressions are polynomials in one variable and which are not ? Give reasons for you answer.

(i) $3x^2 - 2x + 5$

(ii) $x^2 + \sqrt{2}$

(iii) $p^2 - 3p + q$

(iv) $y + \frac{2}{y} (y \neq 0)$

(v) $5\sqrt{x} + x\sqrt{5}$

(vi) $x^{100} + y^{100}$

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3. Write the coefficient of x^3 in each of the following

$(i) x^3 + x + 1$

(ii) $2 - x^3 + x^2$

(iii) $\sqrt{2}x^3 + 5$

(iv) $2x^3 + 5$

(v) $\frac{\pi}{2}x^3 + x$

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

(vii) $2x^2 + 5$

(viii) 4

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4. Classify the following as linear, quadratic and cubic polynomials

(i) $5x^2 + x - 7$

(ii) $x - x^3$

(iii) $x^2 + x + 4$

(iv) $x - 1$

(v) 3p

(vi) πr^2

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5. Write whether the following statements are True or False. Justify your answer

(i) A binomial has two terms

(ii) Every polynomial is a binomial

(iii) A binomial may have degree 3

(iv) Degree of zero polynomial is zero

(v) The degree of $x^2 + 2xy + y^2$ is 2

(vi) πr^2 is a monomial.

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6. Give one example each of a monomial and trinomial of degree 10.

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Exercise 2 2

1. Find the value of the polynomial $4x^2 - 5x + 3,$ at

(i) $x = 0$

(ii) $x = -1$

(iii) $x = 2$

(iv) $x = \frac{1}{2}$

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2. Find $p(0)p, (1)$ and $p(2)$ for each of the following polynomials.

(i) $p(x) = x^2 - x + 1$

(ii)$p(z) = z^3$

(iii) $p(y) = 2 + y + 2y^2 - y^3$

(iii) $p(z) = z^3$

(iv) $p(t) = (t - 1)(t + 1)$

(v) $p(x) = x^2 - 3x + 2$

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3. Verify whether the following are zeros of the polynomial , Indicted against them , or not,

(i) $p(x) = 2x - 1, x = \frac{1}{2}$

(ii) $p(x) = x^3 - 1, x = 1$

(iii) $p(x) = ax + b, x = \frac{-b}{a}$

(iv) $p(x) = (x + 3)(x - 4), x = -3, x = 4$

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4. Find the zero of the polynomial in each of the following cases.

(i) $f(x) = x + 2$

(ii) $f(x) = x - 2$

(iii) $f(x) = 2x + 3$

(iv) $f(x) = 2x - 3$

(v) $f(x) = x^2$

(vi) $f(x) = px, p \neq 0$

(vii) $f(x) = px + q, p \neq 0 pq$ are real numbers.

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5. If 2 is a zero of the polynomial $p(x) = 2x^2 - 3x + 7a,$ then find the value of a.

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6. If 0 and 1 are the zeroes of the polynomial $f(x) = 2x^3 - 3x^2 + ax + b,$ then find the values of a and b.

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Exercise 2 3

1. Find the remainder when $x^3 + 3x^2 + 3x + 1$ is divided by the following Linear polynomials:

(i) $x + 1$

(ii) $x - \frac{1}{2}$

(iii) x

(iv) $x + \pi$

(v) $5 + 2x$

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2. Find the remainder when $x^3 - px^2 + 6x - p$ is divided by $x - p$.

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3. Find the remainder when $2x^2 - 3x + 5$ is divided $2x - 3$. Does it exactly divided the polynomial ? State reason.

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4. Find the remainder when $9x^3 - 3x^2 + x - 5$ is divided by $x - \frac{2}{3}$

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5. If the polynomials $2x^3 + ax^2 + 3x - 5$ and $x^3 + x^2 - 4x + a$ leave the same remainder when divided by $x - 2$, find te value of a.

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6. If the polynomials $x^3 + ax^2 + 5$ and $x^3 - 2x^2 + a$ are divided by $(x + 2)$ leave the same remainder. Find the value of a.

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7. Find the remainder when $f(x) = x^4 - 3x^2 + 4$ is divided by $g(x) = x - 2$ and verify the result by actual division .

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8. Find the remainder when $p(x) = x^3 - 6x^2 + 14x - 3$ is divided b y $g(x) = 1 - 2x$ and verify the result by long division.

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9. When a polynomial $2x^3 + 3x^2 + ax + b$ is divided by $(x - 2)$ leaves remainder 2, and $(x + 2)$ leaves remainder -2. Find a and b.

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Exercise 2 4

1. Determine which of the following polynomials has $(x + 1)$ as a factor.

(i) $x^3 - x^2 - x + 1$

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

(iii) $x^4 + 2x^3 + 2x^2 + x + 1$

(iv) $x^3 - x^2 - \left(3 - \sqrt{3}\right)x + \sqrt{3}$

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2. Use the Factor Theorem to determine whether g (x) is factor of f(x) in each of the following cases:

(i) $f(x) = 5x^3 + x^2 - 5x - 1, g(x) = x + 1$

(ii) $f(x) = x^3 + 3x^2 + 3x + 1, g(x) = x + 1$

(iii) $f(x) = x^3 - 4x^2 + x + 6, g(x) = x - 2$

(iv) $f(x) = 3x^3 + x^2 - 20x + 12, g(x) = 3x - 2$

(v) $f(x) = 4x^3 + 20x^2 + 33x + 18, g(x) = 2x + 3$

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3. Show that $(x - 2), (x + 3)$ and $(x - 4)$ are factors of $x^3 - 3x^2 - 10x + 24.$

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4. Show that $(x+4), (x-3)$ and $(x-7)$ are factors of $x^3 - 6x^2 - 19x + 84.$

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5. If both $(x-2)$ and $\left(x - \frac{1}{2}\right)$ are fractors of $px^2 5x + r,$ then show that p=r.

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6. If $\left(x^2 - 1\right)$ is a factor of $ax^4 + bx^3 + cx^2 + dx + e,$ then show that $a + c + e = b + d = 0$

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7. Determine which of the following polynomials has $(x+1)$ as a factor.

(i) $x^3 - x^2 - x + 1$

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

(iii) $x^4 + 2x^3 + 2x^2 + x + 1$

(iv) $x^3 - x^2 - (3 - \sqrt{3})x + \sqrt{3}$

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8. If $ax^2 + bx + c$ and $bx^2 + ax + c$ have a common factor $x+1$ then show that $c = 0$ and $a = b$.

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9. If $x^2 - x - 6$ and $x^2 + 3x - 18$ have a common factor $(x - a)$ then find the value of a.

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10. If $(y-3)$ is a factor of $y^3-2y^2-9y+18$ then find the other two factors.

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Exercise 2 5

1. Use suitable idntities to find the following products

(i) $(x+5)(x+2)$

(ii) $(x-5)(x-5)$

(iii) $(3x+3)(3x-2)$

(iv) $\left(x^2+\frac{1}{x^2}\right)\left(x^2-\frac{1}{x^2}\right)$

(v) $(1+x)(1+x)$

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2. Evaluate the following products without actual multiplication.

(i) 101×99

(ii) 999×99

(iii) $50\frac{1}{2} \times 49\frac{1}{2}$

(iii) 501×501

(iv)30.5×29.5

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3. Factorise the following using appropriate identities.

(i) $16x^2 + 24xy + 9y^2$

(ii) $4y^2 - 4y + 1$

(iii) $4x^2 - \frac{y^2}{25}$

(iv) $18a^2 - 50$

(v) $x^2 + 5x + 6$

(vi) $3p^2 - 24p + 36$

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4. Expand each of the following, using suitable identities

(i) $(x+2y+4z)^2$

(ii) $(2a-3b)^3$

(iii) $(-2a+5b-3c)^2$

(iv) $\left(\frac{a}{4}-\frac{b}{2}+1\right)^2$

(v) $(p+1)^3$

(vi) $\left(x-\frac{2}{3}y\right)^3$

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5. Factories

$(i) 25x^2+16y^2+4z^2-40xy+16yz-20zx$

$(ii) 9a^2+4b^2+16c^2+12ab-16bc-24ca$

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6. If $a+b+c=9$ and $ab+bc+ca=26$, then find $a^2+b^2+c^2$.

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7. Evaluate the following using suitable identites.

(i) $(99)^3$ $(ii)(102)^3$ $(iii)(998)^3$ $(iv)(1001)^3$

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8. Factorise each of the following

$(i)8a^3+b^3+12a^2b+6ab^2$

(ii) $8a^3-b^3-12a^2b+6ab^2$

(iii) $1-64a^3-12a+48a^2$

(iv) $8p^3-\frac{12}{5}p^2+\frac{6}{25}p-\frac{1}{125}$

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9. Verify

(i) $x^3 + y^3 = (x + y)\left(x^2 - xy + y^2\right)$

(ii) $x^3 - y^3 = (x - y)\left(x^2 + xy + y^2\right)$

using some non-zone positive integers and check by actual multiplication. Can you call these as identities ?

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10. Faactorise

(i) $27a^3 + 64b^3$

(ii) $343y^3 - 1000$ using the above results.

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11. Factorise $27x^3 + y^3 + z^3 - 9xyz$ using identitiy.

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12. Verify that

$$x^3+y^3+z^3-3xyz=\frac{1}{2}(x+y+z)\left[(x-y)^2+(y-z)^2+(z-x)^2\right]$$

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13. (a) $If x+y+z=0,$ show that $x^3+y^3+z^3=3xyz.$

(b) Show that

$$(a-b)^3+(b-c)^3+(c-a)^3=3(a-b)(b-c)(c-a)$$

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14. Without actual calculating the cubes, find the vlaue of each of the following

(i) $(-10)^3+(7)^3+(3)^3$

(ii) $(28)^3+(-15)^3+(-13)^3$

(iii) $\left(\frac{1}{2}\right)^3+\left(\frac{1}{3}\right)^3-\left(\frac{5}{6}\right)^3$

(iv) $(0.2)^3-(0.3)^3+(0.1)^3$

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15. Gi ven possible expressions for the length and breadth of the rectangle whose area is given by

(i) $4a^2 + 4a - 3$

(ii)$25a^2 - 35a + 12$

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16. What are the possible polynomial expressions for the dimensions of the cuboids whose volumes are given below ?

(i) $3x^3 - 12x$

(ii)$12y^2 + 8y - 20.$

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17. If $2\left(a^2 + b^2\right) = (a + b)^2,$ then show that $a = b$

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Think Discuss And Write

1. Which of the following expressions are polynomias ? Which are not?

Give reasons.

(i)$4x^2 + 5x - 2$

(ii) $y^2 - 8$

(iii)5

(iv) $2x^2 + \frac{3}{x} - 5$

(v) $\sqrt{3}x^2 + 5y$

(vi$\frac{1}{x} + 1(x \neq 0)$

(vii)$\sqrt{x}$

(viii) 3 xyz

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2. How many terms a cubic (degree 3) polynomial with one variable can have ? Give examples.

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3. $x^2 + 1$ has no real zeroes. Why ?

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4. Can you tell the number of zeroes of a polynomials of n^{th} degree ?

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Do These

1. Write two polynomials with variable 'x'

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2. Write three polynomials with variable 'y'

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3. Is the polynomial $2x^2 + 3xy + 5y^2$ in one variable ?

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4. Write the formulae of area and volume of different solid shapes. Find out the variables and constants in them.

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5. Write the degree of each of the following polynomials

(i) $7x^3 + 5x^2 + 2x - 6$

(ii) $7 - x + 3x^2$

(iii) $5p - \sqrt{3}$

(iv) 2

(v) $-5xy^2$

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6. Write the coefficient of x^2 in each of the following br>

$(i) 15 - 3x + 2x^2$

(ii) $1 - x^2$

(iii) $\pi x^2 - 3x + 5$

(iv) $\sqrt{2}x^2 + 5x - 1$

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7. Find the vaoue of each of the folllowing polynomials for the indicated value of variables:

$(i) p(x) = 4x^2 - 3x + 7 at x = 1$

(ii) $q(y) = 2y^3 - 4y + \sqrt{11}aty = 1$

(iii) $r(t) = 4t^4 + 3t^3 - t^2 + 6att = p, t \in R$

(iv) $s(z) = z^3 - 1atz = 1$

(v) $p(x) = 3x^2 + 5x - 7atx = 1$

(vii) $q(z) = 5z^3 - 4z + \sqrt{2}atz = 2$

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8. Find the blanks:

Linear Polynomial	Zero of the polynomial
$x + a$	$-a$
$x - a$	----------
$ax + b$	----------
$ax - b$	$\frac{b}{a}$

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9. Divide $3y^3 + 2y^2 + y$ by 'y' and write division face

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10. Divide $4p^2 + 2p + 2$ by '2p' and write division fact.

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11. Fractorise the following

(i) $6x^2 + 19x + 15$

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12. $10m^2 - 31m - 132$

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13. $12x^2 + 11x + 2$

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14. Find the following using appropriate identities

(i) $(x + 5)(x + 5)$

(ii) $(p - 3)(p + 3)$

(iii) $(y - 1)(y - 1)$

(iv) $(t + 2)(t + 4)$

(v) 102×98

(vi) $(x + 1)(x + 2)(x + 3)$

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15. Factorise the following using appropriate identities

$(i) 49a^2 + 70ab + 25b^2$

(ii) $\frac{9}{16}x^2 - \frac{y^2}{9}$

(iii)$t^2 - 2t + 1$

(iv)$x^2 + 3x + 2$

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16. Write $(p + 2q + r)^2$ in expanded from.

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17. Expand $(4x - 2y - 3z)^2$ using identity

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18. Fractorise $4a^2 + b^2 + c^2 - 4ab + 2bc - 4ca$ using suitable identity.

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19. Expand $(x+1)^3$ using an identity

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20. Compute $(3m-2n)^3$

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21. Factorise $a^3-3a^2b+3ab^2-b^3$

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22. Find the proudct $(a-b-c)\left(a^2+b^2+c^2-ab+bc-ca\right)$ without actual multiplication.

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23. Fractorise $27a^3 + b^3 + 8c^3 - 18$ abc using identity.

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Try These

1. Write a polynomial with 2 terms in variable x.

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2. Hoe can you write a polynomial with 15 terms in variable p ?

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3. Find zeroes of the following polynomals

(i) $2x - 3$

(ii)$x^2 - 5x + 6$

(iii) $x + 5$

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4. Show that $(x - 1)$ is a factor of $x^n - 1$.

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5. How can you find $(x - y)^3$ without actual multiplication?

Verify with actual multiplication.

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