POLYNOMIALS

CLASS – IX

Constant

$2, -3, \frac{5}{2}, \sqrt{2}, 3^{1/2}$

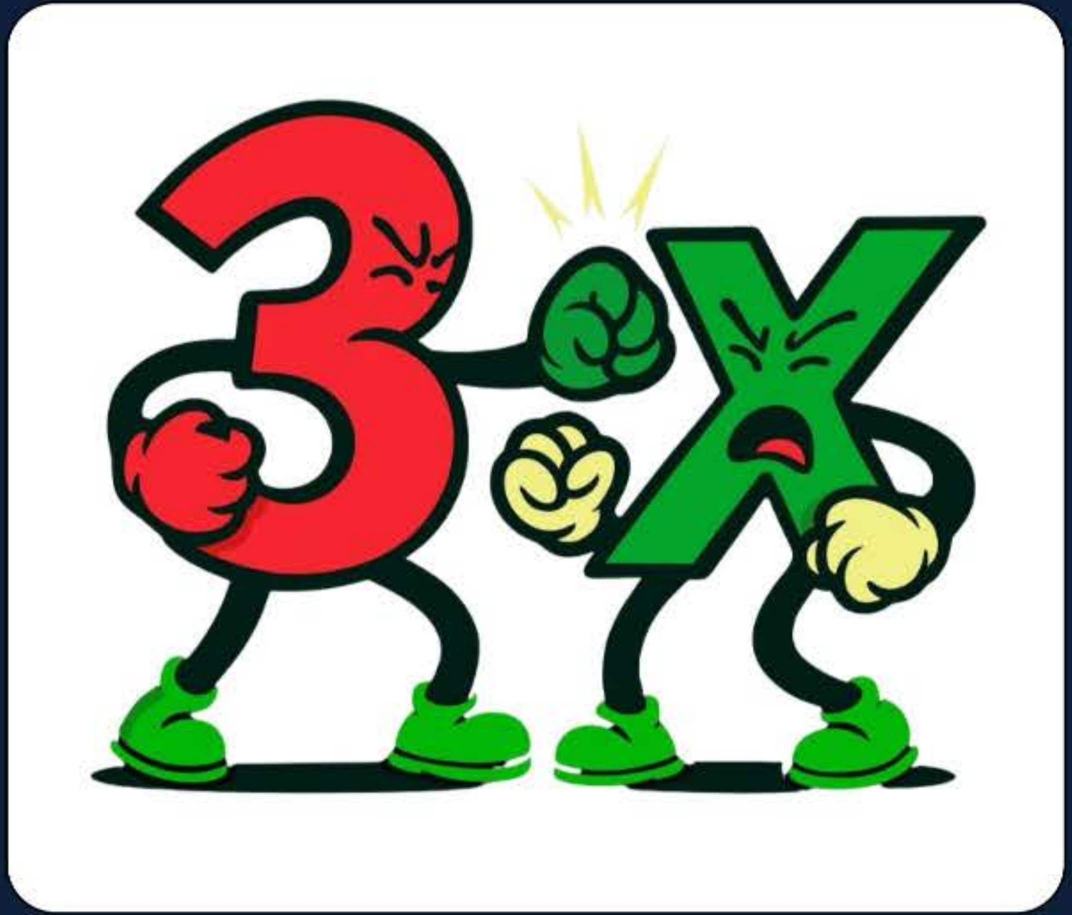
A symbol having a fixed numerical value is called a constant.

Variables

change

A symbol which may be assigned different numerical value is known as variable.

x, y, z, r, p



Terms

constant

$2, -3, \frac{5}{2}, \sqrt{100}$

variable

x, y, z, r ... .

$C \times V$

$2x, -3x, 4y^2, -3xyz, \ldots$

$$\boxed{-3 + y - 2x}$$

Algebraic Expressions

A combination of constants and variables, connected by some or all operations +, - , x , ÷ is known as an algebraic expression.

Exponent

Mathematical Operators

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

Coefficients

Variables

Constants

$d=2$

$3x^2-5x+2$

$d=2$

$x^2+y^2+z^2-3x+3$

$d=3$

$5x^3+3x^1y^1+2$

$d=3$

$4x+y+3x^3$

$\sqrt{2}x^1+y^1$

$-6x^2-3x+\frac{2}{y^1}$ $2y^{-1}$

$-5x+\frac{2}{3}x^2+5y^{-1}$

$\sqrt{5x}+2+3x^3$

$\sqrt{5}\sqrt{x}=x^{1/2}$

$\frac{2}{3}x^{-1}+2x+y^2$

$3x+2$

$100x^2+9x^3-2x^5$

$d=5$

$\sqrt{x}+y^2+x^3-3$

Polynomials

$\{0, 1, 2, 3, 4 \ldots \infty\}$

"A.E"

Variable ki power whole no. hoti hai.

non.negative integer

highest power of variable.

Degree of poly.

$3x^2 + 5x - 2 \rightarrow d = 2$

Types of Polynomials

Polynomials

- On the basis of no. of terms
- On the basis of power of variable/ degree of polynomial

On the Basis of degree

$5x^2 - 3x + 2 \rightarrow d=2$

Quadratic

Degree

$$4x^{100} + 5x^{50} + 3$$

- **Linear Polynomial** - Polynomials of $\boxed{\text{degree 1}}$ are called linear polynomials.
- **Quadratic Polynomial** - Polynomials of degree 2 are called quadratic polynomials.
- **Cubic Polynomial** - Polynomials of degree 3 are called cubic polynomials.
- **Biquadratic Polynomial** - polynomials of degree 4 are called biquadratic polynomials.

On the Basis of terms

one.

- **Monomial** - A Polynomial containing 1 term is called monomial.
  Examples - 9, 14, 6x, $-8x^2$, $5x^3$, $2x^4$,etc.

2

- **Binomial** - A Polynomial containing 2 terms is called binomial.
  Examples - (9 +4x), $(x - 3x^2)$, $(8 + x^3)$, etc.

3

- **Trinomial** - A Polynomial containing 3 terms is called trinomial.
  Examples - $(x^2 + 2x - 3)$, $(2x^3 + 5x^2 - 4)$, $(-7x^4 + 5x^2 + 6)$, etc.

Constant Polynomial

A Polynomial containing one term, consisting of nonzero constant is called constant polynomial.

non-zero

$\sqrt{2}x^0 \rightarrow d=0$

$2x^0$, $3x^0$, $-5x^0$

$\boxed{\text{degree}=0}$

Zero Polynomial

A Polynomial containing one term, namely zero is called zero polynomial.

0

degree = ???

$0x^0, 0x^{100}, 0x^2, 0x^3, 0x^4, 0x^{10}$

$\boxed{\text{degree = not defined}}$

Representation of a polynomial

$P(x) = 3x+2$ $\quad$ $r(y) = 2y^2-3y+2$

$g(x) = 5x^2+3x+2$ $\quad$ $q(x) = 5x^5+2$

Value of a polynomial

$P(5) = 5-5 = \boxed{0}$

$P(x) = x-5$

$\boxed{\text{Zero} = 5}$

$P(100) = 100-5 = 95$

$P(-5) = -5-5 = -10$

$P\left(\frac{3}{2}\right) = \frac{3}{2} - \frac{5}{1} = \frac{3-10}{2} = \quad .2$

Zero of a polynomial

Variable ki value.

poly $= 0$

Q $q(x) = x+2$

$\boxed{\text{zero} = -2}$

Q $r(x) = x+100$

$\boxed{\text{zero} = -100}$

Q Find the zeroes!

① $p(x) = x+2$

$x+2=0$

$\boxed{x=-2}$

Zero $= -2$

② $q(x) = 3x-2$

$3x-2=0$

$3x=2$

$\boxed{x=2/3}$

Zero $= 2/3$

③ $r(x) = 5x+4$

$5x+4=0$

$5x=-4$

$\boxed{x=-4/5}$ zero.

④ $g(x) = ax+b,\ a\neq 0$

$ax+b=0$

$ax=-b$

$\boxed{x=-b/a}$

⑤ $p(x) = x$

$\boxed{x=0}$ $\boxed{\text{Zero}=0}$

if $p(x) = \boxed{x^3 + 2x^2 - 5x - 6}$, **find** p(2), p(-1), p(-3) **and** p(0)

$$P(x) = x^3 + 2x^2 - 5x - 6$$

$$P(2) = (2)^3 + 2(2)^2 - 5(2) - 6$$

$$= 8 + 8 - 10 - 6$$

$$= 16 - 16$$

$$\boxed{P(2) = 0}$$

$$P(-1) = (-1)^3 + 2(-1)^2 - 5(-1) - 6$$

$$= -1 + 2 + 5 - 6$$

$$= 1 - 1 = \boxed{0}$$

$$P(-3) = (-3)^3 + 2(-3)^2 - 5(-3) - 6$$

$$= -27 + 18 + 15 - 6$$

$$= -9 + 9$$

$$\boxed{P(-3) = 0}$$

$$P(0) = (0)^3 + 2(0)^2 - 5(0) - 6$$

$$= 0 + 0 - 0 - 6$$

$$\boxed{P(0) = -6}$$

if $\boxed{p(x) = x^2 - 2\sqrt{2}x + 1}$, then $p\left(2\sqrt{2}\right)$ equals

A 0

B 1

C $4\sqrt{2}$

D $8\sqrt{2} + 1$

$P(x) = x^2 - 2\sqrt{2}x + 1$

$P(2\sqrt{2}) = (2\sqrt{2})^2 - 2\sqrt{2}(2\sqrt{2}) + 1$

$= (4 \cdot 2) - 4 \cdot 2 + 1$

$= \cancel{8} - \cancel{8} + 1$

$\boxed{P(2\sqrt{2}) = 1}$

if $x = \frac{4}{3}$ is a zero of the polynomial $f(x) = 6x^3 - 11x^2 + kx - 20$, find value of k

$F(x) = 6x^3 - 11x^2 + kx - 20$

$\boxed{x = \frac{4}{3} = \text{zero}}$

$\boxed{F\left(\frac{4}{3}\right) = 0}$

$6\left(\frac{4}{3}\right)^3 - 11\left(\frac{4}{3}\right)^2 + k\left(\frac{4}{3}\right) - 20 = 0$

${}^{2}\cancel{6}\left(\frac{64}{\cancel{27}_{9}}\right) - 11\left(\frac{16}{9}\right) + \frac{4k}{3} - 20 = 0$

$\frac{128}{9} - \frac{176}{9} + \frac{4k}{3} - \frac{20}{1} = 0$

$$\frac{128-176+12k-180}{9}=0$$

$$-48+12k-180=0$$

$$-228+12k=0$$

$$12k=228$$

$$k=\frac{\cancel{228}^{\,\cancel{114}\ \cancel{57}\ 19}}{\cancel{12}_{\,\cancel{6}\ \cancel{3}\ 1}}$$

$$\boxed{k=19}$$

Remainder Theorem

Remainder deti hai directly.

$x - a = 0$

$x = a$

$$\boxed{P(x) \div x - a}$$

$$\boxed{R = P(a)}$$

$\rightarrow P(x) \div x+3$

$R = P(-3)$

$\rightarrow g(x) \div x+4$

$R = g(-4)$

$\rightarrow r(x) \div 3x+2$

$R = r\left(\frac{-2}{3}\right)$

$3x+2=0$

$3x=-2$

$x = \frac{-2}{3}$

Q $P(x) \div g(x)$, $R = ?$

$$P(x) = x^3 - 3x^2 + 4x + 50$$

$$g(x) = x + 3$$

$$x + 3 = 0$$

$$\boxed{x = -3}$$

$$R = P(-3)$$

$$P(-3) = (-3)^3 - 3(-3)^2 + 4(-3) + 50$$

$$= -27 - 27 - 12 + 50$$

$$\boxed{P(-3) = -16}$$

$$\boxed{R = -16}$$

Q $P(x) \div g(x)$, $R = ?$

$$P(x) = x^4 + 2x^3 - 3x^2 + x - 1$$

$$g(x) = x - 2$$

$$x - 2 = 0$$

$$x = 2$$

$$\boxed{R = P(2)}$$

$$R = (2)^4 + 2(2)^3 - 3(2)^2 + 2 - 1$$

$$= 16 + 16 - 12 + 2 - 1$$

$$= 32 - 11$$

$$\boxed{R = 21}$$

$$x^3+4x^2+5x+11$$

$$x-2\,\big)\,\overline{\cancel{x^4}+2x^3-3x^2+x-1}$$

$$\cancel{x^4}-2x^3$$

$$- \quad +$$

$$\cancel{4x^3}-3x^2+x-1$$

$$\cancel{4x^3}-8x^2$$

$$- \quad +$$

$$\cancel{5x^2}+x-1$$

$$\cancel{5x^2}-10x$$

$$- \quad +$$

$$\cancel{11x}-1$$

$$\cancel{11x}-22$$

$$- \quad +$$

$$21$$

Find the remainder when the polynomial $p(x) = 12x^3 - 13x^2 - 5x + 7$ is divi~~sible~~ded by $g(x) = 2 + 3x$

$$2 + 3x = 0$$

$$3x = -2$$

$$\boxed{x = -\frac{2}{3}}$$

$$R = p\left(-\frac{2}{3}\right)$$

$$p\left(-\frac{2}{3}\right) = 12\left(-\frac{2}{3}\right)^3 - 13\left(-\frac{2}{3}\right)^2 - 5\left(-\frac{2}{3}\right) + 7$$

$$= \cancel{12}^{\,4}\left(\frac{-8}{\cancel{27}_{\,9}}\right) - 13\left(\frac{4}{9}\right) + \frac{10}{3} + 7$$

$$= -\frac{32}{9} - \frac{52}{9} + \frac{10}{3} + \frac{7}{1}$$

$$= \frac{-32 - 52 + 30 + 63}{9}$$

$$= \frac{9}{9} = 1$$

$$R = 1$$

#QI

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

$P(x) = 2x^3 + ax^2 + 3x - 5$

$P(x) \div x - 2$

$\boxed{R = P(2)}$

$g(x) = x^3 + x^2 - 2x + a$

$g(x) \div (x - 2)$

$\boxed{R = g(2)}$

Acco. to the question -

$\boxed{P(2) = g(2)}$

$2(2)^3 + a(2)^2 + 3(2) - 5 = (2)^3 + (2)^2 - 2(2) + a$

$16 + 4a + 6 - 5 = 8 \cancel{+4} \cancel{-4} + a$

$17 + 4a = 8 + a$

$4a - a = 8 - 17$

$3a = -9$

$a = -3$

The remainder when $1 + x + x^2 + x^3 \ldots\ldots\ldots + x^{1007}$ is divided by $(x - 1)$

A 1006

B 1008

C 1007

D 0

$1 + \underbrace{1 + (1)^2 + (1)^3 \cdots\cdots\cdots (1)^{1007}}$

$x - 1 = 0$

$x = 1$

$= 1 + 1007$

$= \boxed{1008}$

Factor Theorem

Let $p(x)$ be a polynomial of degree 1 or more and let α be any real number.

- **If $p(\alpha) = 0$, then $(x - \alpha)$ is a factor of $p(x)$.**
- **If $(x - \alpha)$ is a factor of $p(x)$, then $p(\alpha) = 0$.**

$$P(x) \div (x-a) \Longrightarrow \boxed{R = P(a)}$$

Baat no 1.

If $(x-a)$ is a factor of $P(x)$,

then, $R = P(a) = 0$.

Baat no. 2

If, $R = P(a) = 0$

then, $(x-a)$ is a factor of $P(x)$.

Use factor theorem to show that $(x^4 + 2x^3 - 2x^2 + 2x - 3)$ is exactly divisible by $(x + 3)$

$P(x)$

$x+3=0$

$\boxed{x=-3}$

$\boxed{R = P(-3)}$

$P(-3) = (-3)^4 + 2(-3)^3 - 2(-3)^2 + 2(-3) - 3$

$= 81 - 54 - 18 - 6 - 3$

$P(-3) = 0$

$\boxed{R=0}$

By "F.T" $\because R=0$

$\therefore P(x)$ is exactly divisible by $x+3$.

If $(x-a)$ is a factor of $(x^3 - ax^2 + 2x + a - 1)$, find the value of a

$$x - a = 0$$

$$\boxed{x = a}$$

$p(x)$

$$\boxed{R = p(a)}$$

By F.T,

$\because$ $(x-a)$ is a factor of $p(x)$

$\therefore$ $R = 0$.

$$p(a) = (a)^3 - a(a)^2 + 2(a) + a - 1$$

$$0 = \cancel{a^3} - \cancel{a^3} + 2a + a - 1$$

$$0 = 3a - 1$$

$$1 = 3a$$

$$\boxed{\frac{1}{3} = a}$$

Basic identities

① $(a+b)^2 = a^2 + b^2 + 2ab$

② $(a-b)^2 = a^2 + b^2 - 2ab$

③ $a^2 - b^2 = (a+b)(a-b)$

④ $(x+a)(x+b) = x^2 + (a+b)x + ab$

Q Evaluate:

(i) $(x+4)(x+10)$

$(x+a)(x+b) = x^2 + (a+b)x + ab$

$= \boxed{x^2 + 14x + 40}$

(ii) $(x+8)(x-10)$

$(x+8)(x+-10)$

$x^2 + (8+-10)x + 8(-10)$

$\boxed{x^2 - 2x - 80}$

$(a+b)(a-b) = a^2 - b^2$

(iii) $(3x+4)(3x-4)$

$= (3x)^2 - (4)^2$

$= \boxed{9x^2 - 16}$

(iv) $\left(y^2 + \frac{3}{2}\right)\left(y^2 - \frac{3}{2}\right)$

$(a+b)(a-b) = a^2 - b^2$

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

$= \boxed{y^4 - \frac{9}{4}}$

The value of $300^2 - 299^2$ is

A 12

B 499

C 600

D 599

$$a^2 - b^2 = (a+b)(a-b)$$

$$= (300+299)(300-299)$$

$$= (599)(1)$$

$$= \boxed{599}$$

2. Evaluate the following products without multiplying directly:

(i) $\boxed{103 \times 107}$ (ii) 95×96 (iii) 104×96

#GPU $(100-5)(100-4)$

$(x+a)(x+b)$

(i) $(100+3)(100+7)$

$\boxed{(x+a)(x+b) = x^2+(a+b)x+ab}$

$= (100)^2+(3+7)100+(3)(7)$

$= 10000+1000+21$

$= \boxed{11021}$

(iii) $(100+4)(100-4)$

$(a+b)(a-b)$

$= a^2-b^2$

$= (100)^2-(4)^2$

$= 10000-16$

$= \boxed{9984}$

$\boxed{\text{Factorisation.}}$

$21 = (7) \times (3)$

$x^2 - 16 = (x+4)(x-4)$

$20abc = 5 \times 2 \times 2 \times a \times b \times c$

3. Factorise the following using appropriate identities:

(i) $9x^2 + 6xy + y^2$ (ii) $4y^2 - 4y + 1$ (iii) $x^2 - \frac{y^2}{100}$

(i) $9x^2 + 6xy + y^2$

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

$$\boxed{(a)^2 + 2(a)(b) + (b)^2 = (a+b)^2}$$

$= (3x + y)^2$

$= \boxed{(3x+y)(3x+y)}$

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

$(\underset{a}{2y})^2 - 2(\underset{a}{2y})(\underset{b}{1}) + (\underset{b}{1})^2$

$= (2y - 1)^2$

$= \boxed{(2y-1)(2y-1)}$

(iii) $x^2 - \frac{y^2}{100}$

$$(x)^2 - \left(\frac{y}{10}\right)^2$$

$$(a)^2 - (b)^2 = (a+b)(a-b)$$

$$\boxed{\left(x + \frac{y}{10}\right)\left(x - \frac{y}{10}\right)}$$

(iv) $16x^2 - 81y^2$

$$= (4x)^2 - (9y)^2$$

$$= \boxed{(4x+9y)(4x-9y)}$$

Factorise : $2x^2 + 11x - 21$

$$2x^2 + 11x - 21$$

$$\underbrace{2x^2 + 14x}\underbrace{-3x - 21}$$

$$2x[x+7] - 3[x+7]$$

$$\boxed{(x+7)(2x-3)}$$

Sum = 11

Product = −42

14, −3

$$\begin{array}{r|l} 2 & 42 \\ \hline 3 & 21 \\ 7 & 7 \\ & 1 \end{array}$$

Factorise : $6x^2 + 7x - 3$

$6x^2+7x-3$

$\underbrace{6x^2+9x}-\underbrace{2x-3}$

$\underline{3x[2x+3]}\ \underline{-1[2x+3]}$

$\boxed{(2x+3)(3x-1)}$

Sum $=7$

Product $=-18$

$9, -2$

$$\begin{array}{r|l} 2 & 18 \\ \hline 3 & 9 \\ 3 & 3 \\ 1 & 1 \\ & 1 \end{array}$$

Factorise : $2x^2 - 7x - 39$

$$2x^2 \cancel{-7x} - 39$$

$$2x^2 + 6x - 13x - 39$$

Sum $= -7$

Product $= -78$

6, −13

2	78
3	39
13	13
	1
	1

Square of a Trinomial

Formula

$$:(x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$$

$$\boxed{(x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz}$$

Expand : $(2a+3b+4c)^2$

$$= (2a)^2+(3b)^2+(4c)^2+2(2a)(3b)+2(3b)(4c)+2(2a)(4c)$$

$$= \boxed{4a^2+9b^2+16c^2+12ab+24bc+16ac}$$

Expand : $(-x + 2y + 3z)^2$

$(a + b + c)^2$

$= (-x)^2 + (2y)^2 + (3z)^2 + 2(-x)(2y) + 2(2y)(3z) + 2(-x)(3z)$

$= \boxed{x^2 + 4y^2 + 9z^2 - 4xy + 12yz - 6xz}$

Q $(2x - 3y + 4z)^2$

$(2x + -3y + 4z)^2$

Factorise : $4x^2 + 9y^2 + 16z^2 + 12xy - 24yz - 16zx$

$$\boxed{a^2 + b^2 + c^2 + 2ab + 2bc + 2ca = (a+b+c)^2}$$

$$= (2x)^2 + (3y)^2 + (-4z)^2 + 2(2x)(3y) + 2(3y)(-4z) + 2(2x)(-4z)$$

$$= (2x + 3y - 4z)^2$$

$$= \boxed{(2x+3y-4z)(2x+3y-4z)}$$

Factorise : $16x^2 + 4y^2 + 9z^2 - 16xy - 12yz + \overset{24}{\cancel{\;\;\;}}xz$

$$a^2 + b^2 + c^2 + 2ab + 2bc + 2ca = (a+b+c)^2$$

$$= (4x)^2 + (-2y)^2 + (3z)^2 + 2(4x)(-2y) + 2(-2y)(3z)$$
$$+ 2(4x)(3z)$$

$$= (4x - 2y + 3z)^2$$

$$= \boxed{(4x - 2y + 3z)(4x - 2y + 3z)}$$

Factorise : $2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8xz$

$\sqrt{8} = 2\sqrt{2}$

$= (-\sqrt{2}x)^2 + (y)^2 + (2\sqrt{2}z)^2 + 2(-\sqrt{2}x)(y)$

$+ 2(y)(2\sqrt{2}z)$

$+ 2(-\sqrt{2}x)(2\sqrt{2}z)$

$= (-\sqrt{2}x + y + 2\sqrt{2}z)^2$

$=$ ______________________

Cube of a Binomial

Formula

:
$$(x+y)^3 = x^3 + y^3 + 3xy\,(x+y) = x^3 + y^3 + 3x^2y + 3xy^2$$

$$(x-y)^3 = x^3 - y^3 - 3xy\,(x-y) = x^3 - y^3 - 3x^2y + 3xy^2$$

$$\boxed{(x+y)^3 = x^3 + y^3 + 3x^2y + 3xy^2}$$

$$\boxed{(x-y)^3 = x^3 - y^3 - 3x^2y + 3xy^2}$$

Expand :

1. $(4a + 5b)^3$

$$= (4a)^3 + (5b)^3 + 3(4a)^2(5b) + 3(5b)^2(4a)$$

$$= \boxed{64a^3 + 125b^3 + 240a^2b + 300b^2a}$$

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

$$\boxed{(3a)^3 - (2b)^3 - 3(3a)^2(2b) + 3(2b)^2(3a)}$$

Expand : $\left(\frac{1}{x}+\frac{y}{3}\right)^3$

$$=\left(\frac{1}{x}\right)^3+\left(\frac{y}{3}\right)^3+\cancel{3}\left(\frac{1}{x}\right)^2\left(\frac{y}{\cancel{3}}\right)+3\left(\frac{y}{3}\right)^2\left(\frac{1}{x}\right)$$

$$=\boxed{\frac{1}{x^3}+\frac{y^3}{27}+\frac{y}{x^2}+\frac{y^2}{3x}}$$

Factorise :

$$8a^3 + b^3 + 12a^2b + 6ab^2$$

$$\boxed{x^3 + y^3 + 3x^2y + 3xy^2 = (x+y)^3}$$

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

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

$$= \boxed{(2a+b)(2a+b)(2a+b)}$$

Factorise : $27p^3 - \frac{9}{2}p^2 + \frac{1}{4}p - \frac{1}{216}$

$= 27p^3 - \frac{1}{216} - \frac{9}{2}p^2 + \frac{p}{4}$

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

$= \left(3p - \frac{1}{6}\right)^3$

$= \boxed{\left(3p - 1/6\right)\left(3p - 1/6\right)\left(3p - 1/6\right)}$

Evaluate :

1. $(102)^3$

$= (100+2)^3$

$= (100)^3 + (2)^3 + 3(100)^2(2) + 3(100)(2)^2$

$= 1000000 + 8 + 60000 + 1200$

$= \boxed{1061208}$

2. $(999)^3$

$(1000-1)^3$

#Gpk

Factorisation of sum or differences of cubes

Formula

:

$$a^3 + b^3 = (a+b)\left(a^2 - ab + b^2\right)$$

$$a^3 - b^3 = (a-b)\left(a^2 + ab + b^2\right)$$

Factorise :

1. $1 + 64x^3$

$= (1)^3 + (4x)^3$

$= \boxed{(1+4x)(1+16x^2-4x)}$

2. $27x^3 + 125y^3$

$= (3x)^3 + (5y)^3$

$= \boxed{(3x+5y)(9x^2+25y^2-15xy)}$

Special Identity

Formula

: $(x^3 + y^3 + z^3 - 3xyz) = (x+y+z)\left(x^2 + y^2 + z^2 - xy - yz - zx\right)$

$\boxed{x^3+y^3+z^3 = 3xyz}$

ATTENTION

If $x + y + z = 0$

Then : $x^3 + y^3 + z^3 = 3xyz$

:

ATTENTION

Factorise : $8x^3 + y^3 + 27z^3 - 18xyz$

$= (2x)^3 + (y)^3 + (3z)^3 - 3(2x)(y)(3z)$

$(a)^3 + (b)^3 + (c)^3 - 3(a)(b)(c) = (a+b+c)(a^2+b^2+c^2 - ab - bc - ca)$

$= \boxed{(2x+y+3z)(4x^2+y^2+9z^2 - 2xy - 3yz - 6xz}$

$\underline{\underline{Q}}$ $(-20)^3+(50)^3+(-30)^3 = ?$

$-20+50-30 = 0$ //

$= 3(-20)(50)(-30)$

$= \boxed{90000}$ //

$a^3+b^3+c^3 = 3abc$

$\downarrow$

If $\boxed{a+b+c=0}$

Factorise : $(p-q)^3+(q-r)^3+(r-p)^3$

#OT

$a \qquad b \qquad c$

$\cancel{p}-\cancel{q}+\cancel{q}-\cancel{r}+\cancel{r}-\cancel{p}=0$

$$= \boxed{3(p-q)(q-r)(r-p)}$$

Using factor theorem, factorize the poynomial $x^3 - 6x^2 + 11x - 6$

$p(x)$

$\pm 1, \pm 2, \pm 3, \pm 6.$

$$P(1) = (1)^3 - 6(1)^2 + 11(1) - 6$$
$$= 1 - 6 + 11 - 6$$
$$= -5 + 5$$

$$\boxed{P(1) = 0}$$

By "FT"

$$\boxed{(x-1) \text{ is a factor of } p(x)}$$

$$\begin{array}{r|l} & x^2 - 5x + 6 \\ \hline x - 1 & x^3 - 6x^2 + 11x - 6 \\ & \cancel{x^3} - x^2 \\ & (-)\quad(+) \\ \hline & -\cancel{5x^2} + 11x - 6 \\ & -\cancel{5x^2} + 5x \\ & (+)\quad(-) \\ \hline & \cancel{6x} - \cancel{6} \\ & \cancel{6x} - \cancel{6} \\ & (-)\quad(+) \\ \hline & 0 \end{array}$$

$$\boxed{D = d \times q + r}$$

$$x^3 - 6x^2 + 11x - 6 = (x-1)(x^2 - 5x + 6)$$

middle term splitting.

$$= (x-1)(x^2 - 2x - 3x + 6)$$

$$= (x-1)\left[x(x-2) - 3(x-2)\right]$$

$$= \boxed{(x-1)(x-2)(x-3)}$$

ONE SHOT

Thank You