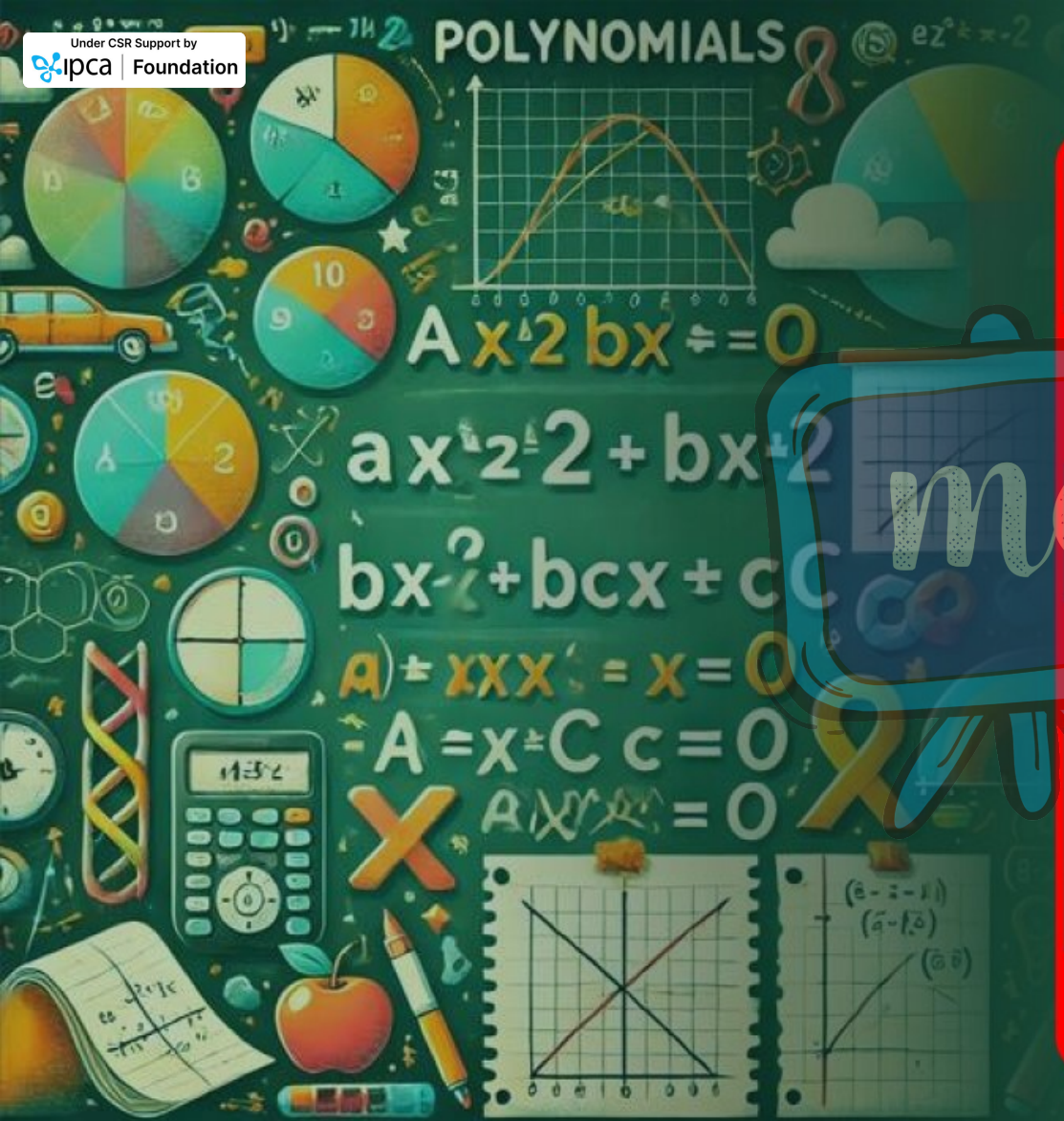
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missiongyan

# कक्षा - 9

## गणित

### अध्याय - 2

## बहुपद

### भाग - 9

### बीजीय सर्वसमिकाएँ

हर्ष गोयल

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# विवरण (Overview)

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1. बहुपद का परिचय
2. बहुपदों के शून्यक
3. बहुपदों का गुणनखंड
4. बीजीय सर्वसमिकाएँ

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# योग्यता आधारित शिक्षण (Competency)

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बहुपदों के लिए विभिन्न सर्वसमिकाओं का उपयोग

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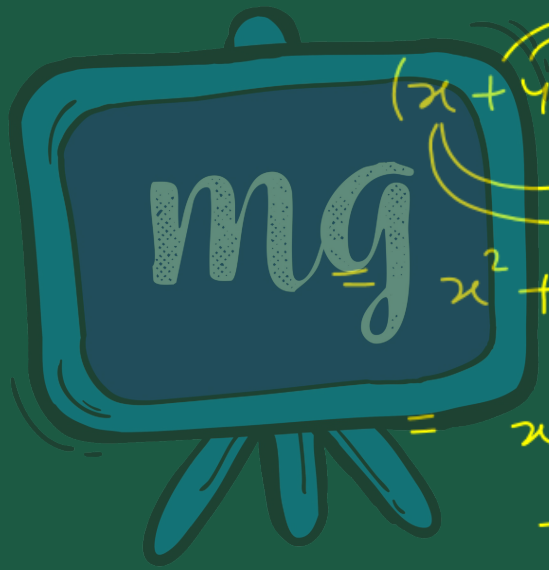
# द्वितीय सर्वसमिकाएँ

① $(x+y)^2 = x^2 + 2xy + y^2$

$(x+y)(x+y)$

$= x^2 + xy + yx + y^2$

$= x^2 + 2xy + y^2$



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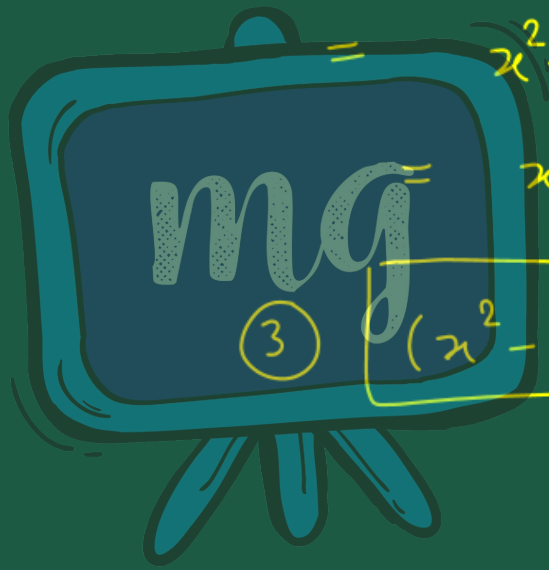
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② $(x-y)^2 = x^2 - 2xy + y^2$

$(x-y)(x-y)$

$= x^2 - xy - yx + y^2$

$= x^2 - 2xy + y^2$




③ $(x^2 - y^2) = (x-y)(x+y)$

$x^2 + xy - yx - y^2$

$= x^2 - y^2$

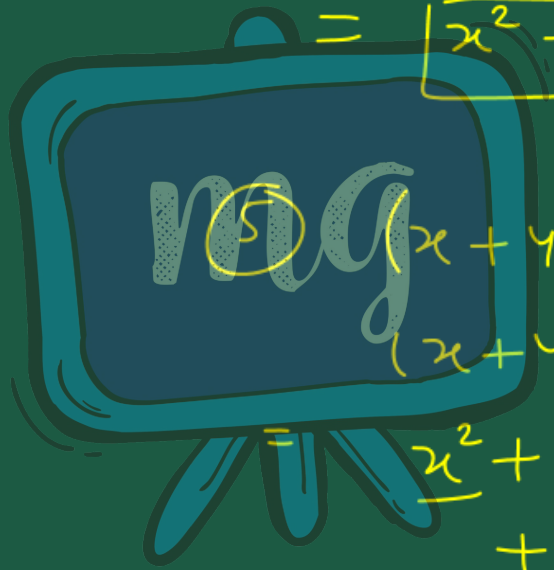
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④ $(x+a)(x+b)$

$= x^2 + bx + ax + ab$

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



⑤ $(x+y+z)^2 =$

$(x+y+z)(x+y+z)$

$= x^2 + xy + xz + yx + y^2 + yz + zx + zy + z^2$

$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

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

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

$= (x^2 + 2xy + y^2)(x+y)$

$= x^3 + 2x^2y + xy^2$

$+ x^2y + 2xy^2 + y^3$

$= x^3 + 3x^2y + 3xy^2 + y^3$

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

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(7) $(x-y)^3$

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

$= (x^2-2xy+y^2)(x-y)$

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

$\quad -yx^2+2xy^2-y^3$

$= x^3-3x^2y+3xy^2-y^3$

$= x^3-y^3+3xy(y-x)$

Or

$x^3-y^3-3xy(x-y)$

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# बीजीय सर्वसमिकाएं

| | |
|---|---|
| I. | $(x + y)^2 = x^2 + 2xy + y^2$ |
| II. | $(x - y)^2 = x^2 - 2xy + y^2$ |
| III. | $(x^2 - y^2) = (x - y)(x + y)$ |
| IV. | $(x + a)(x + b) = x^2 + x(a + b) + ab$ |

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| | |
|---|---|
| V. | $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$ |
| VI. | $(x + y)^3 = x^3 + y^3 + 3xy(x + y)$ |
| VII. | $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$ |
| IV. | $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$ |

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# उदाहरण 11 :

(i) उपयुक्त सर्वसमिकाओं का उपयोग करके निम्नलिखित गुणनफल ज्ञात कीजिए :

$(x + 3)(x + 3)$

$= (x + 3)^2$

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

$= x^2 + 6x + 9$

$(x + y)^2$

$= x^2 + 2xy + y^2$

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(ii) $(x - 3)(x + 5)$

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

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

यहाँ $a = -3$ , $b = 5$

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

$(x-3)(x+5) = x^2 + 2x - 15$

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## उदाहरण 12 :

सीधे गुणा न करे 105 × 106 का मान ज्ञात कीजिए।




$105 = 100 + 5$

$106 = 100 + 6$

$105 \times 106$

$= (100+5)(100+6)$

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

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$(100+5)(100+6$

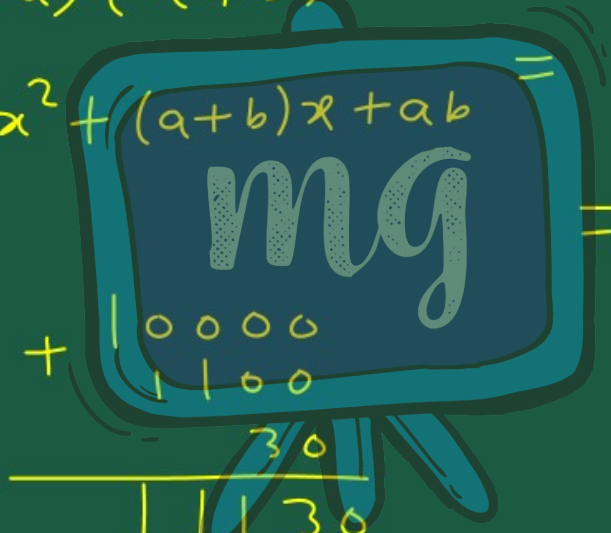
$= (100)^2 + (5+6)100 + 5\times 6$

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

$= 10000 + 1100 + 30$

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

$= 11,130$ Ans




$+\ 10000$

$\ \ 1100$

$\ \ \ \ 30$

$11,130$

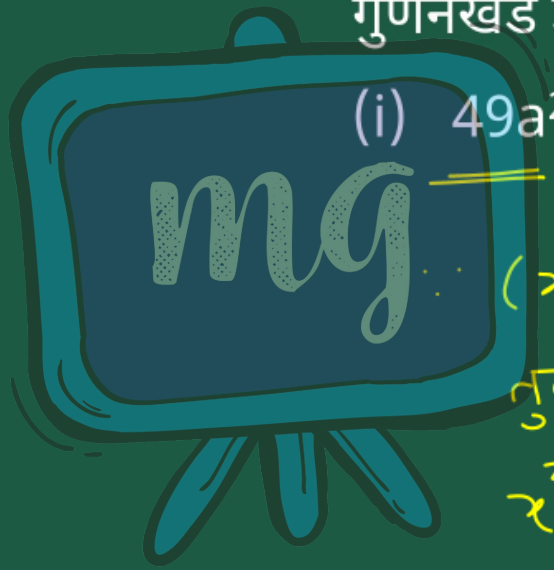
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# उदाहरण 13 :

गुणनखंड ज्ञात कीजिए :

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




$\therefore (x+y)^2 = x^2 + 2xy + y^2$

तुलना करने पर

$x^2 = 49a^2 \Rightarrow x = 7a$

$y^2 = 25b^2 \Rightarrow y = 5b$

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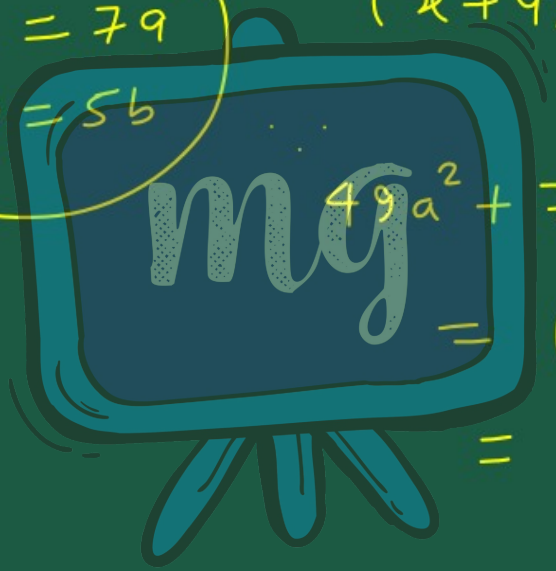
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$49a^2 + 70ab + 25b^2$

$(x+y)^2 = x^2 + 2xy + y^2$

$x = 7a$

$y = 5b$



$49a^2 + 70ab + 25b^2$

$= (7a+5b)^2$

$= (7a+5b)(7a+5b)$

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(ii) $\frac{25}{4}x^2 - \frac{y^2}{9}$

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

तुलना से

$x \to \frac{5}{2}x$ , $y \to \frac{y}{3}$

$\frac{25}{4}x^2 - \frac{y^2}{9} = \left(\frac{5}{2}x + \frac{y}{3}\right)\left(\frac{5}{2}x - \frac{y}{3}\right)$

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# सीखने के प्रतिफल (Learning Outcomes)

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बीजीय सर्वसमिकाऐं

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# मूल्यांकन (Assessment)

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**1** $(x + 3y)^2$ का प्रसार करने पर हमें प्राप्त होता है :

अ $x^2 + 9y^2 - 6xy$

ब $x^2 + 9y^2 + 12xy$

स $x^2 + 9y^2 - 12xy$

द $x^2 + 9y^2 + 6xy$

$(x+3y)^2$

$(x+y)^2 = x^2+2xy+y^2$

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

$= x^2 + 6xy + 9y^2$

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# मूल्यांकन (Assessment)

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**2** सीधे गुणा न करने 103 x 107 पर का मान होगा :

अ 11921

ब 11021

स 11821

द 11521

$103 = 100 + 3$

$107 = 100 + 7$

$103 \times 107$

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

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

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

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$103 \times 107$

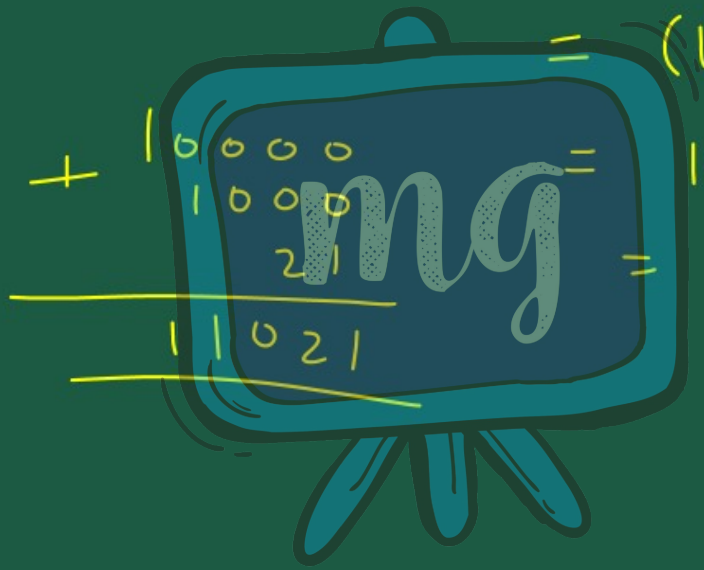
$= (100+3)(100+7)$

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

$= 10000 + 1000 + 21$

$= 11021$

$+ \begin{array}{r} 10000 \\ 1000 \\ 21 \\ \hline 11021 \end{array}$



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# मूल्यांकन (Assessment)

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**3** यदि $x+\frac{1}{x}=4$ है तो $x^4+\frac{1}{x^4}=$

अ 196

ब 194

स 192

द 190

$x+\frac{1}{x}=4$

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

$=x^2+\frac{1}{x^2}+2$

$x^2+\frac{1}{x^2}+2=(4)^2$

$x^2+\frac{1}{x^2}=16-2=14$

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$x^4 + \frac{1}{x^4} = ?$

$\therefore x^2 + \frac{1}{x^2} = 14$

$\left(x^2 + \frac{1}{x}\right)^2 = (x^2)^2 + 2 \times x^2 \left(\frac{1}{x^2}\right) + \left(\frac{1}{x^2}\right)^2$

$(14)^2 = x^4 + 2 + \frac{1}{x^4}$

$196 = x^4 + \frac{1}{x^4} + 2$

$x^4 + \frac{1}{x^4} = 194$