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A METHOD OF FACTORING A POLYNOMIAL WITH UNCERTAIN COEFFICIENTS AND INTRODUCING A NEW VARIABLE

Akhmedova Gavkhar Akhadovna

QDPI

Astonaliyeva Dildora Madaminjon daughter

Teacher of the 1st ideal private school in Fergana city

Abstract: This article provides information on methods of factoring a polynomial with uncertain coefficients and introducing a new variable. Example solutions for each method are provided.

Key words: polynomial, root, coefficient, method, unknown, variable, multiplier.

x ga bog'liq ko'phad deb

$$a_0x^n + a_1x^{n-1} + a_2x^{n-2} + ... + a_{n-2}x^2 + a_{n-1}x + a_n$$

ko'rinishidagi ko'phadga aytiladi. Bu yerda $a_0, a_1, a_2, ...a_n -$ ko'phadning koeffitsientlari deyiladi. $c-$ biror haqiqiy son bo'lsin. $x = c$ dagi ko'phadning qiymati deb x o'rniga c larni qo'yib va ko'rsatilgan amallarni bajarish natijasida hosil bo'lgan songa aytiladi.

Bu usulda berilgan ko'phadni ko'paytuvchilarga ajratganimizda hosil bo'ladigan ko'phadlar ko'rinishi faraz qilinadi. Bu usulning mohiyati quyidagicha

1) ikkita ko'phad aynan teng bo'lishi uchun x ning bir xil darajalari oldindagi koeffitsientlari teng bo'lishi kerak;
2) ixtiyoriy uchinchi darajali ko'phad chiziqli va kvadrat ko'paytuvchilarga ajraladi;
3)ixtiyoriy to'rtinchi darajali ko'phad ikkita ikkinchi darajali ko'phadlar ko'paytmasiga ajratiladi.

1-misol. Ushbu
$x^3 - 5x^2 + 7x - 3$
ko'phadni ko'paytuvchilarga ajrating.

Yechish. $x - \alpha$ va $\beta_1x^2 + \beta_2x + \beta_3$ ko'phadlarni izlaymiz. Bunda quyidagi tenglik o'rinli

$$x^3 - 5x^2 + 7x - 3 = (x - \alpha)(\beta_1x^2 + \beta_2x + \beta_3) \qquad (*)$$

Tenglikning o'ng qismini quyidagi ko'rinishda yozib olamiz.

$$\beta_1x^3 + (\beta_2 - \alpha\beta_1)x^2 + (\beta_3 - \alpha\beta_2)x - \alpha\beta_3$$

(*) ayniyatdagi x ning teng darajalari oldidagi koeffitsientlarni tenglaymiz va quyidagi sistemani hosil qilamiz.

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$$\beta_1 = 1,$$
$$\beta_2 - \alpha\beta_1 = -5,$$
$$\beta_3 - \alpha\beta_2 = 7,$$
$$\alpha\beta_3 = 3.$$

Bu tenglamalarni $\beta_1 = 1, \beta_2 = -2, \beta_3 = 1, \alpha = 3$ sonlar qanoatlantiradi. Bundan $x^3 - 5x^2 + 7x - 3$ ko'phad $x-3$ va $x^2 - 2x + 1$ ko'paytuvchilarga ajratiladi.

$$x^3 - 5x^2 + 7x - 3 = (x-3)(x^2 - 2x + 1).$$

Yangi o'zgaruvchi kiritish usuli.

Ba'zi hollarda $P_n(x)$ ko'phad tarkibiga kirgan $f(x)$ ifodani y orqali belgilab, y ga nisbatan ko'paytuvchilarga oson ajraladigan ko'phadni hosil qilamiz. So'ngra y ni $f(x)$ bilan almashtirib $P_n(x)$ ko'phadning ko'paytuvchilarga ajralgan shaklini hosil qilamiz.

2-misol. Ushbu

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

ko'phadni ko'paytuvchilarga ajrating.

Yechish. $\frac{x-4+x+2}{2} = x-1$, $x-1 = y$ deb belgilash kiritamiz. U holda

$$(x-4)^4 + (x+2)^4 = (y-3)^4 + (y+3)^4 = y^4 + 12y^3 + 54y^2 - 108y + 81 + y^4 + 12y^3 + 54y^2 + 108y +$$
$$+81 = 2y^4 + 108y^2 + 162 = 2(y^4 + 54y^2 + 81) = 2((y^2+27)^2 - 648) = 2(y^2 + 27 - \sqrt{648})(y^2 + 27 + \sqrt{648}) =$$
$$= 2((x-1)^2 + 27 - 18\sqrt{2})((x-1)^2 + 27 + 18\sqrt{2}) = 2(x^2 - 2x + 28 - 18\sqrt{2})(x^2 - 2x + 28 + 18\sqrt{2}).$$

3-misol. Agar $a \quad N$ va $f(a) = a^4 + 6a^3 + 11a^2 + 6a$ bo'lsa, $f(a) \vdots 24$ bo'lishini isbotlang.

Isbot: $6a^3$ va $11a^2$ larni quyidagicha yozib olamiz.

$$6a^3 = a^3 + 5a^3; \; 11a^2 = 5a^2 + 6a^2$$

U holda

$$f(a) = a^4 + (a^3 + 5a^3) + (5a^2 + 6a^2) + 6a =$$
$$= (a^4 + a^3) + (5a^3 + 5a^2) + (6a^2 + 6a) = a^3(a+1) + 5a^2(a+1) +$$
$$+6a(a+1) = a(a+1)(a^2 + 5a + 6) = a(a+1)(a+2)(a+3)$$

To'rtta ketma-ket kelgan sonlardan bittasi albatta 3 ga bo'linadi, 2 tasi albatta juft sondir. Bu juft sonlardan biri albatta 4 ga bo'linadi. Demak, bu 4 ta son kopaytmasi $3 \; 2 \; 4$ ga bo'linadi.

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Shunday qilib, $f(a) \vdots 24$.

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