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MATEMATIKA FANINI O'QITISHDA INNOVATSION TEXNOLOGIYALARDAN VA NOAN'ANAVIY USULLARDAN FOYDALANISH

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ANNOTATSIYA

Ushbu maqolada talabalarni o'qitishning dolzarb masalalariga bag'ishlangan, o'quv jarayoniga innovatsiya tamoyilini tatbiq etishda ijodiy tasavvurni rivojlantirish usullari ochib berilgan. Maqolada bir nechta trigonometrik funktsiyalarni oddiy trigonometrik funktsiyalarga aylantirish uchun noan'anaviy usullardan foydalanish ko'rib chiqiladi.

Kalit so'zlar: Ko'p argumentli trigonometrik funksiyalar, oddiy trigonometrik funksiyalar, ikki burchak yig'indisining sinusi, ikki burchak yig'indisining kosinusu, algebraik tenglama, zamonaviy fan va texnika, noan'anaviy usullar, ko'phadli koeffitsientlar, Paskal uchburchagi, sxemalar bilan ishlash.

Kelajak uchun har tomonlama etuk mutaxassis kadrlar tayyorlashning mohiyati, zamonaviy fan va texnikaning rivojlanish talablariga mos barkamol avlodni tarbiyalash masalalari izchillik bilan tashkil etilib, bu boradagi dolzarb masalalar va ularni amalga oshirish chora tadbiri milliy dasturda belgilab berilgan.

Shu ma'noda "trigonametrik funksiya" larni o'rganishni klassik bo'lmagan (noan'anaviy) usulini misol tariqasida keltirishni lozim topdik.

Algebraik tenglama va funksiyalarni yaxshi o'rgangan o'quvchilar ham trigonametrik funksiyalarni o'rganishda ba'zi bir qiyinchiliklarga duch kelishi mumkin. Muammoning asosiy sabablaridan biri, mualliflarning fikricha adabiyotlarning yo'qligida yoki bo'lsa ham juda kamligidadir.

Karrali trigonametrik funksiyalarni oddiy trigonametrik funksiyalarga

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aylantirishda ikki burchak yig'indisining sinusi va kosinuslaridan foydalanadi. Bu an'anaviy usul o'quvchilardan ko'proq vaqt talab qiladi.

Hozirgi fan va texnika taraqqiyoti o'quvchilardan muammolarni tez va o'ta to'g'ri bajarishni talabqiladi. Masalan, $cos3x$ karrali funksiyani oddiy trigonametrik funksiya ko'rinishida keltiraylik.

$cos3x=\cos(x+2x)=cosxcos2x-sinxsin2x$ va ba'zi almashtirishlardan so'ng $4cos^3x-3cosx$ ifodaga tengligi kelib chiqadi. Bu klassik usul bilan ayniyatni isbotlashda o'quvchilar vaqtni yutqazish bilan birga soddalashtirish jarayonida xatolikka yo'l qo'yishi ham mumkin.

Biz taklif qilgan noan'anaviy usul vaqtni tejash bilan birgalikda algebraik ayniyat bilan trigonametrik funksiyaning uzviy bog'liqligini asoslaydi.

Ko'phadlarni koeffitsentlarini aniqlashda Paskal uchburchagidan foydalanamiz.

1 (n=0)

1 1 (n=1)

1 2 1 (n=2)

1 3 3 1 (n=3)

1 4 6 4 1 (n=4)

1 5 10 10 5 1 (n=5)

1 6 15 20 15 6 1 (n=6)

Misol tariqasida $(a+b)^n$ darajasini ko'phad ko'rinishga keltiraylik. Bu hadlarni $a=cosx,\ b=sinx$ bilan almashtirsak va $n=2$ bo'lganda Paskal uchburchagi

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

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

$(a+b)^4=a^4+4a^3b+6a^2b^2+4ab^3+b^4$

$$(a+b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$$

O'quvchi cos*n*x va sin*n*x formulalarni oddiy trigonametrik funksiyaga almashtirishning bu usulini quyidagi sxemada ko'rish mumkin (1-sxema):

$cos2x = 1cos^2x \qquad - 1sin^2x$

+

$sin2x = 2cosxsinx$

$cos3x = 1cos^3x - \qquad -3cosxsin^2x$

+

$sin3x = 3cos^2xsinx \qquad +1sin^3x$

$cos4x = 1cos^4x - \qquad -6cos^2xsin^2x \qquad -1sin^4x$

+

$sin4x = 4cos^3xsinx \qquad + 4cosxsin^3x$

Bu ma'lumotdan kelib chiqib quyidagi formulalarni taklif qilamiz [1];

$$cosnx = a_1cos^nx - a_3cos^nx - a_5sin^2x + \ldots\ldots\ldots\ldots$$

$$\sin nx = a_2cos^{n-1}xsinx - a_4cos^{n-3}xsin^3x + \ldots\ldots$$

Bu usul yordamida qiyinroq bo'lgan $tgnx$ funksiyasini ham oddiy funksiya ko'rinishiga keltirishimiz mumkin:

Xususiy holda $tg2x = \frac{2tgx}{1-tg^2x}$; $tg3x = \frac{3tgx-tg^3x}{1-3tg^2x}$; $tg4x = \frac{4tgx-4tg^3x}{1-6tg^2x+tg^4x}$ va hakozo.

1- **Misol. Ayniyatni isbot qiling**.

$$cos\left(\frac{5}{2}\pi - 6\alpha\right)\sin^3(\pi - 2\alpha) - \cos(6\alpha - \pi)\, sin^3\left(\frac{\pi}{2} - 2\alpha\right) = cos^3 4\alpha$$

Yechish: $cos\left(\frac{5}{2}\pi-6\alpha\right)\sin^3(\pi-2\alpha)-\cos(6\alpha-\pi)\,sin^3\left(\frac{\pi}{2}-2\alpha\right)=$

$$=cos\left(\frac{5}{2}\pi-6\alpha\right)(\sin(\pi-2\alpha))^3-\cos(\pi-6\alpha)\left(sin\left(\frac{\pi}{2}-2\alpha\right)\right)^3=$$

$=[sin3x=3sinx-4sin^3x,\ \ cos3x=4cos^3x-3cosx]=sin6\alpha sin^3 2\alpha+$

$+cos6\alpha cos^3 2\alpha=sin3(2\alpha)sin^3 2\alpha+cos3(2\alpha)cos^3 2\alpha=(3sin2\alpha-$

$-4sin^3 2\alpha)sin^3 2\alpha+(4cos^3 2\alpha-3cos2\alpha)cos^3 2\alpha=3sin^4 2\alpha-4sin^6 2\alpha+$

$+4cos^6 2\alpha-3cos^4 2\alpha=-3(cos^4 2\alpha-sin^4 2\alpha)+4(cos^6 2\alpha-sin^6 2\alpha)=$

$=-3(cos^2 2\alpha-sin^2 2\alpha)(cos^2 2\alpha+sin^2 2\alpha)+4(cos^2 2\alpha-sin^2 2\alpha)\times$

$\times(cos^4 2\alpha+cos^2 2\alpha sin^2 2\alpha+sin^4 2\alpha)=-3(cos^2 2\alpha-sin^2 2\alpha)+$

$4(cos^2 2\alpha-sin^2 2\alpha)((cos^4 2\alpha+sin^4 2\alpha)+cos^2 2\alpha sin^2 2\alpha)=-3cos4\alpha+$

$4cos4\alpha((cos^2 2\alpha+sin^2 2\alpha)^2-2cos^2 2\alpha sin^2 2\alpha+cos^2 2\alpha sin^2 2\alpha)=$

$-3cos4\alpha+4cos4\alpha(1-cos^2 2\alpha sin^2 2\alpha)=-3cos4\alpha+4cos4\alpha-cos4\alpha\times$

$\times(4sin^2 2\alpha cos^2 2\alpha)=cos4\alpha-cos4\alpha(4sin^2 2\alpha cos^2 2\alpha)=cos4\alpha-cos4\alpha\times$

$sin^2 4\alpha=cos4\alpha(1-sin^2 4\alpha)=cos4\alpha cos^2 4\alpha=cos^3 4\alpha.$

2- misol. Tenglamani yeching.

$2\,cos13x+3cos3x+3cos5x-8cosxcos^3 4x=0$

Yechish. $cos3\alpha=4cos^3\alpha-3cos\alpha,\ \ cos\alpha+cos\beta=2cos\frac{\alpha+\beta}{2}cos\frac{\alpha-\beta}{2},$

$$cos\alpha-cos\beta=2sin\frac{\alpha+\beta}{2}sin\frac{\beta-\alpha}{2}$$

$2cos13x+3(cos3x+cos5x)-8cosxcos^3 4x=0$

$\Leftrightarrow 2cos13x+3\cdot 2cos4xcosx-8cosxcos^3 4x=0\ \Leftrightarrow$

$\Leftrightarrow 2cos13x - 2cosx(4cos^3 4x - 3cos4x) = 0 \Leftrightarrow$

$\Leftrightarrow 2cos13x - 2cosxcos12x = 0 \Leftrightarrow 2cos13x - (cos13x + cos11x) = 0 \Leftrightarrow$

$\Leftrightarrow -2sin12xsinx = 0$

1) $sin12x = 0,\ 12x = \pi k, x_1 = \frac{\pi k}{12}, k\epsilon Z$
2) $sinx = 0, x_2 = \pi n,\ \ n\epsilon Z$ chet ildiz

Javob. $x = \frac{\pi k}{12}, k\epsilon Z$

Shunday qilib, karrali trigonametrik funksiyalarni oddiy trigonametrik funksuyaga aylantirishning noan'anaviy va an'anaviy usulga qaraganda bir qancha qulayliklarga ega. Shulardan biri vaqtni tejash bilan birga o'quvchilarda sxemalar bilan ishlash mahoratini shakllantiradi. Shuningdek, trigonametrik funksiyalarni algebraik ayniyatlar bilan uzviy bog'liqligini ta'minlaydi. Bir vaqtda karrali trigonametrik funksiyalarni ayni $\cos nx, \sin nx$larni oddiy trigonametrik funksiyalarga o'tkazish mumkin. (1-sxema)

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