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9-Mavzu: Ko`paytmani yig`indiga keltirish formulalari

Ko`paytmani yig`indiga keltirish formulalari.

$sin(α+ β)=sin\ α\ cos\ β + cos\ α\ sin\ β$ **(1)**

$sin(α- β)=sin\ α\ cos\ β - cos\ α\ sin\ β$ **(2)**

(1) va (2) tengliklarni hadma-had qo'shamiz

$sin(α+ β)+ sin(α- β)=2sinαcosβ$ $→$

$sinαcosβ = \dfrac{1}{2}[sin(α+ β)+ sin(α- β)]$ **(3) hosil bo'ladi**

Ko`paytmani yig`indiga keltirish formulalari.

$cos(α+ β)=cos αcos β - sin α sin β$ (4)

$cos(α- β)=cos αcos β + sin α sin β$ (5)

(4) va (5) tengliklarni hadma-had qo'shamiz

$cos(α + β)+cos(α - β) = 2cos αcosβ →$

$cosαcosβ= \frac{1}{2}[cos(α + β) + cos(α − β)]$ (6)

(5) dan (4) ni ayirib soddalashtirilsa (7) formulani hosil qilamiz

$sinαsinβ = \frac{1}{2}[cos(α − β) − cos(α + β)]$ (7)

Misollar

Hisoblang: $sin40°sin20°$ **ni yig`indiga keltiring**

Yechish: $sin40°sin20 = \frac{1}{2}[cos(40° - 20°) - cos(40° + 20°)] =$

$= \frac{1}{2}cos20° - \frac{1}{4}$

Hisoblang: $sin10°cos20°$ **ni yig'indiga keltiring**

Yechish: $sin10°cos20° = \frac{1}{2}[sin(10° + 20°) + sin(10° - 20°)] =$

$= \frac{1}{2}(sin30° + sin(-10°)) = \frac{1}{4} - \frac{1}{2}sin10°$

Yig`indini ko`paytmaga keltirish formulalari

$$sin(x + y) = sinxcosy + cosxsiny \quad (1)$$
$$sin(x - y) = sinxcosy - cosxsiny \quad (2)$$
$$cos(x + y) = cosxcosy - sinxsiny \quad (3)$$
$$cos(x - y) = cosxcosy + sinxsiny \quad (4)$$

(1) va (2) tengliklarni hadma-had qo'shamiz

$$sin(x + y) + sin(x - y) = 2sinxcosy \quad (5)$$
$$x + y = \alpha, x - y = \beta \quad (6) \text{ deb olsak, u holda}$$
$$x = \frac{\alpha + \beta}{2}, y = \frac{\alpha - \beta}{2} \quad (7)$$

(5) Tenglikda (6) va (7) formulalar bo`yicha almashtirishlarni bajarib, sinuslar yig`indisinig formulasiga kelamiz:

$$sin\alpha + sin\beta = 2sin\frac{\alpha+\beta}{2}cos\frac{\alpha-\beta}{2}$$ (8)

(1) Tenglikdan (2) tenglikni hadma-had ayirib,

$$sin(x + y) - sin(x - y) = 2cosxsiny$$

Tenglikni hosil qilamiz, bu tenglikda (6) va (7) formulalar bo`yicha almashtirishlarni bajarsak, ushbu ko`rinishni oladi:

$$sin\alpha - sin\beta = 2cos\frac{\alpha+\beta}{2}sin\frac{\alpha-\beta}{2}$$ (9)

Huddi shuningdek, (3) va (4) tengliklardan quyidagilar kelib chiqadi:

$$cos\alpha + cos\beta = 2cos\frac{\alpha+\beta}{2}cos\frac{\alpha-\beta}{2} \quad (10)$$

$$cos\alpha - cos\beta = -2sin\frac{\alpha+\beta}{2}sin\frac{\alpha-\beta}{2} \quad (11)$$

Sinus toq funksiya bo`lgani uchun, (11) formulani

$$cos\alpha - cos\beta = 2sin\frac{\alpha+\beta}{2}sin\frac{\beta-\alpha}{2} \quad (11a)$$

ko`rinishda yozish mumkin.