

$$\cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x = \frac{1}{8} \cdot \cos 15x \quad | \cdot \sin x$$

$$\sin x \neq 0$$

$$x \neq Pn$$

$$x_1 = 2Pn \text{ и } x_2 = P + 2Pn$$

$$\sin x \cdot \cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x = \frac{1}{8} \cdot \cos 15x \cdot \sin x \quad | \cdot 2$$

$$2 \sin x \cdot \cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x = \frac{1}{4} \cdot \cos 15x \cdot \sin x$$

$$\sin 2x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x = \frac{1}{4} \cdot \cos 15x \cdot \sin x \quad | \cdot 8$$

$$8 \sin 2x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x = 2 \cdot \cos 15x \cdot \sin x$$

$$4 \sin 4x \cdot \cos 4x \cdot \cos 8x = 2 \cdot \cos 15x \cdot \sin x$$

$$2 \sin 8x \cdot \cos 8x = 2 \cdot \cos 15x \cdot \sin x$$

$$\sin 16x = 2 \cdot \cos 15x \cdot \sin x$$

$$\sin 16x = 2 \cdot (\sin(x+15x) + \sin(x-15x)) / 2$$

$$\sin 16x = (\sin 16x + \sin 14x)$$

$$\sin 16x = \sin 16x + \sin 14x$$

$$\sin 14x = 0$$

$$14x = Pn$$

$$x = Pn/14$$

1 проверка $x = 2Pn$

$$\cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x$$

$$\cos(2Pn) \cdot \cos(4Pn) \cdot \cos(8Pn) \cdot \cos(16Pn) = 1$$

$$\frac{1}{8} \cdot \cos(30Pn) = \frac{1}{8}$$

2 проверка $x = P + 2Pn$

$$\cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x$$

$$\cos(P+2Pn) \cdot \cos(2P+4Pn) \cdot \cos(4P+8Pn) \cdot \cos(8P+16Pn) = -1$$

$$\frac{1}{8} \cdot \cos(15P+2Pn) = -\frac{1}{8}$$

$$Pn/14 \neq Pk \quad | \cdot 14/P$$

$$n \neq 14k$$

Ответ: $Pn/14$ при $n \neq 14k$

$$\sin x \cdot \cos y = (\sin(x+y) + \sin(x-y)) / 2$$

$$\begin{aligned} \sin y + \cos 3y &= 1 - 2\sin^2 y + \sin 2y \\ \sin y + \cos 3y &= \cos 2y + \sin 2y \\ \sin y - \sin 2y &= \cos 2y - \cos 3y \\ \sin y - \sin 2y &= 2 \cdot \sin((y-2y)/2) \cdot \cos((y+2y)/2) = -2 \cdot \sin(y/2) \cdot \cos(3y/2) \\ \cos 2y - \cos 3y &= -2 \cdot \sin((2y-3y)/2) \cdot \sin((2y+3y)/2) = 2 \cdot \sin(y/2) \cdot \sin(5y/2) \\ -2 \cdot \sin(y/2) \cdot \cos(3y/2) &= 2 \cdot \sin(y/2) \cdot \sin(5y/2) \quad | :2 \\ \sin(y/2) \cdot \sin(5y/2) + \sin(y/2) \cdot \cos(3y/2) &= 0 \\ \sin(y/2) \cdot (\sin(5y/2) + \cos(3y/2)) &= 0 \\ \sin(y/2) &= 0 \\ y/2 &= Pn \\ y &= 2Pn \\ \sin(5y/2) + \cos(3y/2) &= 0 \\ \sin(2y+y/2) + \cos(2y-y/2) &= 0 \\ \sin 2y \cdot \cos(y/2) + \sin(y/2) \cdot \cos 2y + \cos 2y \cdot \cos(y/2) + \sin 2y \cdot \sin(y/2) &= 0 \\ \sin 2y(\cos(y/2) + \sin(y/2)) + \cos 2y(\sin(y/2) + \cos(y/2)) &= 0 \\ (\sin(y/2) + \cos(y/2))(\sin 2y + \cos 2y) &= 0 \\ \sin(y/2) + \cos(y/2) &= 0 \\ V(2) \cdot (\sin(y/2)/V2 + \cos(y/2)/V2) &= 0 \\ 1/V2 = \cos t & \\ 1/V2 = \sin t & \\ t = P/4 & \\ V2 \cdot (\sin(y/2) \cdot \cos P/4 + \cos(y/2) \cdot \sin P/4) &= 0 \\ V2 \cdot (\sin(y/2 + P/4)) &= 0 \\ \sin(y/2 + P/4) &= 0 \\ y/2 + P/4 = Pn & \\ y/2 = Pn - P/4 & \\ y = 2Pn - P/2 & \end{aligned}$$

ДЗ

$\sin 2y + \cos 2y = 0$ решить без вспомогательного аргумента

$$\sin 2y + \cos 2y = 0$$

$$2y = 3P/4 + 2Pn$$

$$y = 3P/8 + Pn$$

$$\sin 2y + \cos 2y = 0$$

$$2 \cdot \sin y \cdot \cos y + 2 \cos^2 y - 1 = 0$$

$$2 \cdot \sin y \cdot \cos y + 2 \cos^2 y - \sin^2 y - \cos^2 y = 0$$

$$2 \cdot \sin y \cdot \cos y + \cos^2 y - \sin^2 y = 0$$

$$\sin y = t$$

$$\cos y = k$$

$$k^2 + 2tk - t^2 = 0 \text{ однородное уравнение}$$

$$k^2/t^2 + 2k/t - 1 = 0$$

$$k/t = u$$

$$u^2 + 2u - 1 = 0$$

$$D = 1 + 1 = 2$$

$$u_1 = (-1 - \sqrt{2})$$

$$\cos y / \sin y = -1 - \sqrt{2}$$

$$\operatorname{ctg} y = -1 - \sqrt{2}$$

$$y = \operatorname{arcctg}(-1 - \sqrt{2}) + Pn$$

$$u_2 = (-1 + \sqrt{2})$$

$$\cos y / \sin y = \sqrt{2} - 1$$

$$\operatorname{ctg} y = \sqrt{2} - 1$$

$$y = \operatorname{arcctg}(\sqrt{2} - 1) + Pn$$

Ответ: $\operatorname{arcctg}(-1 - \sqrt{2}) + Pn$; $\operatorname{arcctg}(\sqrt{2} - 1) + Pn$.

$$\sin 2y + \cos 2y = 0$$

$$V2 \cdot (\sin 2y/V2 + \cos 2y/V2)$$

$$1/V2 = \cos t$$

$$1/V2 = \sin t$$

$$t = P/4$$

$$V2 \cdot (\sin 2y \cdot \cos P/4 + \cos 2y \cdot \sin P/4) = 0$$

$$\sin 2y \cdot \cos P/4 + \cos 2y \cdot \sin P/4 = 0$$

$$\sin(2y + P/4) = 0$$

$$2y + P/4 = Pn$$

$$2y = Pn - P/4$$

$$y = Pn/2 - Pn/8$$