

In[2]:= **TrigExpand**[Sin[2 x]]

Out[2]=  $2 \cos[x] \sin[x]$

In[4]:= **TrigExpand**[Sin[3 x]]

Out[4]=  $3 \cos[x]^2 \sin[x] - \sin[x]^3$

In[5]:= **TrigExpand**[Sin[4 x]]

Out[5]=  $4 \cos[x]^3 \sin[x] - 4 \cos[x] \sin[x]^3$

In[6]:= **TrigExpand**[Sin[x + y]]

Out[6]=  $\cos[y] \sin[x] + \cos[x] \sin[y]$

In[7]:= **TrigExpand**[Sin[x + y + z]]

Out[7]=  $\cos[y] \cos[z] \sin[x] + \cos[x] \cos[z] \sin[y] + \cos[x] \cos[y] \sin[z] - \sin[x] \sin[y] \sin[z]$

In[8]:= **TrigExpand**[Cos[x + y + z]]

Out[8]=  $\cos[x] \cos[y] \cos[z] - \cos[z] \sin[x] \sin[y] - \cos[y] \sin[x] \sin[z] - \cos[x] \sin[y] \sin[z]$

In[9]:= **TrigExpand**[Cos[x + y]]

Out[9]=  $\cos[x] \cos[y] - \sin[x] \sin[y]$

In[10]:= **TrigToExp**[Cosh[x + iy]]

Out[10]=  $\frac{e^{-iy-x}}{2} + \frac{e^{iy+x}}{2}$

In[11]:= **TrigExpand**[Tan[x1 + x2 + x3 + x4 + x5]]

Out[11]= 
$$\frac{(\cos[x2] \cos[x3] \cos[x4] \cos[x5] \sin[x1])}{(\cos[x1] \cos[x2] \cos[x3] \cos[x4] \cos[x5] - \cos[x3] \cos[x4] \cos[x5] \sin[x1] \sin[x2] - \cos[x2] \cos[x4] \cos[x5] \sin[x1] \sin[x3] - \cos[x1] \cos[x4] \cos[x5] \sin[x2] \sin[x3] - \cos[x2] \cos[x3] \cos[x5] \sin[x1] \sin[x4] - \cos[x1] \cos[x3] \cos[x5] \sin[x2] \sin[x4] - \cos[x1] \cos[x2] \cos[x5] \sin[x3] \sin[x4] + \cos[x5] \sin[x1] \sin[x2] \sin[x3] \sin[x4] - \cos[x2] \cos[x3] \cos[x4] \sin[x1] \sin[x5] - \cos[x1] \cos[x3] \cos[x4] \sin[x2] \sin[x5] - \cos[x1] \cos[x2] \cos[x4] \sin[x3] \sin[x5] + \cos[x4] \sin[x1] \sin[x2] \sin[x3] \sin[x5] - \cos[x1] \cos[x2] \cos[x3] \sin[x4] \sin[x5] + \cos[x3] \sin[x1] \sin[x2] \sin[x4] \sin[x5] + \cos[x2] \sin[x1] \sin[x3] \sin[x4] \sin[x5] + \cos[x1] \sin[x2] \sin[x3] \sin[x4] \sin[x5])} + \frac{(\cos[x1] \cos[x3] \cos[x4] \cos[x5] \sin[x2])}{(\cos[x1] \cos[x2] \cos[x3] \cos[x4] \cos[x5] - \cos[x3] \cos[x4] \cos[x5] \sin[x1] \sin[x2] - \cos[x2] \cos[x4] \cos[x5] \sin[x1] \sin[x3] - \cos[x1] \cos[x4] \cos[x5] \sin[x2] \sin[x3] - \cos[x2] \cos[x3] \cos[x5] \sin[x1] \sin[x4] - \cos[x1] \cos[x3] \cos[x5] \sin[x2] \sin[x4] - \cos[x1] \cos[x2] \cos[x5] \sin[x3] \sin[x4] + \cos[x5] \sin[x1] \sin[x2] \sin[x3] \sin[x4] - \cos[x2] \cos[x3] \cos[x4] \sin[x1] \sin[x5] - \cos[x1] \cos[x3] \cos[x4] \sin[x2] \sin[x5] - \cos[x1] \cos[x2] \cos[x4] \sin[x3] \sin[x5] + \cos[x4] \sin[x1] \sin[x2] \sin[x3] \sin[x5] - \cos[x1] \cos[x2] \cos[x3] \sin[x4] \sin[x5] + \cos[x3] \sin[x1] \sin[x2] \sin[x4] \sin[x5] + \cos[x2] \sin[x1] \sin[x3] \sin[x4] \sin[x5] + \cos[x1] \sin[x2] \sin[x3] \sin[x4] \sin[x5])}$$

[illegible]

[illegible]

[illegible]

```
In[12]:= TrigToExp[TrigExpand[Tan[x1 + x2 + x3]]]
```

$$\text{Out}[12]= \left( i e^{-i x_1 - i x_2 - i x_3} \right) /$$

$$\begin{aligned} & \left( 2 \left( \frac{1}{8} \left( e^{-i x_1} + e^{i x_1} \right) \left( e^{-i x_2} - e^{i x_2} \right) \left( e^{-i x_3} - e^{i x_3} \right) + \frac{1}{8} \left( e^{-i x_1} - e^{i x_1} \right) \left( e^{-i x_2} + e^{i x_2} \right) \left( e^{-i x_3} - e^{i x_3} \right) + \right. \right. \\ & \quad \frac{1}{8} \left( e^{-i x_1} - e^{i x_1} \right) \left( e^{-i x_2} - e^{i x_2} \right) \left( e^{-i x_3} + e^{i x_3} \right) + \\ & \quad \left. \left. \frac{1}{8} \left( e^{-i x_1} + e^{i x_1} \right) \left( e^{-i x_2} + e^{i x_2} \right) \left( e^{-i x_3} + e^{i x_3} \right) \right) \right) - \left( i e^{i x_1 + i x_2 + i x_3} \right) / \\ & \left( 2 \left( \frac{1}{8} \left( e^{-i x_1} + e^{i x_1} \right) \left( e^{-i x_2} - e^{i x_2} \right) \left( e^{-i x_3} - e^{i x_3} \right) + \frac{1}{8} \left( e^{-i x_1} - e^{i x_1} \right) \left( e^{-i x_2} + e^{i x_2} \right) \left( e^{-i x_3} - e^{i x_3} \right) + \right. \right. \\ & \quad \frac{1}{8} \left( e^{-i x_1} - e^{i x_1} \right) \left( e^{-i x_2} - e^{i x_2} \right) \left( e^{-i x_3} + e^{i x_3} \right) + \frac{1}{8} \left( e^{-i x_1} + e^{i x_1} \right) \left( e^{-i x_2} + e^{i x_2} \right) \left( e^{-i x_3} + e^{i x_3} \right) \left. \right) \end{aligned}$$

This is a prelude to some of the most important formulas in trigonometry, a lot of trigonometric identities and formulas come from elementary symmetric polynomials and Newton's Power Sum Polynomials. Let's explore the "Hidden" relation between trigonometric identities and Newton Power Sum Polynomials.

I am mostly want to show a pictorial relation between such identities, binomial theorem and other mathematical identities.

We explore cases from  $n=1$  to  $n=30$  for the function  $\sin(x)$

In[14]:= **TrigToExp[Sin[x]]**

$$\text{Out[14]} = \frac{1}{2} i e^{-i x} - \frac{1}{2} i e^{i x}$$

In[15]:= **TrigExpand[Sin[x1 + x2]]**

$$\text{Out[15]} = \cos[x2] \sin[x1] + \cos[x1] \sin[x2]$$

In[16]:= **TrigExpand[Sin[x1 + x2 + x3]]**

$$\text{Out[16]} = \cos[x2] \cos[x3] \sin[x1] + \cos[x1] \cos[x3] \sin[x2] + \cos[x1] \cos[x2] \sin[x3] - \sin[x1] \sin[x2] \sin[x3]$$

In[17]:= **TrigExpand[Sin[x1 + x2 + x3 + x4]]**

$$\begin{aligned} \text{Out[17]} = & \cos[x2] \cos[x3] \cos[x4] \sin[x1] + \cos[x1] \cos[x3] \cos[x4] \sin[x2] + \\ & \cos[x1] \cos[x2] \cos[x4] \sin[x3] - \cos[x4] \sin[x1] \sin[x2] \sin[x3] + \\ & \cos[x1] \cos[x2] \cos[x3] \sin[x4] - \cos[x3] \sin[x1] \sin[x2] \sin[x4] - \\ & \cos[x2] \sin[x1] \sin[x3] \sin[x4] - \cos[x1] \sin[x2] \sin[x3] \sin[x4] \end{aligned}$$

In[18]:= **TrigExpand[Sin[x1 + x2 + x3 + x4 + x5]]**

$$\begin{aligned} \text{Out[18]} = & \cos[x2] \cos[x3] \cos[x4] \cos[x5] \sin[x1] + \cos[x1] \cos[x3] \cos[x4] \cos[x5] \sin[x2] + \\ & \cos[x1] \cos[x2] \cos[x4] \cos[x5] \sin[x3] - \cos[x4] \cos[x5] \sin[x1] \sin[x2] \sin[x3] + \\ & \cos[x1] \cos[x2] \cos[x3] \cos[x5] \sin[x4] - \cos[x3] \cos[x5] \sin[x1] \sin[x2] \sin[x4] - \\ & \cos[x2] \cos[x5] \sin[x1] \sin[x3] \sin[x4] - \cos[x1] \cos[x5] \sin[x2] \sin[x3] \sin[x4] + \\ & \cos[x1] \cos[x2] \cos[x3] \cos[x4] \sin[x5] - \cos[x3] \cos[x4] \sin[x1] \sin[x2] \sin[x5] - \\ & \cos[x2] \cos[x4] \sin[x1] \sin[x3] \sin[x5] - \cos[x1] \cos[x4] \sin[x2] \sin[x3] \sin[x5] - \\ & \cos[x2] \cos[x3] \sin[x1] \sin[x4] \sin[x5] - \cos[x1] \cos[x3] \sin[x2] \sin[x4] \sin[x5] - \\ & \cos[x1] \cos[x2] \sin[x3] \sin[x4] \sin[x5] + \sin[x1] \sin[x2] \sin[x3] \sin[x4] \sin[x5] \end{aligned}$$

In[19]:= **TrigExpand**[**Sin**[**x1 + x2 + x3 + x4 + x5 + x6**]]

Out[19]=  $\begin{aligned} & \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_1] + \\ & \cos[x_1] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_2] + \\ & \cos[x_1] \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_3] - \\ & \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_3] + \\ & \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_5] \cos[x_6] \sin[x_4] - \\ & \cos[x_3] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_4] - \\ & \cos[x_2] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_3] \sin[x_4] - \\ & \cos[x_1] \cos[x_5] \cos[x_6] \sin[x_2] \sin[x_3] \sin[x_4] + \\ & \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \sin[x_5] - \\ & \cos[x_3] \cos[x_4] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_5] - \\ & \cos[x_2] \cos[x_4] \cos[x_6] \sin[x_1] \sin[x_3] \sin[x_5] - \\ & \cos[x_1] \cos[x_4] \cos[x_6] \sin[x_2] \sin[x_3] \sin[x_5] - \\ & \cos[x_2] \cos[x_3] \cos[x_6] \sin[x_1] \sin[x_4] \sin[x_5] - \\ & \cos[x_1] \cos[x_3] \cos[x_6] \sin[x_2] \sin[x_4] \sin[x_5] - \\ & \cos[x_1] \cos[x_2] \cos[x_6] \sin[x_3] \sin[x_4] \sin[x_5] + \\ & \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] + \\ & \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \sin[x_6] - \\ & \cos[x_3] \cos[x_4] \cos[x_5] \sin[x_1] \sin[x_2] \sin[x_6] - \\ & \cos[x_2] \cos[x_4] \cos[x_5] \sin[x_1] \sin[x_3] \sin[x_6] - \\ & \cos[x_1] \cos[x_4] \cos[x_5] \sin[x_2] \sin[x_3] \sin[x_6] - \\ & \cos[x_2] \cos[x_3] \cos[x_5] \sin[x_1] \sin[x_4] \sin[x_6] - \\ & \cos[x_1] \cos[x_3] \cos[x_5] \sin[x_2] \sin[x_4] \sin[x_6] - \\ & \cos[x_1] \cos[x_2] \cos[x_5] \sin[x_3] \sin[x_4] \sin[x_6] + \\ & \cos[x_5] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_6] - \\ & \cos[x_2] \cos[x_3] \cos[x_4] \sin[x_1] \sin[x_5] \sin[x_6] - \\ & \cos[x_1] \cos[x_3] \cos[x_4] \sin[x_2] \sin[x_5] \sin[x_6] - \\ & \cos[x_1] \cos[x_2] \cos[x_4] \sin[x_3] \sin[x_5] \sin[x_6] + \\ & \cos[x_4] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_5] \sin[x_6] - \\ & \cos[x_1] \cos[x_2] \cos[x_3] \sin[x_4] \sin[x_5] \sin[x_6] + \\ & \cos[x_3] \sin[x_1] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] + \\ & \cos[x_2] \sin[x_1] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] + \\ & \cos[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \end{aligned}$

In[20]:= **TrigExpand**[**Sin**[**x1 + x2 + x3 + x4 + x5 + x6 + x7**]]

Out[20]=  $\begin{aligned} & \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] + \\ & \cos[x_1] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_2] + \\ & \cos[x_1] \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_3] - \\ & \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_3] + \\ & \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_4] - \\ & \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_4] - \\ & \cos[x_2] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_3] \sin[x_4] - \\ & \cos[x_1] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_2] \sin[x_3] \sin[x_4] + \\ & \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_5] - \\ & \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_5] - \\ & \cos[x_2] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_3] \sin[x_5] - \end{aligned}$

[illegible]

$$\begin{aligned}
& \cos[x_2] \cos[x_4] \sin[x_1] \sin[x_3] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_4] \sin[x_2] \sin[x_3] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_2] \cos[x_3] \sin[x_1] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_3] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] - \\
& \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7]
\end{aligned}$$

In[21]:= **TrigExpand[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7]]**

Out[21]=

$$\begin{aligned}
& \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] + \\
& \cos[x_1] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_2] + \\
& \cos[x_1] \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_3] - \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_3] + \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_4] - \\
& \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_4] - \\
& \cos[x_2] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_3] \sin[x_4] - \\
& \cos[x_1] \cos[x_5] \cos[x_6] \cos[x_7] \sin[x_2] \sin[x_3] \sin[x_4] + \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_5] - \\
& \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_5] - \\
& \cos[x_2] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_3] \sin[x_5] - \\
& \cos[x_1] \cos[x_4] \cos[x_6] \cos[x_7] \sin[x_2] \sin[x_3] \sin[x_5] - \\
& \cos[x_2] \cos[x_3] \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_4] \sin[x_5] - \\
& \cos[x_1] \cos[x_3] \cos[x_6] \cos[x_7] \sin[x_2] \sin[x_4] \sin[x_5] - \\
& \cos[x_1] \cos[x_2] \cos[x_6] \cos[x_7] \sin[x_3] \sin[x_4] \sin[x_5] + \\
& \cos[x_6] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] + \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_7] \sin[x_6] - \\
& \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_6] - \\
& \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_7] \sin[x_1] \sin[x_3] \sin[x_6] - \\
& \cos[x_1] \cos[x_4] \cos[x_5] \cos[x_7] \sin[x_2] \sin[x_3] \sin[x_6] - \\
& \cos[x_2] \cos[x_3] \cos[x_5] \cos[x_7] \sin[x_1] \sin[x_4] \sin[x_6] - \\
& \cos[x_1] \cos[x_3] \cos[x_5] \cos[x_7] \sin[x_2] \sin[x_4] \sin[x_6] - \\
& \cos[x_1] \cos[x_2] \cos[x_5] \cos[x_7] \sin[x_3] \sin[x_4] \sin[x_6] + \\
& \cos[x_5] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_6] - \\
& \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_7] \sin[x_1] \sin[x_5] \sin[x_6] - \\
& \cos[x_1] \cos[x_3] \cos[x_4] \cos[x_7] \sin[x_2] \sin[x_5] \sin[x_6] - \\
& \cos[x_1] \cos[x_2] \cos[x_4] \cos[x_7] \sin[x_3] \sin[x_5] \sin[x_6] + \\
& \cos[x_4] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_5] \sin[x_6] - \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_7] \sin[x_4] \sin[x_5] \sin[x_6] + \\
& \cos[x_3] \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] + \\
& \cos[x_2] \cos[x_7] \sin[x_1] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] + \\
& \cos[x_1] \cos[x_7] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] + \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_7] - \\
& \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_7] - \\
& \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_3] \sin[x_7] - \\
& \cos[x_1] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_2] \sin[x_3] \sin[x_7] - \\
& \cos[x_2] \cos[x_3] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_4] \sin[x_7] - \\
& \cos[x_1] \cos[x_3] \cos[x_5] \cos[x_6] \sin[x_2] \sin[x_4] \sin[x_7] - \\
& \cos[x_1] \cos[x_2] \cos[x_5] \cos[x_6] \sin[x_3] \sin[x_4] \sin[x_7] +
\end{aligned}$$



```

Cos[x5] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x7] -
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Sin[x1] Sin[x5] Sin[x7] -
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Sin[x2] Sin[x5] Sin[x7] -
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Sin[x3] Sin[x5] Sin[x7] +
Cos[x4] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x7] -
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Sin[x4] Sin[x5] Sin[x7] +
Cos[x3] Cos[x6] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x7] +
Cos[x2] Cos[x6] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x7] +
Cos[x1] Cos[x6] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x7] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x6] Sin[x7] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Sin[x2] Sin[x6] Sin[x7] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Sin[x3] Sin[x6] Sin[x7] +
Cos[x4] Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x6] Sin[x7] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Sin[x4] Sin[x6] Sin[x7] +
Cos[x3] Cos[x5] Sin[x1] Sin[x2] Sin[x4] Sin[x6] Sin[x7] +
Cos[x2] Cos[x5] Sin[x1] Sin[x3] Sin[x4] Sin[x6] Sin[x7] +
Cos[x1] Cos[x5] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Sin[x5] Sin[x6] Sin[x7] +
Cos[x3] Cos[x4] Sin[x1] Sin[x2] Sin[x5] Sin[x6] Sin[x7] +
Cos[x2] Cos[x4] Sin[x1] Sin[x3] Sin[x5] Sin[x6] Sin[x7] +
Cos[x1] Cos[x4] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] +
Cos[x2] Cos[x3] Sin[x1] Sin[x4] Sin[x5] Sin[x6] Sin[x7] +
Cos[x1] Cos[x3] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] +
Cos[x1] Cos[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] -
Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7]

```

In[22]:= **TrigExpand[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8]]**

```

Out[22]= Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] +
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] +
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x3] -
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] +
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x4] -
Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x4] -
Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x4] -
Cos[x1] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x4] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x5] -
Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x5] -
Cos[x2] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x5] -
Cos[x1] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x5] -
Cos[x2] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x5] -
Cos[x1] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x4] Sin[x5] -
Cos[x1] Cos[x2] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x5] +
Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x6] -
Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x6] -
Cos[x2] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x6] -
Cos[x1] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x6] -

```



[illegible]

```

Cos[x2] Cos[x4] Cos[x5] Sin[x1] Sin[x3] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x4] Cos[x5] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x5] Sin[x1] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x5] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x5] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x4] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x4] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x4] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x3] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8]

```

```
In[23]:= TrigExpand[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8]]
```

```

Out[23]= Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] +
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] +
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x3] -
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] +
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x4] -
Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x4] -
Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x4] -
Cos[x1] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x4] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x5] -
Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x5] -
Cos[x2] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x5] -
Cos[x1] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x5] -
Cos[x2] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x5] -
Cos[x1] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x4] Sin[x5] -
Cos[x1] Cos[x2] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x5] +
Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x6] -
Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x6] -
Cos[x2] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x6] -
Cos[x1] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x6] -
Cos[x2] Cos[x3] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x6] -
Cos[x1] Cos[x3] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x4] Sin[x6] -
Cos[x1] Cos[x2] Cos[x5] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x6] +
Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] -
Cos[x2] Cos[x3] Cos[x4] Cos[x7] Cos[x8] Sin[x1] Sin[x5] Sin[x6] -
Cos[x1] Cos[x3] Cos[x4] Cos[x7] Cos[x8] Sin[x2] Sin[x5] Sin[x6] -
Cos[x1] Cos[x2] Cos[x4] Cos[x7] Cos[x8] Sin[x3] Sin[x5] Sin[x6] +
Cos[x4] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x7] Cos[x8] Sin[x4] Sin[x5] Sin[x6] +
Cos[x3] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] +
Cos[x2] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] +

```

[illegible]



$$\begin{aligned} & \cos(x_3) \sin(x_1) \sin(x_2) \sin(x_4) \sin(x_5) \sin(x_6) \sin(x_7) \sin(x_8) - \\ & \cos(x_2) \sin(x_1) \sin(x_3) \sin(x_4) \sin(x_5) \sin(x_6) \sin(x_7) \sin(x_8) - \\ & \cos(x_1) \sin(x_2) \sin(x_3) \sin(x_4) \sin(x_5) \sin(x_6) \sin(x_7) \sin(x_8) \end{aligned}$$

```
In[24]:= TrigExpand[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9]]
```

[illegible]





```

Cos[x3] Cos[x4] Cos[x7] Cos[x9] Sin[x1] Sin[x2] Sin[x5] Sin[x6] Sin[x8] +
Cos[x2] Cos[x4] Cos[x7] Cos[x9] Sin[x1] Sin[x3] Sin[x5] Sin[x6] Sin[x8] +
Cos[x1] Cos[x4] Cos[x7] Cos[x9] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x8] +
Cos[x2] Cos[x3] Cos[x7] Cos[x9] Sin[x1] Sin[x4] Sin[x5] Sin[x6] Sin[x8] +
Cos[x1] Cos[x3] Cos[x7] Cos[x9] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x8] +
Cos[x1] Cos[x2] Cos[x7] Cos[x9] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x8] -
Cos[x7] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x8] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x9] Sin[x1] Sin[x7] Sin[x8] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x9] Sin[x2] Sin[x7] Sin[x8] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x9] Sin[x3] Sin[x7] Sin[x8] +
Cos[x4] Cos[x5] Cos[x6] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x7] Sin[x8] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x9] Sin[x4] Sin[x7] Sin[x8] +
Cos[x3] Cos[x5] Cos[x6] Cos[x9] Sin[x1] Sin[x2] Sin[x4] Sin[x7] Sin[x8] +
Cos[x2] Cos[x5] Cos[x6] Cos[x9] Sin[x1] Sin[x3] Sin[x4] Sin[x7] Sin[x8] +
Cos[x1] Cos[x5] Cos[x6] Cos[x9] Sin[x2] Sin[x3] Sin[x4] Sin[x7] Sin[x8] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x9] Sin[x5] Sin[x7] Sin[x8] +
Cos[x3] Cos[x4] Cos[x6] Cos[x9] Sin[x1] Sin[x2] Sin[x5] Sin[x7] Sin[x8] +
Cos[x2] Cos[x4] Cos[x6] Cos[x9] Sin[x1] Sin[x3] Sin[x5] Sin[x7] Sin[x8] +
Cos[x1] Cos[x4] Cos[x6] Cos[x9] Sin[x2] Sin[x3] Sin[x5] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x6] Cos[x9] Sin[x1] Sin[x4] Sin[x5] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x6] Cos[x9] Sin[x2] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x6] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x9] Sin[x6] Sin[x7] Sin[x8] +
Cos[x3] Cos[x4] Cos[x5] Cos[x9] Sin[x1] Sin[x2] Sin[x6] Sin[x7] Sin[x8] +
Cos[x2] Cos[x4] Cos[x5] Cos[x9] Sin[x1] Sin[x3] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x4] Cos[x5] Cos[x9] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x5] Cos[x9] Sin[x1] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x5] Cos[x9] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x5] Cos[x9] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x5] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x4] Cos[x9] Sin[x1] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x4] Cos[x9] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x4] Cos[x9] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x4] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x9] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x3] Cos[x9] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x9] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x9] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x9] -
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x9] -
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x9] -
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x9] -
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x9] -
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x4] Sin[x9] -
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x9] +
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x9] -

```



```

Cos[x5] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x9] +
Cos[x2] Cos[x3] Cos[x4] Cos[x8] Sin[x1] Sin[x5] Sin[x6] Sin[x7] Sin[x9] +
Cos[x1] Cos[x3] Cos[x4] Cos[x8] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x9] +
Cos[x1] Cos[x2] Cos[x4] Cos[x8] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x9] -
Cos[x4] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x9] +
Cos[x1] Cos[x2] Cos[x3] Cos[x8] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x9] -
Cos[x3] Cos[x8] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x9] -
Cos[x2] Cos[x8] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x9] -
Cos[x1] Cos[x8] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x9] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x8] Sin[x9] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x2] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x3] Sin[x8] Sin[x9] +
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Sin[x4] Sin[x8] Sin[x9] +
Cos[x3] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x4] Sin[x8] Sin[x9] +
Cos[x2] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x3] Sin[x4] Sin[x8] Sin[x9] +
Cos[x1] Cos[x5] Cos[x6] Cos[x7] Sin[x2] Sin[x3] Sin[x4] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Sin[x5] Sin[x8] Sin[x9] +
Cos[x3] Cos[x4] Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x5] Sin[x8] Sin[x9] +
Cos[x2] Cos[x4] Cos[x6] Cos[x7] Sin[x1] Sin[x3] Sin[x5] Sin[x8] Sin[x9] +
Cos[x1] Cos[x4] Cos[x6] Cos[x7] Sin[x2] Sin[x3] Sin[x5] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x6] Cos[x7] Sin[x1] Sin[x4] Sin[x5] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x6] Cos[x7] Sin[x2] Sin[x4] Sin[x5] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x6] Cos[x7] Sin[x3] Sin[x4] Sin[x5] Sin[x8] Sin[x9] -
Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Sin[x6] Sin[x8] Sin[x9] +
Cos[x3] Cos[x4] Cos[x5] Cos[x7] Sin[x1] Sin[x2] Sin[x6] Sin[x8] Sin[x9] +
Cos[x2] Cos[x4] Cos[x5] Cos[x7] Sin[x1] Sin[x3] Sin[x6] Sin[x8] Sin[x9] +
Cos[x1] Cos[x4] Cos[x5] Cos[x7] Sin[x2] Sin[x3] Sin[x6] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x5] Cos[x7] Sin[x1] Sin[x4] Sin[x6] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x5] Cos[x7] Sin[x2] Sin[x4] Sin[x6] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x5] Cos[x7] Sin[x3] Sin[x4] Sin[x6] Sin[x8] Sin[x9] -
Cos[x5] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x4] Cos[x7] Sin[x1] Sin[x5] Sin[x6] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x4] Cos[x7] Sin[x2] Sin[x5] Sin[x6] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x4] Cos[x7] Sin[x3] Sin[x5] Sin[x6] Sin[x8] Sin[x9] -
Cos[x4] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x3] Cos[x7] Sin[x4] Sin[x5] Sin[x6] Sin[x8] Sin[x9] -
Cos[x3] Cos[x7] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x8] Sin[x9] -
Cos[x2] Cos[x7] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x8] Sin[x9] -
Cos[x1] Cos[x7] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Sin[x1] Sin[x2] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Sin[x1] Sin[x3] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Sin[x2] Sin[x3] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Sin[x1] Sin[x4] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Sin[x2] Sin[x4] Sin[x7] Sin[x8] Sin[x9] +

```

```

Cos[x1] Cos[x2] Cos[x5] Cos[x6] Sin[x3] Sin[x4] Sin[x7] Sin[x8] Sin[x9] -
Cos[x5] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Sin[x1] Sin[x5] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Sin[x2] Sin[x5] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Sin[x3] Sin[x5] Sin[x7] Sin[x8] Sin[x9] -
Cos[x4] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Sin[x4] Sin[x5] Sin[x7] Sin[x8] Sin[x9] -
Cos[x3] Cos[x6] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Cos[x6] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x6] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Sin[x2] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Sin[x3] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x4] Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x3] Cos[x5] Sin[x1] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Cos[x5] Sin[x1] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x5] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x3] Cos[x4] Sin[x1] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Cos[x4] Sin[x1] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x4] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Cos[x3] Sin[x1] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x3] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9]

```

```
In[25]:= TrigExpand[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9 + x10]]
```

```

Out[25]= Cos[x10] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] +
Cos[x1] Cos[x10] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] -
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x2] +
Cos[x1] Cos[x10] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x3] -
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x3] -
Cos[x10] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x3] -
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x2] Sin[x3] +
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x4] -
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x4] -
Cos[x10] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x4] -
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x2] Sin[x4] -
Cos[x10] Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x3] Sin[x4] -
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x3] Sin[x4] -
Cos[x1] Cos[x10] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] Sin[x3] Sin[x4] +
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x4] +
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x5] -
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x5] -
Cos[x10] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x5] -

```

[illegible]



[illegible]





[illegible]

[illegible]

|           |           |          |           |           |           |           |           |          |          |
|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|
| Cos [x1]  | Cos [x2]  | Cos [x5] | Cos [x7]  | Cos [x8]  | Sin [x10] | Sin [x3]  | Sin [x4]  | Sin [x6] | Sin [x9] |
| Cos [x1]  | Cos [x10] | Cos [x5] | Cos [x7]  | Cos [x8]  | Sin [x2]  | Sin [x3]  | Sin [x4]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x5]  | Cos [x7]  | Cos [x8] | Sin [x1]  | Sin [x10] | Sin [x2]  | Sin [x3]  | Sin [x4]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x10] | Cos [x2] | Cos [x3]  | Cos [x4]  | Cos [x7]  | Cos [x8]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x2]  | Cos [x3]  | Cos [x4] | Cos [x7]  | Cos [x8]  | Sin [x1]  | Sin [x10] | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x3]  | Cos [x4] | Cos [x7]  | Cos [x8]  | Sin [x1]  | Sin [x2]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x3]  | Cos [x4] | Cos [x7]  | Cos [x8]  | Sin [x10] | Sin [x2]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x2]  | Cos [x4] | Cos [x7]  | Cos [x8]  | Sin [x1]  | Sin [x3]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x2]  | Cos [x4] | Cos [x7]  | Cos [x8]  | Sin [x10] | Sin [x3]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x4]  | Cos [x7]  | Cos [x8] | Sin [x1]  | Sin [x10] | Sin [x2]  | Sin [x3]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x2]  | Cos [x3] | Cos [x7]  | Cos [x8]  | Sin [x1]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x2]  | Cos [x3] | Cos [x7]  | Cos [x8]  | Sin [x10] | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x10] | Cos [x3] | Cos [x7]  | Cos [x8]  | Sin [x2]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x3]  | Cos [x7]  | Cos [x8] | Sin [x1]  | Sin [x10] | Sin [x2]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x10] | Cos [x2] | Cos [x7]  | Cos [x8]  | Sin [x3]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x2]  | Cos [x7]  | Cos [x8] | Sin [x1]  | Sin [x10] | Sin [x3]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x7]  | Cos [x8] | Sin [x1]  | Sin [x2]  | Sin [x3]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x7]  | Cos [x8] | Sin [x10] | Sin [x2]  | Sin [x3]  | Sin [x4]  | Sin [x5]  | Sin [x6] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x2]  | Cos [x3] | Cos [x4]  | Cos [x5]  | Cos [x6]  | Cos [x8]  | Sin [x1]  | Sin [x7] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x2]  | Cos [x3] | Cos [x4]  | Cos [x5]  | Cos [x6]  | Cos [x8]  | Sin [x10] | Sin [x7] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x10] | Cos [x3] | Cos [x4]  | Cos [x5]  | Cos [x6]  | Cos [x8]  | Sin [x2]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x3]  | Cos [x4]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x1]  | Sin [x10] | Sin [x2]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x10] | Cos [x2] | Cos [x4]  | Cos [x5]  | Cos [x6]  | Cos [x8]  | Sin [x3]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x2]  | Cos [x4]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x1]  | Sin [x10] | Sin [x3]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x4]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x1]  | Sin [x2]  | Sin [x3]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x4]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x10] | Sin [x2]  | Sin [x3]  | Sin [x7] | Sin [x9] |
| -         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x10] | Cos [x2] | Cos [x3]  | Cos [x5]  | Cos [x6]  | Cos [x8]  | Sin [x4]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x2]  | Cos [x3]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x1]  | Sin [x10] | Sin [x4]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x10] | Cos [x3]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x1]  | Sin [x2]  | Sin [x4]  | Sin [x7] | Sin [x9] |
| +         |           |          |           |           |           |           |           |          |          |
| Cos [x1]  | Cos [x3]  | Cos [x5] | Cos [x6]  | Cos [x8]  | Sin [x10] | Sin [x2]  | Sin [x4]  | Sin [    |          |

[illegible]

[illegible]

[illegible]

```

Cos[x2] Cos[x3] Cos[x5] Sin[x1] Sin[x10] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x3] Cos[x5] Sin[x1] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x3] Cos[x5] Sin[x10] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x2] Cos[x5] Sin[x1] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x5] Sin[x10] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x5] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x5] Sin[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x10] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x3] Cos[x4] Sin[x1] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x3] Cos[x4] Sin[x10] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x2] Cos[x4] Sin[x1] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x4] Sin[x10] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x4] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x4] Sin[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x2] Cos[x3] Sin[x1] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Sin[x10] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x3] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x3] Sin[x1] Sin[x10] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Sin[x1] Sin[x10] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9]

```

In[26]:= **TrigExpand**[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9 + x10 + x11]]

```

Out[26]= Cos[x10] Cos[x11] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] +
Cos[x1] Cos[x11] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] +
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x11] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x11] +
Cos[x1] Cos[x10] Cos[x11] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] -
Cos[x11] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x2] -
Cos[x10] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x11] Sin[x2] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x11] Sin[x2] +
Cos[x1] Cos[x10] Cos[x11] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x3] -
Cos[x11] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x3] -
Cos[x10] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x11] Sin[x3] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x11] Sin[x3] -
Cos[x10] Cos[x11] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x3] -
Cos[x1] Cos[x11] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x2] Sin[x3] -
Cos[x1] Cos[x10] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x11] Sin[x2] Sin[x3] +
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x11] Sin[x2] Sin[x3] +
Cos[x1] Cos[x10] Cos[x11] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x4] -
Cos[x11] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x4] -
Cos[x10] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x11] Sin[x4] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x11] Sin[x4] -
Cos[x10] Cos[x11] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x4] -
Cos[x1] Cos[x11] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x2] Sin[x4] -

```

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

```

Cos[x1] Cos[x11] Cos[x2] Cos[x3] Sin[x10] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Sin[x11] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Sin[x1] Sin[x10] Sin[x11] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x11] Cos[x3] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x11] Cos[x3] Sin[x1] Sin[x10] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x3] Sin[x1] Sin[x11] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Sin[x10] Sin[x11] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x11] Cos[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x11] Cos[x2] Sin[x1] Sin[x10] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x2] Sin[x1] Sin[x11] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Sin[x10] Sin[x11] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x11] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x11] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Sin[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Sin[x1] Sin[x10] Sin[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9]

```

```
In[27]:= TrigExpand[Sin[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9 + x10 + x11 + x12]]
```

```

Out[27]= Cos[x10] Cos[x11] Cos[x12] Cos[x2] Cos[x3] Cos[x4] Cos[x5]
Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] + Cos[x1] Cos[x11] Cos[x12]
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] +
Cos[x1] Cos[x10] Cos[x12] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6]
Cos[x7] Cos[x8] Cos[x9] Sin[x11] - Cos[x12] Cos[x2] Cos[x3] Cos[x4]
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x11] +
Cos[x1] Cos[x10] Cos[x11] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7]
Cos[x8] Cos[x9] Sin[x12] - Cos[x11] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6]
Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x12] - Cos[x10] Cos[x2] Cos[x3]
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x11] Sin[x12] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9]
Sin[x10] Sin[x11] Sin[x12] + Cos[x1] Cos[x10] Cos[x11] Cos[x12]
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] -
Cos[x11] Cos[x12] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8]
Cos[x9] Sin[x1] Sin[x10] Sin[x2] - Cos[x10] Cos[x12] Cos[x3] Cos[x4]
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x11] Sin[x2] -
Cos[x1] Cos[x12] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9]
Sin[x10] Sin[x11] Sin[x2] - Cos[x10] Cos[x11] Cos[x3] Cos[x4]
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x12] Sin[x2] -
Cos[x1] Cos[x11] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9]
Sin[x10] Sin[x12] Sin[x2] - Cos[x1] Cos[x10] Cos[x3] Cos[x4]
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x11] Sin[x12] Sin[x2] +
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10]
Sin[x11] Sin[x12] Sin[x2] + Cos[x1] Cos[x10] Cos[x11] Cos[x12]
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x3] -
Cos[x11] Cos[x12] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9]
Sin[x1] Sin[x10] Sin[x3] - Cos[x10] Cos[x12] Cos[x2] Cos[x4] Cos[x5] Cos[x6]
Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x11] Sin[x3] - Cos[x1] Cos[x12] Cos[x2]
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x11] Sin[x3] -
Cos[x10] Cos[x11] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9]

```

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]





[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]





[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$$\begin{aligned}
& \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_3] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_3] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_{11}] \cos[x_{12}] \cos[x_2] \sin[x_1] \\
& \sin[x_{10}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{12}] \cos[x_2] \sin[x_1] \sin[x_{11}] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{12}] \cos[x_2] \sin[x_{10}] \\
& \sin[x_{11}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_2] \sin[x_1] \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_2] \sin[x_{10}] \\
& \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_2] \sin[x_{11}] \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_2] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_{12}] \sin[x_{10}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{12}] \sin[x_{11}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{12}] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{11}] \sin[x_1] \sin[x_{10}] \sin[x_{12}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_{10}] \sin[x_1] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9]
\end{aligned}$$

Now we Explore the Properties of Cos(x)

In[28]:= **TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9 + x10 + x11 + x12]]**

Out[28]:= 
$$\begin{aligned}
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \\
& \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] - \cos[x_{11}] \cos[x_{12}] \cos[x_2] \\
& \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] - \\
& \cos[x_{10}] \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{11}] - \cos[x_1] \cos[x_{12}] \cos[x_2] \cos[x_3] \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{11}] - \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \\
& \cos[x_9] \sin[x_1] \sin[x_{12}] - \cos[x_1] \cos[x_{11}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{12}] - \cos[x_1] \cos[x_{10}] \cos[x_2] \\
& \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{11}] \sin[x_{12}] + \\
& \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \\
& \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] - \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_3] \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_2] -
\end{aligned}$$

[illegible]

$$\begin{aligned}
& \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{11}] \sin[x_2] \sin[x_4] + \cos[x_1] \cos[x_{12}] \cos[x_3] \\
& \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{11}] \sin[x_2] \sin[x_4] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \\
& \sin[x_{12}] \sin[x_2] \sin[x_4] + \cos[x_1] \cos[x_{11}] \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{12}] \sin[x_2] \sin[x_4] + \cos[x_1] \cos[x_{10}] \cos[x_3] \\
& \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_4] - \\
& \cos[x_3] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_2] \sin[x_4] - \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \cos[x_5] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_3] \sin[x_4] + \cos[x_{11}] \cos[x_{12}] \cos[x_2] \\
& \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_3] \sin[x_4] + \\
& \cos[x_{10}] \cos[x_{12}] \cos[x_2] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \\
& \sin[x_{11}] \sin[x_3] \sin[x_4] + \cos[x_1] \cos[x_{12}] \cos[x_2] \cos[x_5] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{11}] \sin[x_3] \sin[x_4] + \cos[x_{10}] \cos[x_{11}] \cos[x_2] \\
& \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{12}] \sin[x_3] \sin[x_4] + \\
& \cos[x_1] \cos[x_{11}] \cos[x_2] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \\
& \sin[x_{12}] \sin[x_3] \sin[x_4] + \cos[x_1] \cos[x_{10}] \cos[x_2] \cos[x_5] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_{11}] \sin[x_{12}] \sin[x_3] \sin[x_4] - \cos[x_2] \cos[x_5] \cos[x_6] \\
& \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_3] \sin[x_4] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \\
& \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] + \cos[x_1] \cos[x_{11}] \cos[x_{12}] \cos[x_5] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_2] \sin[x_3] \sin[x_4] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{12}] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{11}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] - \cos[x_{12}] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \\
& \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_2] \sin[x_3] \sin[x_4] + \cos[x_1] \cos[x_{10}] \cos[x_{11}] \\
& \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] - \\
& \cos[x_{11}] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_{12}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] - \cos[x_{10}] \cos[x_5] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \\
& \sin[x_1] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] - \cos[x_1] \cos[x_5] \cos[x_6] \\
& \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] - \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_5] - \cos[x_1] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \\
& \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_5] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_{11}] \sin[x_5] + \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_5] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_{12}] \sin[x_5] + \cos[x_{11}] \cos[x_2] \cos[x_3] \cos[x_4] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_{12}] \sin[x_5] + \\
& \cos[x_{10}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \\
& \sin[x_{11}] \sin[x_{12}] \sin[x_5] + \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \\
& \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_5] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \\
& \cos[x_8] \cos[x_9] \sin[x_2] \sin[x_5] + \cos[x_{11}] \cos[x_{12}] \cos[x_3] \cos[x_4] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_1] \sin[x_{10}] \sin[x_2] \sin[x_5] + \\
& \cos[x_{10}] \cos[x_{12}] \cos[x_3] \cos[x_4] \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \\
& \sin[x_1] \sin[x_{11}] \sin[x_2] \sin[x_5] + \cos[x_1] \cos[x_{12}] \cos[x_3] \cos[x_4] \\
& \cos[x_6] \cos[x_7] \cos[x_8] \cos[x_9] \sin[x_{10}] \sin[x_{11}] \sin[x_2] \sin[x_5] +
\end{aligned}$$



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$$\begin{aligned}
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \cos[x_{12}] \cos[x_2] \cos[x_7] \cos[x_8] \\
& \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_2] \cos[x_7] \cos[x_8] \sin[x_{12}] \sin[x_3] \\
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \cos[x_{11}] \cos[x_2] \cos[x_7] \cos[x_8] \\
& \sin[x_1] \sin[x_{10}] \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_2] \cos[x_7] \cos[x_8] \sin[x_1] \sin[x_{11}] \sin[x_{12}] \sin[x_3] \\
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \cos[x_1] \cos[x_2] \cos[x_7] \cos[x_8] \\
& \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_7] \cos[x_8] \sin[x_2] \sin[x_3] \\
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \cos[x_{11}] \cos[x_{12}] \cos[x_7] \cos[x_8] \\
& \sin[x_1] \sin[x_{10}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{12}] \cos[x_7] \cos[x_8] \sin[x_1] \sin[x_{11}] \sin[x_2] \sin[x_3] \\
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \cos[x_1] \cos[x_{12}] \cos[x_7] \cos[x_8] \\
& \sin[x_{10}] \sin[x_{11}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_7] \cos[x_8] \sin[x_1] \sin[x_{12}] \sin[x_2] \sin[x_3] \\
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_7] \cos[x_8] \\
& \sin[x_{10}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_7] \cos[x_8] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \\
& \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] - \cos[x_7] \cos[x_8] \sin[x_1] \sin[x_{10}] \\
& \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_9] - \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \\
& \cos[x_6] \cos[x_8] \sin[x_7] \sin[x_9] + \cos[x_{11}] \cos[x_{12}] \cos[x_2] \cos[x_3] \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \sin[x_1] \sin[x_{10}] \sin[x_7] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{12}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \\
& \sin[x_1] \sin[x_{11}] \sin[x_7] \sin[x_9] + \cos[x_1] \cos[x_{12}] \cos[x_2] \cos[x_3] \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \sin[x_{10}] \sin[x_{12}] \sin[x_7] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_7] \sin[x_9] - \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \\
& \cos[x_8] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_7] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \\
& \sin[x_1] \sin[x_2] \sin[x_7] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_{12}] \cos[x_3] \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \sin[x_{10}] \sin[x_2] \sin[x_7] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{12}] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \\
& \sin[x_{11}] \sin[x_2] \sin[x_7] \sin[x_9] - \cos[x_{12}] \cos[x_3] \cos[x_4] \cos[x_5] \\
& \cos[x_6] \cos[x_8] \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_2] \sin[x_7] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \\
& \sin[x_{12}] \sin[x_2] \sin[x_7] \sin[x_9] - \cos[x_{11}] \cos[x_3] \cos[x_4] \cos[x_5] \\
& \cos[x_6] \cos[x_8] \sin[x_1] \sin[x_{10}] \sin[x_{12}] \sin[x_2] \sin[x_7] \sin[x_9] - \\
& \cos[x_{10}] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \sin[x_1] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_2] \sin[x_7] \sin[x_9] - \cos[x_1] \cos[x_3] \cos[x_4] \cos[x_5] \\
& \cos[x_6] \cos[x_8] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_7] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \\
& \sin[x_1] \sin[x_3] \sin[x_7] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \\
& \cos[x_4] \cos[x_5] \cos[x_6] \cos[x_8] \sin[x_{10}] \sin[x_3] \sin[x_7] \sin[x_9] +
\end{aligned}$$

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$$\begin{aligned}
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{12}] \cos[x_2] \cos[x_3] \\
& \sin[x_{10}] \sin[x_{11}] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_2] \cos[x_3] \sin[x_1] \sin[x_{12}] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_2] \cos[x_3] \\
& \sin[x_{10}] \sin[x_{12}] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_2] \cos[x_3] \sin[x_{11}] \sin[x_{12}] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_2] \cos[x_3] \sin[x_1] \sin[x_{10}] \\
& \sin[x_{11}] \sin[x_{12}] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_3] \sin[x_1] \sin[x_2] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_{12}] \cos[x_3] \\
& \sin[x_{10}] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{12}] \cos[x_3] \sin[x_{11}] \sin[x_2] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{12}] \cos[x_3] \sin[x_1] \sin[x_{10}] \\
& \sin[x_{11}] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_3] \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{11}] \cos[x_3] \sin[x_1] \sin[x_{10}] \\
& \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_{10}] \cos[x_3] \sin[x_1] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_1] \cos[x_3] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \sin[x_1] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \cos[x_1] \cos[x_{11}] \cos[x_{12}] \cos[x_2] \\
& \sin[x_{10}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{12}] \cos[x_2] \sin[x_{11}] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{12}] \cos[x_2] \sin[x_1] \sin[x_{10}] \\
& \sin[x_{11}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_2] \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{11}] \cos[x_2] \sin[x_1] \sin[x_{10}] \\
& \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_{10}] \cos[x_2] \sin[x_1] \sin[x_{11}] \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_1] \cos[x_2] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_{12}] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \\
& \cos[x_1] \cos[x_{10}] \cos[x_{11}] \cos[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_{11}] \cos[x_{12}] \sin[x_1] \sin[x_{10}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_{10}] \cos[x_{12}] \sin[x_1] \sin[x_{11}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_1] \cos[x_{12}] \sin[x_{10}] \sin[x_{11}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_{10}] \cos[x_{11}] \sin[x_1] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \cos[x_1] \cos[x_{11}] \sin[x_{10}] \sin[x_{12}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] - \\
& \cos[x_1] \cos[x_{10}] \sin[x_{11}] \sin[x_{12}] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \\
& \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9] + \sin[x_1] \sin[x_{10}] \sin[x_{11}] \sin[x_{12}] \\
& \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] \sin[x_8] \sin[x_9]
\end{aligned}$$

In[29]:= TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9 + x10 + x11]]

Out[29]= Cos[x1] Cos[x10] Cos[x11] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] -  
Cos[x11] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] -

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]



[illegible]

[illegible]

[illegible]

[illegible]

```

Cos[x1] Cos[x11] Cos[x5] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Cos[x5] Sin[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x5] Sin[x1] Sin[x10] Sin[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x11] Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x11] Cos[x2] Cos[x3] Cos[x4] Sin[x10] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x4] Sin[x11] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x10] Sin[x11] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x11] Cos[x3] Cos[x4] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x11] Cos[x3] Cos[x4] Sin[x1] Sin[x10] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x3] Cos[x4] Sin[x1] Sin[x11] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Cos[x4] Sin[x10] Sin[x11] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x11] Cos[x2] Cos[x4] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x11] Cos[x2] Cos[x4] Sin[x1] Sin[x10] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x2] Cos[x4] Sin[x1] Sin[x11] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x4] Sin[x10] Sin[x11] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x11] Cos[x4] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x11] Cos[x4] Sin[x10] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Cos[x4] Sin[x11] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x4] Sin[x1] Sin[x10] Sin[x11] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x11] Cos[x2] Cos[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x11] Cos[x2] Cos[x3] Sin[x1] Sin[x10] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x2] Cos[x3] Sin[x1] Sin[x11] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Cos[x3] Sin[x10] Sin[x11] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x11] Cos[x3] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x11] Cos[x3] Sin[x10] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Cos[x3] Sin[x11] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x3] Sin[x1] Sin[x10] Sin[x11] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x11] Cos[x2] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x11] Cos[x2] Sin[x10] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Cos[x2] Sin[x11] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Sin[x1] Sin[x10] Sin[x11] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Cos[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x11] Sin[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Sin[x1] Sin[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Sin[x10] Sin[x11] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9]

```

In[30]:= **TrigExpand**[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9 + x10]]

Out[30]= Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] -  
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] -  
Cos[x10] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] -  
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x2] -  
Cos[x10] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x3] -  
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x3] -  
Cos[x1] Cos[x10] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] Sin[x3] +  
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x10] Sin[x2] Sin[x3] -  
Cos[x10] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x4] -  
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x10] Sin[x4] -

[illegible]

[illegible]

[illegible]



[illegible]



[illegible]



[illegible]



[illegible]

```

Cos[x1] Cos[x10] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x10] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x2] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Sin[x10] Sin[x2] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x2] Cos[x4] Cos[x5] Sin[x1] Sin[x3] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Sin[x10] Sin[x3] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x4] Cos[x5] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x4] Cos[x5] Sin[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x2] Cos[x3] Cos[x5] Sin[x1] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Sin[x10] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x3] Cos[x5] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x3] Cos[x5] Sin[x1] Sin[x10] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x2] Cos[x5] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x5] Sin[x1] Sin[x10] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x5] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x10] Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Sin[x10] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x3] Cos[x4] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x3] Cos[x4] Sin[x1] Sin[x10] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x2] Cos[x4] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x4] Sin[x1] Sin[x10] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x4] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x4] Sin[x10] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x10] Cos[x2] Cos[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Cos[x3] Sin[x1] Sin[x10] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x3] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x3] Sin[x10] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x10] Cos[x2] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x2] Sin[x10] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Cos[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Sin[x1] Sin[x10] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9]

```

In[31]:= **TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8 + x9]]**

```

Out[31]= Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] -
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] -
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x3] -
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] Sin[x3] -
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x4] -
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] Sin[x4] -
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x3] Sin[x4] +
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x4] -
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x5] -
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x2] Sin[x5] -
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x3] Sin[x5] +
Cos[x4] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x5] -
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Cos[x9] Sin[x4] Sin[x5] +

```



[illegible]

[illegible]

```

Cos[x4] Cos[x6] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Cos[x9] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x3] Cos[x6] Cos[x9] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x2] Cos[x6] Cos[x9] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x1] Cos[x6] Cos[x9] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x9] Sin[x1] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x9] Sin[x2] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x9] Sin[x3] Sin[x6] Sin[x7] Sin[x8] -
Cos[x4] Cos[x5] Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x9] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x3] Cos[x5] Cos[x9] Sin[x1] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x5] Cos[x9] Sin[x1] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x5] Cos[x9] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x9] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x3] Cos[x4] Cos[x9] Sin[x1] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x4] Cos[x9] Sin[x1] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x4] Cos[x9] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x3] Cos[x9] Sin[x1] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x3] Cos[x9] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x2] Cos[x9] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Cos[x9] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x9] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x9] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x9] +
Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x4] Sin[x9] +
Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x4] Sin[x9] +
Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x4] Sin[x9] +
Cos[x1] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x4] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x5] Sin[x9] +
Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x5] Sin[x9] +
Cos[x2] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x5] Sin[x9] +
Cos[x1] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x5] Sin[x9] +
Cos[x2] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x5] Sin[x9] +
Cos[x1] Cos[x2] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x5] Sin[x9] -
Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x6] Sin[x9] +
Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x6] Sin[x9] +
Cos[x2] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x6] Sin[x9] +
Cos[x1] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x6] Sin[x9] +
Cos[x2] Cos[x3] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x6] Sin[x9] +
Cos[x1] Cos[x3] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x4] Sin[x6] Sin[x9] +
Cos[x1] Cos[x2] Cos[x5] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x6] Sin[x9] -
Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x9] +
Cos[x2] Cos[x3] Cos[x4] Cos[x7] Cos[x8] Sin[x1] Sin[x5] Sin[x6] Sin[x9] +
Cos[x1] Cos[x3] Cos[x4] Cos[x7] Cos[x8] Sin[x2] Sin[x5] Sin[x6] Sin[x9] +

```



[illegible]

```

Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x3] Cos[x4] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x4] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x4] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] -
Cos[x1] Cos[x2] Cos[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x3] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x2] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9] +
Cos[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] Sin[x9]

```

```
In[32]:= TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7 + x8]]
```

```

Out[32]= Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] -
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] -
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] -
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] -
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x4] -
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x4] -
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x4] +
Cos[x5] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] -
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x5] -
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x5] -
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x3] Sin[x5] +
Cos[x4] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x5] -
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x4] Sin[x5] +
Cos[x3] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x4] Sin[x5] +
Cos[x2] Cos[x6] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x4] Sin[x5] +
Cos[x1] Cos[x6] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x4] Sin[x5] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x6] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x6] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x3] Sin[x6] +
Cos[x4] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x7] Cos[x8] Sin[x4] Sin[x6] +
Cos[x3] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x4] Sin[x6] +
Cos[x2] Cos[x5] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x4] Sin[x6] +
Cos[x1] Cos[x5] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x4] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x7] Cos[x8] Sin[x5] Sin[x6] +
Cos[x3] Cos[x4] Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x5] Sin[x6] +
Cos[x2] Cos[x4] Cos[x7] Cos[x8] Sin[x1] Sin[x3] Sin[x5] Sin[x6] +
Cos[x1] Cos[x4] Cos[x7] Cos[x8] Sin[x2] Sin[x3] Sin[x5] Sin[x6] +
Cos[x2] Cos[x3] Cos[x7] Cos[x8] Sin[x1] Sin[x4] Sin[x5] Sin[x6] +
Cos[x1] Cos[x3] Cos[x7] Cos[x8] Sin[x2] Sin[x4] Sin[x5] Sin[x6] +
Cos[x1] Cos[x2] Cos[x7] Cos[x8] Sin[x3] Sin[x4] Sin[x5] Sin[x6] -
Cos[x7] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x8] Sin[x1] Sin[x7] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x8] Sin[x2] Sin[x7] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x8] Sin[x3] Sin[x7] +
Cos[x4] Cos[x5] Cos[x6] Cos[x8] Sin[x1] Sin[x2] Sin[x3] Sin[x7] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x8] Sin[x4] Sin[x7] +

```

[illegible]

```

Cos[x2] Cos[x3] Cos[x5] Cos[x7] Sin[x1] Sin[x4] Sin[x6] Sin[x8] +
Cos[x1] Cos[x3] Cos[x5] Cos[x7] Sin[x2] Sin[x4] Sin[x6] Sin[x8] +
Cos[x1] Cos[x2] Cos[x5] Cos[x7] Sin[x3] Sin[x4] Sin[x6] Sin[x8] -
Cos[x5] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x8] +
Cos[x2] Cos[x3] Cos[x4] Cos[x7] Sin[x1] Sin[x5] Sin[x6] Sin[x8] +
Cos[x1] Cos[x3] Cos[x4] Cos[x7] Sin[x2] Sin[x5] Sin[x6] Sin[x8] +
Cos[x1] Cos[x2] Cos[x4] Cos[x7] Sin[x3] Sin[x5] Sin[x6] Sin[x8] -
Cos[x4] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x7] Sin[x4] Sin[x5] Sin[x6] Sin[x8] -
Cos[x3] Cos[x7] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x8] -
Cos[x2] Cos[x7] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x8] -
Cos[x1] Cos[x7] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x8] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Sin[x7] Sin[x8] +
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Sin[x1] Sin[x2] Sin[x7] Sin[x8] +
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Sin[x1] Sin[x3] Sin[x7] Sin[x8] +
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Sin[x2] Sin[x3] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Sin[x1] Sin[x4] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Sin[x2] Sin[x4] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Sin[x3] Sin[x4] Sin[x7] Sin[x8] -
Cos[x5] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Sin[x1] Sin[x5] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Sin[x2] Sin[x5] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Sin[x3] Sin[x5] Sin[x7] Sin[x8] -
Cos[x4] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x3] Cos[x6] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x2] Cos[x6] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] -
Cos[x1] Cos[x6] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x7] Sin[x8] +
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Sin[x2] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Sin[x3] Sin[x6] Sin[x7] Sin[x8] -
Cos[x4] Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x3] Cos[x5] Sin[x1] Sin[x2] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x5] Sin[x1] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x5] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] Sin[x8] +
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x3] Cos[x4] Sin[x1] Sin[x2] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x4] Sin[x1] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x4] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x2] Cos[x3] Sin[x1] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x3] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] -
Cos[x1] Cos[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8] +
Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] Sin[x8]

```

In[33]:= TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7]]

Out[33]= Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] -  
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x2] -



|          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|
| Cos [x2] | Cos [x4] | Cos [x5] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x3] |
| Cos [x1] | Cos [x4] | Cos [x5] | Cos [x6] | Cos [x7] | Sin [x2] | Sin [x3] |
| -        |          |          |          |          |          |          |
| Cos [x2] | Cos [x3] | Cos [x5] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x4] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x3] | Cos [x5] | Cos [x6] | Cos [x7] | Sin [x2] | Sin [x4] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x5] | Cos [x6] | Cos [x7] | Sin [x3] | Sin [x4] |
| +        |          |          |          |          |          |          |
| Cos [x5] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x2] | Sin [x3] | Sin [x4] |
| -        |          |          |          |          |          |          |
| Cos [x2] | Cos [x3] | Cos [x4] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x5] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x3] | Cos [x4] | Cos [x6] | Cos [x7] | Sin [x2] | Sin [x5] |
|          |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x4] | Cos [x6] | Cos [x7] | Sin [x3] | Sin [x5] |
| +        |          |          |          |          |          |          |
| Cos [x4] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x2] | Sin [x3] | Sin [x5] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x3] | Cos [x6] | Cos [x7] | Sin [x4] | Sin [x5] |
| +        |          |          |          |          |          |          |
| Cos [x3] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x2] | Sin [x4] | Sin [x5] |
| +        |          |          |          |          |          |          |
| Cos [x2] | Cos [x6] | Cos [x7] | Sin [x1] | Sin [x3] | Sin [x4] | Sin [x5] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x6] | Cos [x7] | Sin [x2] | Sin [x3] | Sin [x4] | Sin [x5] |
| -        |          |          |          |          |          |          |
| Cos [x2] | Cos [x3] | Cos [x4] | Cos [x5] | Cos [x7] | Sin [x1] | Sin [x6] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x3] | Cos [x4] | Cos [x5] | Cos [x7] | Sin [x2] | Sin [x6] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x4] | Cos [x5] | Cos [x7] | Sin [x3] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x4] | Cos [x5] | Cos [x7] | Sin [x1] | Sin [x2] | Sin [x3] | Sin [x6] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x3] | Cos [x5] | Cos [x7] | Sin [x4] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x3] | Cos [x5] | Cos [x7] | Sin [x1] | Sin [x2] | Sin [x4] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x2] | Cos [x5] | Cos [x7] | Sin [x1] | Sin [x3] | Sin [x4] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x5] | Cos [x7] | Sin [x2] | Sin [x3] | Sin [x4] | Sin [x6] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x3] | Cos [x4] | Cos [x7] | Sin [x5] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x3] | Cos [x4] | Cos [x7] | Sin [x1] | Sin [x2] | Sin [x5] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x2] | Cos [x4] | Cos [x7] | Sin [x1] | Sin [x3] | Sin [x5] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x4] | Cos [x7] | Sin [x2] | Sin [x3] | Sin [x5] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x2] | Cos [x3] | Cos [x7] | Sin [x1] | Sin [x4] | Sin [x5] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x3] | Cos [x7] | Sin [x2] | Sin [x4] | Sin [x5] | Sin [x6] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x7] | Sin [x3] | Sin [x4] | Sin [x5] | Sin [x6] |
| -        |          |          |          |          |          |          |
| Cos [x7] | Sin [x1] | Sin [x2] | Sin [x3] | Sin [x4] | Sin [x5] | Sin [x6] |
| -        |          |          |          |          |          |          |
| Cos [x2] | Cos [x3] | Cos [x4] | Cos [x5] | Cos [x6] | Sin [x1] | Sin [x7] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x3] | Cos [x4] | Cos [x5] | Cos [x6] | Sin [x2] | Sin [x7] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x4] | Cos [x5] | Cos [x6] | Sin [x3] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x4] | Cos [x5] | Cos [x6] | Sin [x1] | Sin [x2] | Sin [x3] | Sin [x7] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x3] | Cos [x5] | Cos [x6] | Sin [x4] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x3] | Cos [x5] | Cos [x6] | Sin [x1] | Sin [x2] | Sin [x4] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x2] | Cos [x5] | Cos [x6] | Sin [x1] | Sin [x3] | Sin [x4] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x5] | Cos [x6] | Sin [x2] | Sin [x3] | Sin [x4] | Sin [x7] |
| -        |          |          |          |          |          |          |
| Cos [x1] | Cos [x2] | Cos [x3] | Cos [x4] | Cos [x6] | Sin [x5] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x3] | Cos [x4] | Cos [x6] | Sin [x1] | Sin [x2] | Sin [x5] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x2] | Cos [x4] | Cos [x6] | Sin [x1] | Sin [x3] | Sin [x5] | Sin [x7] |
| +        |          |          |          |          |          |          |
| Cos [x1] | Cos [x4] | Cos [x6] |          |          |          |          |

```

Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x2] Sin[x6] Sin[x7] +
Cos[x2] Cos[x4] Cos[x5] Sin[x1] Sin[x3] Sin[x6] Sin[x7] +
Cos[x1] Cos[x4] Cos[x5] Sin[x2] Sin[x3] Sin[x6] Sin[x7] +
Cos[x2] Cos[x3] Cos[x5] Sin[x1] Sin[x4] Sin[x6] Sin[x7] +
Cos[x1] Cos[x3] Cos[x5] Sin[x2] Sin[x4] Sin[x6] Sin[x7] +
Cos[x1] Cos[x2] Cos[x5] Sin[x3] Sin[x4] Sin[x6] Sin[x7] -
Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x6] Sin[x7] +
Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x5] Sin[x6] Sin[x7] +
Cos[x1] Cos[x3] Cos[x4] Sin[x2] Sin[x5] Sin[x6] Sin[x7] +
Cos[x1] Cos[x2] Cos[x4] Sin[x3] Sin[x5] Sin[x6] Sin[x7] -
Cos[x4] Sin[x1] Sin[x2] Sin[x3] Sin[x5] Sin[x6] Sin[x7] +
Cos[x1] Cos[x2] Cos[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] -
Cos[x3] Sin[x1] Sin[x2] Sin[x4] Sin[x5] Sin[x6] Sin[x7] -
Cos[x2] Sin[x1] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7] -
Cos[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] Sin[x7]

```

```
In[34]:= TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6 + x7]]
```

```

Out[34]= Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] -
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x2] -
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x3] -
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Cos[x7] Sin[x2] Sin[x3] -
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x4] -
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Cos[x7] Sin[x2] Sin[x4] -
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Cos[x7] Sin[x3] Sin[x4] +
Cos[x5] Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x4] -
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Sin[x1] Sin[x5] -
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Cos[x7] Sin[x2] Sin[x5] -
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Cos[x7] Sin[x3] Sin[x5] +
Cos[x4] Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x5] -
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Cos[x7] Sin[x4] Sin[x5] +
Cos[x3] Cos[x6] Cos[x7] Sin[x1] Sin[x2] Sin[x4] Sin[x5] +
Cos[x2] Cos[x6] Cos[x7] Sin[x1] Sin[x3] Sin[x4] Sin[x5] +
Cos[x1] Cos[x6] Cos[x7] Sin[x2] Sin[x3] Sin[x4] Sin[x5] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Sin[x1] Sin[x6] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Cos[x7] Sin[x2] Sin[x6] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Cos[x7] Sin[x3] Sin[x6] +
Cos[x4] Cos[x5] Cos[x7] Sin[x1] Sin[x2] Sin[x3] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Cos[x7] Sin[x4] Sin[x6] +
Cos[x3] Cos[x5] Cos[x7] Sin[x1] Sin[x2] Sin[x4] Sin[x6] +
Cos[x2] Cos[x5] Cos[x7] Sin[x1] Sin[x3] Sin[x4] Sin[x6] +
Cos[x1] Cos[x5] Cos[x7] Sin[x2] Sin[x3] Sin[x4] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x7] Sin[x5] Sin[x6] +
Cos[x3] Cos[x4] Cos[x7] Sin[x1] Sin[x2] Sin[x5] Sin[x6] +
Cos[x2] Cos[x4] Cos[x7] Sin[x1] Sin[x3] Sin[x5] Sin[x6] +
Cos[x1] Cos[x4] Cos[x7] Sin[x2] Sin[x3] Sin[x5] Sin[x6] +
Cos[x2] Cos[x3] Cos[x7] Sin[x1] Sin[x4] Sin[x5] Sin[x6] +
Cos[x1] Cos[x3] Cos[x7] Sin[x2] Sin[x4] Sin[x5] Sin[x6] +

```

$$\begin{aligned}
& \cos[x_1] \cos[x_2] \cos[x_7] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] - \\
& \cos[x_7] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] - \\
& \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_7] - \\
& \cos[x_1] \cos[x_3] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_2] \sin[x_7] - \\
& \cos[x_1] \cos[x_2] \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_3] \sin[x_7] + \\
& \cos[x_4] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_7] - \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_5] \cos[x_6] \sin[x_4] \sin[x_7] + \\
& \cos[x_3] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_4] \sin[x_7] + \\
& \cos[x_2] \cos[x_5] \cos[x_6] \sin[x_1] \sin[x_3] \sin[x_4] \sin[x_7] + \\
& \cos[x_1] \cos[x_5] \cos[x_6] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_7] - \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_6] \sin[x_5] \sin[x_7] + \\
& \cos[x_3] \cos[x_4] \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_5] \sin[x_7] + \\
& \cos[x_2] \cos[x_4] \cos[x_6] \sin[x_1] \sin[x_3] \sin[x_5] \sin[x_7] + \\
& \cos[x_1] \cos[x_4] \cos[x_6] \sin[x_2] \sin[x_3] \sin[x_5] \sin[x_7] + \\
& \cos[x_2] \cos[x_3] \cos[x_6] \sin[x_1] \sin[x_4] \sin[x_5] \sin[x_7] + \\
& \cos[x_1] \cos[x_3] \cos[x_6] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_7] + \\
& \cos[x_1] \cos[x_2] \cos[x_6] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_7] - \\
& \cos[x_6] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_7] - \\
& \cos[x_1] \cos[x_2] \cos[x_3] \cos[x_4] \cos[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_3] \cos[x_4] \cos[x_5] \sin[x_1] \sin[x_2] \sin[x_6] \sin[x_7] + \\
& \cos[x_2] \cos[x_4] \cos[x_5] \sin[x_1] \sin[x_3] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_4] \cos[x_5] \sin[x_2] \sin[x_3] \sin[x_6] \sin[x_7] + \\
& \cos[x_2] \cos[x_3] \cos[x_5] \sin[x_1] \sin[x_4] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_3] \cos[x_5] \sin[x_2] \sin[x_4] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_2] \cos[x_5] \sin[x_3] \sin[x_4] \sin[x_6] \sin[x_7] - \\
& \cos[x_5] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_6] \sin[x_7] + \\
& \cos[x_2] \cos[x_3] \cos[x_4] \sin[x_1] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_3] \cos[x_4] \sin[x_2] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_2] \cos[x_4] \sin[x_3] \sin[x_5] \sin[x_6] \sin[x_7] - \\
& \cos[x_4] \sin[x_1] \sin[x_2] \sin[x_3] \sin[x_5] \sin[x_6] \sin[x_7] + \\
& \cos[x_1] \cos[x_2] \cos[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] - \\
& \cos[x_3] \sin[x_1] \sin[x_2] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] - \\
& \cos[x_2] \sin[x_1] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7] - \\
& \cos[x_1] \sin[x_2] \sin[x_3] \sin[x_4] \sin[x_5] \sin[x_6] \sin[x_7]
\end{aligned}$$

In[35]:= TrigExpand[Cos[x1 + x2 + x3 + x4 + x5 + x6]]

```

Out[35]= Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] Cos[x6] -
Cos[x3] Cos[x4] Cos[x5] Cos[x6] Sin[x1] Sin[x2] -
Cos[x2] Cos[x4] Cos[x5] Cos[x6] Sin[x1] Sin[x3] -
Cos[x1] Cos[x4] Cos[x5] Cos[x6] Sin[x2] Sin[x3] -
Cos[x2] Cos[x3] Cos[x5] Cos[x6] Sin[x1] Sin[x4] -
Cos[x1] Cos[x3] Cos[x5] Cos[x6] Sin[x2] Sin[x4] -
Cos[x1] Cos[x2] Cos[x5] Cos[x6] Sin[x3] Sin[x4] +
Cos[x5] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x4] -
Cos[x2] Cos[x3] Cos[x4] Cos[x6] Sin[x1] Sin[x5] -
Cos[x1] Cos[x3] Cos[x4] Cos[x6] Sin[x2] Sin[x5] -
Cos[x1] Cos[x2] Cos[x4] Cos[x6] Sin[x3] Sin[x5] +
Cos[x4] Cos[x6] Sin[x1] Sin[x2] Sin[x3] Sin[x5] -
Cos[x1] Cos[x2] Cos[x3] Cos[x6] Sin[x4] Sin[x5] +
Cos[x3] Cos[x6] Sin[x1] Sin[x2] Sin[x4] Sin[x5] +
Cos[x2] Cos[x6] Sin[x1] Sin[x3] Sin[x4] Sin[x5] +
Cos[x1] Cos[x6] Sin[x2] Sin[x3] Sin[x4] Sin[x5] -
Cos[x2] Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x6] -
Cos[x1] Cos[x3] Cos[x4] Cos[x5] Sin[x2] Sin[x6] -
Cos[x1] Cos[x2] Cos[x4] Cos[x5] Sin[x3] Sin[x6] +
Cos[x4] Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x5] Sin[x4] Sin[x6] +
Cos[x3] Cos[x5] Sin[x1] Sin[x2] Sin[x4] Sin[x6] +
Cos[x2] Cos[x5] Sin[x1] Sin[x3] Sin[x4] Sin[x6] +
Cos[x1] Cos[x5] Sin[x2] Sin[x3] Sin[x4] Sin[x6] -
Cos[x1] Cos[x2] Cos[x3] Cos[x4] Sin[x5] Sin[x6] +
Cos[x3] Cos[x4] Sin[x1] Sin[x2] Sin[x5] Sin[x6] +
Cos[x2] Cos[x4] Sin[x1] Sin[x3] Sin[x5] Sin[x6] +
Cos[x1] Cos[x4] Sin[x2] Sin[x3] Sin[x5] Sin[x6] +
Cos[x2] Cos[x3] Sin[x1] Sin[x4] Sin[x5] Sin[x6] +
Cos[x1] Cos[x3] Sin[x2] Sin[x4] Sin[x5] Sin[x6] +
Cos[x1] Cos[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6] -
Sin[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5] Sin[x6]

```

```

In[36]:= TrigExpand[Cos[x1 + x2 + x3 + x4 + x5]]

```

```

Out[36]= Cos[x1] Cos[x2] Cos[x3] Cos[x4] Cos[x5] - Cos[x3] Cos[x4] Cos[x5] Sin[x1] Sin[x2] -
Cos[x2] Cos[x4] Cos[x5] Sin[x1] Sin[x3] - Cos[x1] Cos[x4] Cos[x5] Sin[x2] Sin[x3] -
Cos[x2] Cos[x3] Cos[x5] Sin[x1] Sin[x4] - Cos[x1] Cos[x3] Cos[x5] Sin[x2] Sin[x4] -
Cos[x1] Cos[x2] Cos[x5] Sin[x3] Sin[x4] + Cos[x5] Sin[x1] Sin[x2] Sin[x3] Sin[x4] -
Cos[x2] Cos[x3] Cos[x4] Sin[x1] Sin[x5] - Cos[x1] Cos[x3] Cos[x4] Sin[x2] Sin[x5] -
Cos[x1] Cos[x2] Cos[x4] Sin[x3] Sin[x5] + Cos[x4] Sin[x1] Sin[x2] Sin[x3] Sin[x5] -
Cos[x1] Cos[x2] Cos[x3] Sin[x4] Sin[x5] + Cos[x3] Sin[x1] Sin[x2] Sin[x4] Sin[x5] +
Cos[x2] Sin[x1] Sin[x3] Sin[x4] Sin[x5] + Cos[x1] Sin[x2] Sin[x3] Sin[x4] Sin[x5]

```

In[37]:= **TrigExpand**[**Cos**[**x1 + x2 + x3 + x4**]]

Out[37]=  $\begin{aligned} &\text{Cos}[x1] \text{Cos}[x2] \text{Cos}[x3] \text{Cos}[x4] - \text{Cos}[x3] \text{Cos}[x4] \text{Sin}[x1] \text{Sin}[x2] - \\ &\quad \text{Cos}[x2] \text{Cos}[x4] \text{Sin}[x1] \text{Sin}[x3] - \text{Cos}[x1] \text{Cos}[x4] \text{Sin}[x2] \text{Sin}[x3] - \\ &\quad \text{Cos}[x2] \text{Cos}[x3] \text{Sin}[x1] \text{Sin}[x4] - \text{Cos}[x1] \text{Cos}[x3] \text{Sin}[x2] \text{Sin}[x4] - \\ &\quad \text{Cos}[x1] \text{Cos}[x2] \text{Sin}[x3] \text{Sin}[x4] + \text{Sin}[x1] \text{Sin}[x2] \text{Sin}[x3] \text{Sin}[x4] \end{aligned}$

In[38]:= **TrigExpand**[**Cos**[**x1 + x2 + x3**]]

Out[38]=  $\begin{aligned} &\text{Cos}[x1] \text{Cos}[x2] \text{Cos}[x3] - \text{Cos}[x3] \text{Sin}[x1] \text{Sin}[x2] - \\ &\quad \text{Cos}[x2] \text{Sin}[x1] \text{Sin}[x3] - \text{Cos}[x1] \text{Sin}[x2] \text{Sin}[x3] \end{aligned}$

In[39]:= **TrigExpand**[**Cos**[**x1 + x2**]]

Out[39]=  $\text{Cos}[x1] \text{Cos}[x2] - \text{Sin}[x1] \text{Sin}[x2]$

In[40]:= **TrigExpand**[**Cos**[**x1**]]

Out[40]=  $\text{Cos}[x1]$