```
ln[41]:= (**)
                       Psi[x] = e^{(-i * \Phi * x)} * \{e^{(i * k * x)}, e^{(-i * k * x)}\}
                      Phi[x_] = e^{(i * \Phi * x)} * \{e^{(i * k * x)}, e^{(-i * k * x)}\}
                      \mathtt{PPsi}[\mathtt{x}_{\_}] \; = \; k \; * \; e^{\; \wedge} \; (\; - \; \mathbf{i} \; * \; \Phi \; * \; \mathbf{x}) \; * \; \{\; e^{\; \wedge} \; (\; \mathbf{i} \; * \; k \; * \; \mathbf{x}) \; , \; - \; e^{\; \wedge} \; (\; - \; \mathbf{i} \; * \; k \; * \; \mathbf{x}) \; \}
                      PPhi[x_{-}] = k * e^{(i*\Phi*x)} * \{e^{(i*k*x)}, -e^{(-i*k*x)}\}
                       (*Решения на верхней и нижней дугах с к-нтами А, В *)
                      psi[x_, A_, B_] = Psi[x].{A, B}
                      phi[x_, A_, B_] = Phi[x].{A, B}
                       (*Действие оператора импульса на решения*)
                      pPsi[x_, A_, B_] = PPsi[x].{A, B}
                      pPhi[x_, A_, B_] = PPhi[x].{A, B}
                       (*Условие дельта-соединения в применении к одному из колец цепочки*)
                      psi[0, Cp, Cm] = phi[0, Dp, Dm]
                      psi[\pi, Cp, Cm] = phi[\pi, Dp, Dm]
                      Solve[psi[0, Cp, Cm] = phi[0, Dp, Dm] &&
                                psi[\pi, Cp, Cm] = phi[\pi, Dp, Dm], \{Dp, Dm\}]
                      S0 = e^{(-i * \Phi * \pi)} (e^{(i * k * \pi)} - e^{(-i * k * \pi)})^{-1} *
                                      \{\{e^{\wedge}(\texttt{i} * \texttt{k} * \pi) \; e^{\wedge}(-\texttt{i} * \Phi * \pi) \; - e^{\wedge}(-\texttt{i} * \texttt{k} * \pi) \; e^{\wedge}(\texttt{i} * \Phi * \pi) \; , \;
                                                e^{(-i*k*\pi)} e^{(-i*\Phi*\pi)} - e^{(-i*k*\pi)} e^{(i*\Phi*\pi)},
                                           \{e^{(i*k*\pi)} e^{(-i*\Phi*\pi)} - e^{(i*k*\pi)} e^{(i*\Phi*\pi)},
                                               e^{(-i*k*\pi)} e^{(-i*\Phi*\pi)} - e^{(i*k*\pi)} e^{(i*\Phi*\pi)};
Out[41]= \left\{ e^{i k x - i x \Phi}, e^{-i k x - i x \Phi} \right\}
Out[42]= \left\{ e^{i k x + i x \Phi}, e^{-i k x + i x \Phi} \right\}
Out[43]= \left\{ e^{i k x - i x \Phi} k, -e^{-i k x - i x \Phi} k \right\}
Out[44]= \left\{ e^{i k x + i x \Phi} k, -e^{-i k x + i x \Phi} k \right\}
Out[45]= B e^{-i k x-i x \Phi} + A e^{i k x-i x \Phi}
Out[46]= B e^{-i k x+i x \Phi} + A e^{i k x+i x \Phi}
Out[47]= -B e^{-i k \times -i \times \Phi} k + A e^{i k \times -i \times \Phi} k
Out[48]= -Be^{-ikx+ix\Phi}k+Ae^{ikx+ix\Phi}k
Out[49] = Cm + Cp == Dm + Dp
\text{Out}[50] = \text{Cm } e^{-\text{i} k \pi - \text{i} \pi \Phi} + \text{Cp } e^{\text{i} k \pi - \text{i} \pi \Phi} = \text{Dm } e^{-\text{i} k \pi + \text{i} \pi \Phi} + \text{Dp } e^{\text{i} k \pi + \text{i} \pi \Phi}
\text{Out}[51] = \left\{ \left\{ \text{Dp} \rightarrow -\left( \left( e^{-2\,\mathrm{i}\,\pi\,\Phi}\, \left( -\,\text{Cm} -\,\text{Cp}\, e^{2\,\mathrm{i}\,k\,\pi} +\,\text{Cm}\, e^{2\,\mathrm{i}\,\pi\,\Phi} +\,\text{Cp}\, e^{2\,\mathrm{i}\,\pi\,\Phi} \right) \right) \right. \right. \right. \left. \left. \left( -\,1 + e^{2\,\mathrm{i}\,k\,\pi} \right) \right) \text{, } 
                                 \text{Dm} \rightarrow \left( e^{-2\,\mathrm{i}\,\pi\,\Phi}\, \left( -\,\text{Cm} -\,\text{Cp}\,\,e^{2\,\mathrm{i}\,k\,\pi} +\,\text{Cm}\,\,e^{2\,\mathrm{i}\,k\,\pi + 2\,\mathrm{i}\,\pi\,\Phi} +\,\text{Cp}\,\,e^{2\,\mathrm{i}\,k\,\pi + 2\,\mathrm{i}\,\pi\,\Phi} \right) \right) \, \left/ \, \left( -\,1 \,+\,e^{2\,\mathrm{i}\,k\,\pi} \right) \,\right\} \, \right\} \, e^{-2\,\mathrm{i}\,\mu\,\pi} \, 
                        (*Запишем матрицу S исходя из результата решения ур-я*)
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$$\begin{split} &\text{In}[53] = \; \mathbf{S} = \mathbf{e}^{-2\,\mathrm{i}\,\pi\,\bar{\Phi}} \;\star \left(-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}\right) \,^{\wedge} - 1 \;\star \\ & \quad \left\{ \left\{ \mathbf{e}^{2\,\mathrm{i}\,\pi\,\bar{\Phi}} - \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}, \; \mathbf{e}^{2\,\mathrm{i}\,\pi\,\bar{\Phi}} - 1 \right\}, \; \left\{ \mathbf{e}^{2\,\mathrm{i}\,k\,\pi + 2\,\mathrm{i}\,\pi\,\bar{\Phi}} - \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}, \; \mathbf{e}^{2\,\mathrm{i}\,k\,\pi + 2\,\mathrm{i}\,\pi\,\bar{\Phi}} - 1 \right\} \right\} \\ &\text{Out}[53] = \; \left\{ \left\{ \frac{\mathbf{e}^{-2\,\mathrm{i}\,\pi\,\bar{\Phi}} \left(-\,\mathbf{e}^{2\,\mathrm{i}\,k\,\pi} + \mathbf{e}^{2\,\mathrm{i}\,\kappa\,\pi} \right)}{-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}}, \; \frac{\mathbf{e}^{-2\,\mathrm{i}\,\pi\,\bar{\Phi}} \left(-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi} \right)}{-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}} \right\}, \\ &\left\{ \frac{\mathbf{e}^{-2\,\mathrm{i}\,\pi\,\bar{\Phi}} \left(-\,\mathbf{e}^{2\,\mathrm{i}\,k\,\pi} + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi + 2\,\mathrm{i}\,\pi\,\bar{\Phi}} \right)}{-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}}, \; \frac{\mathbf{e}^{-2\,\mathrm{i}\,\pi\,\bar{\Phi}} \left(-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi + 2\,\mathrm{i}\,\pi\,\bar{\Phi}} \right)}{-1 + \mathbf{e}^{2\,\mathrm{i}\,k\,\pi}} \right\} \right\} \end{split}$$

(* Сверим полученную матрицу S с исходной, выведенной мной*)

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 \begin{array}{l} \text{In} & (*\text{Toyka kohtakta pryk koneu}*) \\ \text{PPsi}[0].\{\text{Cp1},\text{Cm1}\} + \text{PPhi}[0].\text{S.}\{\text{Cp1},\text{Cm1}\} \\ \text{PPsi}[\pi].\{\text{Cp0},\text{Cm0}\} + \text{PPhi}[\pi].\text{S.}\{\text{Cp1},\text{Cm1}\} \\ \text{PPsi}[\pi].\{\text{Cp0},\text{Cm0}\} + \text{PPhi}[\pi].\text{S.}\{\text{Cp1},\text{Cm1}\} == \\ \text{PPsi}[\pi].\{\text{Cp0},\text{Cm0}\} + \text{PPhi}[\pi].\text{S.}\{\text{Cp1},\text{Cm1}\} == \\ \text{PPsi}[\pi].\{\text{Cp0},\text{Cm0}\} + \text{PPhi}[\pi].\text{S.}\{\text{Cp0},\text{Cm0}\} - i \star \alpha \star \text{Psi}[\pi].\{\text{Cp0},\text{Cm0}\} \\ \text{Psi}[\pi].\{\text{Cp0},\text{Cm0}\} + \text{PPhi}[\pi].\text{S.}\{\text{Cp1},\text{Cm1}\} \\ \text{TracePrint}[\text{Solve}[\text{Psi}[\pi].\{\text{Cp0},\text{Cm0}\} == \text{Psi}[0].\{\text{Cp1},\text{Cm1}\} \\ \text{Epsi}[0].\{\text{Cp1},\text{Cm1}\} + \text{PPhi}[0].\text{S.}\{\text{Cp1},\text{Cm1}\} == \text{PPsi}[\pi].\{\text{Cp0},\text{Cm0}\} + \\ \text{PPhi}[\pi].\text{S.}\{\text{Cp0},\text{Cm0}\} - i \star \alpha \star \star \text{Psi}[\pi].\{\text{Cp0},\text{Cm0}\},\{\text{Cp1},\text{Cm1}\}] \\ \text{Out} \\ \text{Out} \\ \text{Cm1} \\ \text{Cm2} \\ \frac{e^{-2i\pi \theta}}{e^{-2i\pi \theta}} \left(-e^{2i\pi \theta} \left(-1 + e^{2i\pi \theta}\right) k - e^{-2i\pi \theta} \left(-1 + e^{2i\pi \pi \theta} + e^{2i\pi \pi \theta}\right) k - 1 + e^{2i\pi \pi} \right) \\ \text{Cm2} \\ \text{Cm3} \\ \frac{e^{ik\pi - i\pi \theta}}{e^{-2i\pi \pi}} \left(-1 + e^{2i\pi \theta}\right) k - e^{-ik\pi - i\pi \theta} \left(-1 + e^{2ik\pi + 2i\pi \theta}\right) k - 1 + e^{2ik\pi} \\ \text{Cm4} \\ \text{Cm5} \\ \frac{e^{ik\pi - i\pi \theta}}{e^{-2i\pi \pi}} \left(-1 + e^{2i\pi \theta}\right) k - e^{-ik\pi - i\pi \theta} \left(-1 + e^{2ik\pi + 2i\pi \theta}\right) k \right) / \left(-1 + e^{2ik\pi}\right) \\ \text{Cm6} \\ \frac{e^{ik\pi - i\pi \theta}}{e^{-2i\pi \pi}} \left(-e^{2ik\pi} + e^{2i\pi \theta}\right) k - e^{-ik\pi - i\pi \theta} \left(-e^{2ik\pi} + e^{2i\pi \pi \theta}\right) k \right) / \left(-1 + e^{2ik\pi}\right) \\ \text{Cm6} \\ \frac{e^{ik\pi - i\pi \theta}}{e^{-2i\pi \pi}} \left(-e^{2ik\pi} - e^{2i\pi \theta}\right) i \alpha \\ \end{array}
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 \text{Out} [79] = -\text{Cm1 } k + \text{Cp1 } k + \text{Cm1} \left( \frac{e^{-2 \, \mathrm{i} \, \pi \, \Phi} \, \left( -1 + e^{2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} - \frac{e^{-2 \, \mathrm{i} \, \pi \, \Phi} \, \left( -1 + e^{2 \, \mathrm{i} \, k \, \pi + 2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \\ \text{Cp1} \left( \frac{e^{-2 \, \mathrm{i} \, \pi \, \Phi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} - \frac{e^{-2 \, \mathrm{i} \, \pi \, \Phi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi + 2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) = -\text{Cm0 } e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, k + \frac{e^{-2 \, \mathrm{i} \, k \, \pi}}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} \right) + \frac{e^{-2 \, \mathrm{i} \, k \, \pi} \, \left( -e^{2 \, \mathrm{i} \, k \, \pi} + e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \mathrm{i} \, k \, \pi}} 
                                                                                                                                              \text{CpO } e^{\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \, k \, + \, \text{CmO} \, \left( \frac{e^{\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \, - \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - 2 \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - 2 \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \pi \, \Phi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - 2 \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \pi \, \Phi} \right) \, \, k}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \pi \, \Phi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - 2 \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \pi \, \Phi} \right) \, \, \lambda}{-1 \, + \, e^{2 \, \text{i} \, k \, \pi + 2 \, \pi \, \Phi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi - 2 \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \Phi} \right) \, \, \lambda}{-1 \, + \, e^{2 \, \text{i} \, k \, \Phi}} \right) \, + \, \frac{e^{-\text{i} \, k \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \text{i} \, k \, \Phi} \right) \, \, \lambda}
                                                                                                                                            \text{Cp0} \left( \frac{e^{ \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, \pi \, \Phi} \right) \, k}{- \, 1 \, + \, e^{ 2 \, \text{i} \, k \, \pi}} \, - \, \left( e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, k \right) \, \middle/ \, \left( - \, 1 \, + \, e^{ 2 \, \text{i} \, k \, \pi} \right) \, \right) \, - \, \left( e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, k \right) \, \middle/ \, \left( - \, 1 \, + \, e^{ 2 \, \text{i} \, k \, \pi} \right) \, \right) \, - \, \left( e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, k \, \pi} \right) \, k \right) \, \middle/ \, \left( - \, 1 \, + \, e^{ 2 \, \text{i} \, k \, \pi} \right) \, \right) \, - \, \left( e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, k \, \pi} \right) \, k \right) \, \middle/ \, \left( - \, 1 \, + \, e^{ 2 \, \text{i} \, k \, \pi} \right) \, \right) \, - \, \left( e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, k \, \pi} \right) \, e^{ - \text{i} \, k \, \pi} \right) \, e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( - \, e^{ 2 \, \text{i} \, k \, \pi} + e^{ 2 \, \text{i} \, k \, \pi} \right) \, e^{ - \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \right) \, e^{ - \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i} \, k \, \pi} \, e^{ 2 \, \text{i
     Out[80]= Cm0 e^{-i k \pi - i \pi \Phi} + Cp0 e^{i k \pi - i \pi \Phi} == Cm1 + Cp1
                                                                                                                  Solve[Psi[\pi].\{Cp0, Cm0\} == Psi[0].\{Cp1, Cm1\} \&\& PPsi[0].\{Cp1, Cm1\} + PPhi[0].S.\{Cp1, Cm1\} == Psi[0].\{Cp1, Cm1\} + Pphi[0].S.\{Cp1, Cm1\} == Psi[0].S.\{Cp1, Cm1\} == Psi[0].S.\{Cp
                                                                                                                                                                   \mathtt{PPsi}[\pi].\{\mathtt{Cp0},\,\mathtt{Cm0}\} + \mathtt{PPhi}[\pi].\,\mathtt{S}.\{\mathtt{Cp0},\,\mathtt{Cm0}\} - \mathtt{i}\,\alpha\,\mathtt{Psi}[\pi].\{\mathtt{Cp0},\,\mathtt{Cm0}\},\,\{\mathtt{Cp1},\,\mathtt{Cm1}\}]
                                                                                                                        Solve
                                                                                                                        Psi[\pi].\{Cp0, Cm0\} = Psi[0].\{Cp1, Cm1\} \&\& PPsi[0].\{Cp1, Cm1\} + PPhi[0].S.\{Cp1, Cm1\} = Psi[0].\{Cp1, Cm1\} + PPhi[0].S.\{Cp1, Cm1\} = Psi[0].S.\{Cp1, Cm1\} = Psi[0].
                                                                                                                                                PPsi[\pi].\{Cp0, Cm0\} + PPhi[\pi].S.\{Cp0, Cm0\} - i \alpha Psi[\pi].\{Cp0, Cm0\}
                                                                                                                                And
                                                                                                                                   Psi[\pi].\{Cp0, Cm0\} = Psi[0].\{Cp1, Cm1\}
                                                                                                                                        Equal
                                                                                                                                        Psi[\pi].\{Cp0, Cm0\}
                                                                                                                                                Dot
                                                                                                                                                   Psi[π]
                                                                                                                                                     Psi
                                                                                                                                                     \left\{ e^{i k \pi - i \pi \Phi}, e^{-i k \pi - i \pi \Phi} \right\}
                                                                                                                                                     List
                                                                                                                                                           е<sup>і к т-і т Ф</sup>
                                                                                                                                                                Power
                                                                                                                                                                ikπ-iπΦ
                                                                                                                                                                           Plus
                                                                                                                                                                           i k \pi
                                                                                                                                                                                Times
                                                                                                                                                                                π
                                                                                                                                                                           - i π Φ
                                                                                                                                                                                Times
                                                                                                                                                                                   - 1
                                                                                                                                                                                i
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π

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Φ
 e^{-{\rm i}\; k\; \pi - {\rm i}\; \pi\; \Phi}
  Power
  -i k π - i π Φ
  Plus
  -ik\pi
   Times
    - 1
    i
    k
   π
   -\,\mathrm{i}\,\,\pi\,\Phi
    Times
    - 1
    i
    π
   Φ
 {Cp0, Cm0}
 List
 Cp0
\left\{e^{i k \pi - i \pi \Phi}, e^{-i k \pi - i \pi \Phi}\right\} \cdot \left\{Cp0, Cm0\right\}
Cm0 e^{-i k \pi - i \pi \Phi} + Cp0 e^{i k \pi - i \pi \Phi}
Psi[0].{Cp1, Cm1}
Dot
Psi[0]
 Psi
 \left\{ e^{i k \cdot 0 - i \cdot 0 \cdot \Phi}, e^{-i k \cdot 0 - i \cdot 0 \cdot \Phi} \right\}
 List
 е<sup>і k О-і О Ф</sup>
  Power
  i k O - i Ο Φ
  Plus
   ik0
    Times
```

i

k

0

0 i k

0

-i0Φ

Times

- 1

i

0

Φ

0 і Ф

Times

i

Φ

0

0 + 0

0

1

e^{-i k О-i О Ф}

Power

-i k 0 - i 0 Φ

Plus

-i k 0

Times

- 1

i

k

0

0 i k

Times

0

i

k

0

-i0Φ

Power

```
Times
      - 1
      i
      Φ
     \texttt{0i}\,\Phi
      Times
      0
      i
     0
    0 + 0
    0
    e^0
   1
  {1, 1}
  {Cp1, Cm1}
   List
   Cp1
   Cm1
 {1, 1}.{Cp1, Cm1}
 Cm1 + Cp1
\texttt{Cm0} \ \texttt{e}^{-\texttt{i} \ \texttt{k} \ \pi - \texttt{i} \ \pi \ \Phi} \ + \, \texttt{Cp0} \ \texttt{e}^{\texttt{i} \ \texttt{k} \ \pi - \texttt{i} \ \pi \ \Phi} \ \texttt{==} \ \texttt{Cm1} \ + \, \texttt{Cp1}
PPsi[0].{Cp1, Cm1} + PPhi[0].S.{Cp1, Cm1} ==
\mathtt{PPsi}[\pi].\{\mathtt{Cp0},\,\mathtt{Cm0}\} + \mathtt{PPhi}[\pi].\mathtt{S}.\{\mathtt{Cp0},\,\mathtt{Cm0}\} - \mathtt{i}\,\alpha\,\mathtt{Psi}[\pi].\{\mathtt{Cp0},\,\mathtt{Cm0}\}
 Equal
 PPsi[0].{Cp1, Cm1} + PPhi[0].S.{Cp1, Cm1}
  PPsi[0].{Cp1, Cm1}
   Dot
   PPsi[0]
    PPsi
    \left\{ e^{i k \cdot 0 - i \cdot 0 \cdot \Phi} k, - e^{-i k \cdot 0 - i \cdot 0 \cdot \Phi} k \right\}
    List
    e^{i k \cdot 0 - i \cdot 0 \cdot \Phi} k
     Times
     е<sup>і k О-і О Ф</sup>
```

е

ik0-i0Φ

Plus

ik0

Times

i

k

0

0 i k

0

-i0Φ

Times

- 1

i

0

Φ

0 i Φ

Times

0

i

Φ

0

0 + 0

0

 e^0

k

1 k

-e^{-i k 0-i 0 Φ} k

Times

- 1

е^{-i k 0-i 0 Ф}

Power

-i k 0 - i 0 Ф

Plus

-i k O

Times

8 | contact2.nb

- 1

i

k

0

0 i k

Times

0

i

k

0

-i0Φ

Times

- 1

i

0

Φ

0 і Ф

Times

0

i

Φ

0

0 + 0

0

0 م

1

k

– k – k

Times

- 1

k

 $\{k, -k\}$

{Cp1, Cm1}

List

Cp1

Cm1

 $\{k, -k\}.\{Cp1, Cm1\}$

-Cm1 k + Cp1 k

```
PPhi[0].S.{Cp1, Cm1}
Dot
PPhi[0]
PPhi
\left\{ e^{i k 0 + i 0 \Phi} k, -e^{-i k 0 + i 0 \Phi} k \right\}
 List
 e^{i k \theta + i \theta \Phi} k
 Times
 е<sup>i k О+i О Ф</sup>
 Power
  ik0+i0\Phi
  Plus
   ik0
   Times
   0
   0 i k
   0
  i0Φ
  Times
   i
   Φ
  0 і Ф
   0
  0 + 0
  0
 1
 k
 1 k
 -e^{-i k \cdot 0 + i \cdot 0 \cdot \Phi} k
 Times
 - 1
  e<sup>-i k 0+i 0 Ф</sup>
```

Power

_

 $-ik0+i0\Phi$

Plus

-i k 0

Times

- 1

i

k

0

0 i k

Times

0

i

k

0

i0Φ

Times

i

0

Φ

0 і Ф

0

0 + 0

0

 e^0

1

k

– k

- k

Times

- 1

k

 $\{k, -k\}$

S

$$\Big\{ \Big\{ \frac{e^{-2\,\mathrm{i}\,\pi\,\Phi}\,\left(-\,e^{2\,\mathrm{i}\,k\,\pi}\,+\,e^{2\,\mathrm{i}\,\pi\,\Phi}\right)}{-\,1\,+\,e^{2\,\mathrm{i}\,k\,\pi}}\,,\,\, \frac{e^{-2\,\mathrm{i}\,\pi\,\Phi}\,\left(-\,1\,+\,e^{2\,\mathrm{i}\,k\,\pi}\right)}{-\,1\,+\,e^{2\,\mathrm{i}\,k\,\pi}} \Big\}, \\ \Big\{ \frac{e^{-2\,\mathrm{i}\,\pi\,\Phi}\,\left(-\,e^{2\,\mathrm{i}\,k\,\pi}\,+\,e^{2\,\mathrm{i}\,k\,\pi+2\,\mathrm{i}\,\pi\,\Phi}\right)}{-\,1\,+\,e^{2\,\mathrm{i}\,k\,\pi}}\,,\,\, \frac{e^{-2\,\mathrm{i}\,\pi\,\Phi}\,\left(-\,1\,+\,e^{2\,\mathrm{i}\,k\,\pi}\right)}{-\,1\,+\,e^{2\,\mathrm{i}\,k\,\pi}} \Big\} \Big\}$$

(cp1, cm1)
List

Cp1

cm1

(k, -k). {
$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2i\pi s}\right)}{-1+e^{2ik\pi}}, \frac{e^{-2i\pi s}\left(-1+e^{2ik\pi}\right)}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)}{-1+e^{2ik\pi}}, \frac{e^{-2i\pi s}\left(-1+e^{2ik\pi}-2i\pi s\right)}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}}, \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-1+e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-1+e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$
List
$$\left\{\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-1+e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left\{\frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right\},$$

$$\left(-Cml k + Cpl k\right) + \left(Cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-e^{2ik\pi}+e^{2ik\pi+2i\pi s}\right)k}{-1+e^{2ik\pi}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}} - \frac{e^{-2i\pi s}\left(-1+e^{2ik\pi}\right)k}{-1+e^{2ik\pi}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2i\pi s}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i\pi s}\left(-1+e^{2i\pi s}\right)k}{-1+e^{2ik\pi}}\right),$$

$$\left(-cml k + Cpl k\right) + \left(cml \left(\frac{e^{-2i$$

PPsi

π

$$\left\{ e^{i k \pi - i \pi \Phi} k, -e^{-i k \pi - i \pi \Phi} k \right\}$$

List

 $e^{i k \pi - i \pi \Phi} k$

Times

 $e^{{\rm i}\,k\,\pi - {\rm i}\,\pi\,\Phi}$

Power

۵

ikπ−iπΦ

Plus

ikπ

Times

i

k

π

-iπΦ

Times

- 1

i

π

Φ

k

$$-e^{-i k \pi - i \pi \Phi} k$$

Times

- 1

 $e^{-i k \pi - i \pi \Phi}$

Power

_

-і k π - і π Ф

Plus

 $-ik\pi$

Times

- 1

i

k

π

 $-\,\mathrm{i}\,\pi\,\Phi$

Times

```
- 1
     i
     π
     Φ
  k
 {Cp0, Cm0}
 List
 CpO
\{e^{i k \pi - i \pi \Phi} k, -e^{-i k \pi - i \pi \Phi} k\}.\{Cp0, Cm0\}
-Cm0 e^{-i k \pi - i \pi \Phi} k + Cp0 e^{i k \pi - i \pi \Phi} k
\mathtt{PPhi}\,[\pi]\mathtt{.S.}\{\mathtt{Cp0,Cm0}\}
Dot
PPhi[\pi]
 PPhi
 \left\{ e^{i k \pi + i \pi \Phi} k, -e^{-i k \pi + i \pi \Phi} k \right\}
 List
  e^{i k \pi + i \pi \Phi} k
  Times
   \mathrm{e}^{\mathrm{i}\,k\,\pi+\mathrm{i}\,\pi\,\Phi}
  Power
   \mathtt{i} \; \mathtt{k} \; \pi + \mathtt{i} \; \pi \; \Phi
    Plus
    \mathtt{i} \ \mathtt{k} \ \pi
     Times
     i
     π
    \mathtt{i}\,\pi\,\Phi
     Times
     i
     π
     Φ
  -e^{-i k \pi + i \pi \Phi} k
  Times
```

- 1

```
e^{-i k \pi + i \pi \Phi}
           Power
           -i kπ+iπΦ
             Plus
              -ik\pi
              Times
               - 1
              ίπΦ
                Times
        k
\left\{ \left\{ \frac{e^{-2i\pi\Phi} \left( -e^{2ik\pi} + e^{2i\pi\Phi} \right)}{-1 + e^{2ik\pi}}, \frac{e^{-2i\pi\Phi} \left( -1 + e^{2i\pi\Phi} \right)}{-1 + e^{2ik\pi}} \right\}, \\ e^{-2i\pi\Phi} \left( -e^{2ik\pi} + e^{2ik\pi + 2i\pi\Phi} \right)}{-1 + e^{2ik\pi}}, \frac{e^{-2i\pi\Phi} \left( -1 + e^{2ik\pi + 2i\pi\Phi} \right)}{-1 + e^{2ik\pi}} \right\} \right\}
    {Cp0, Cm0}
    List
      Cp0
 \left\{ e^{\frac{i \, k \, \pi + i \, \pi \, \Phi}{c}} \, k, \, -e^{-i \, k \, \pi + i \, \pi \, \Phi} \, k \right\} \cdot \left\{ \left\{ \frac{e^{-2 \, i \, \pi \, \Phi} \, \left( -e^{2 \, i \, k \, \pi} + e^{2 \, i \, \pi \, \Phi} \right)}{-1 + e^{2 \, i \, k \, \pi}}, \, \frac{e^{-2 \, i \, \pi \, \Phi} \, \left( -1 + e^{2 \, i \, k \, \pi} \right)}{-1 + e^{2 \, i \, k \, \pi}} \right\}, \\ \left\{ \frac{e^{-2 \, i \, \pi \, \Phi} \, \left( -e^{2 \, i \, k \, \pi} + e^{2 \, i \, k \, \pi + 2 \, i \, \pi \, \Phi} \right)}{-1 + e^{2 \, i \, k \, \pi}}, \, \frac{e^{-2 \, i \, \pi \, \Phi} \, \left( -1 + e^{2 \, i \, k \, \pi} \right)}{-1 + e^{2 \, i \, k \, \pi}} \right\}. \left\{ \text{CpO, CmO} \right\} 
\left\{\frac{e^{\text{i}\,k\,\pi-\text{i}\,\pi\,\Phi}\,\left(-\,e^{2\,\text{i}\,k\,\pi}\,+\,e^{2\,\text{i}\,\pi\,\Phi}\right)\,k}{-\,1\,+\,e^{2\,\text{i}\,k\,\pi}}\,-\,\frac{e^{-\text{i}\,k\,\pi-\text{i}\,\pi\,\Phi}\,\left(-\,e^{2\,\text{i}\,k\,\pi}\,+\,e^{2\,\text{i}\,k\,\pi+2\,\text{i}\,\pi\,\Phi}\right)\,k}{-\,1\,+\,e^{2\,\text{i}\,k\,\pi}}\,\right.
 \frac{ e^{ \mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 + e^{ 2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{ 2 \, \mathrm{i} \, k \, \pi}} \, - \, \frac{ e^{ - \mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 + e^{ 2 \, \mathrm{i} \, k \, \pi + 2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{ 2 \, \mathrm{i} \, k \, \pi}} \right\} . \left\{ \text{Cp0, Cm0} \right\}
  Dot
          e^{{{\tt i}\, k\, \pi} - {{\tt i}\, \pi}\, \Phi}\, \left( -\, e^{2\, {{\tt i}\, k\, \pi}} + e^{2\, {{\tt i}\, \pi}\, \Phi} \right)\, k \quad \  \, e^{-{{\tt i}\, k\, \pi} - {{\tt i}\, \pi}\, \Phi}\, \left( -\, e^{2\, {{\tt i}\, k\, \pi}} + e^{2\, {{\tt i}\, k\, \pi} + 2\, {{\tt i}\, \pi}\, \Phi} \right)\, k
```

List

 $\frac{e^{{\tt i}\, k\, \pi - {\tt i}\, \pi\, \Phi}\, \left(-1 + e^{2\, {\tt i}\, \pi\, \Phi}\right)\, k}{-1 + e^{2\, {\tt i}\, k\, \pi}} - \frac{e^{-{\tt i}\, k\, \pi - {\tt i}\, \pi\, \Phi}\, \left(-1 + e^{2\, {\tt i}\, k\, \pi + 2\, {\tt i}\, \pi\, \Phi}\right)\, k}{-1 + e^{2\, {\tt i}\, k\, \pi}} \bigg\}$

$$\frac{e^{i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n} + e^{2i\,k\,n}\right)\,k}{-1 + e^{2i\,k\,n}} - \frac{e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n} + e^{2i\,k\,n} + e^{2i\,k\,n}\right)\,k}{-1 + e^{2i\,k\,n}} - \frac{e^{-i\,k\,n-i\,n\,8} \left(-1 + e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \left(-1 + e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \left(-1 + e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n-i\,n\,8} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n-i\,n\,8} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} \left(-e^{2i\,k\,n-i\,n\,8} - e^{-i\,k\,n-i\,n\,8} \right)\,k} - e^{-i\,k\,n-i\,n\,8} - e^{-i\,$$

Φ

```
e^{-{\rm i}\; k\; \pi - {\rm i}\; \pi\; \Phi}
                                                           Power
                                                           -ik\pi-i\pi\Phi
                                                                   Plus
                                                                   -ik\pi
                                                                       Times
                                                                          - 1
                                                                     -i\pi\Phi
                                                                          Times
                                                                            - 1
                                               {Cp0, Cm0}
                                                    Cp0
                                                    Cm0
                                      \left\{e^{\text{i}\,k\,\pi-\text{i}\,\pi\,\Phi}\text{, }e^{\text{-i}\,k\,\pi-\text{i}\,\pi\,\Phi}\right\}.\left\{\text{Cp0, Cm0}\right\}
                                      \texttt{Cm0} \ \texttt{e}^{-\texttt{i} \ \texttt{k} \, \pi - \texttt{i} \, \pi \, \Phi} + \texttt{Cp0} \ \texttt{e}^{\texttt{i} \ \texttt{k} \, \pi - \texttt{i} \, \pi \, \Phi}
                                 \mathtt{i} \; \alpha \; \left( \mathtt{Cm0} \; \mathtt{e}^{-\mathtt{i} \; \mathtt{k} \; \pi - \mathtt{i} \; \pi \; \Phi} + \mathtt{Cp0} \; \mathtt{e}^{\mathtt{i} \; \mathtt{k} \; \pi - \mathtt{i} \; \pi \; \Phi} \right)
                                 \left(\text{Cm0 e}^{-i k \pi - i \pi \Phi} + \text{Cp0 e}^{i k \pi - i \pi \Phi}\right) i \alpha
                          -\left(\left(\operatorname{Cm0}\,\mathrm{e}^{-\mathrm{i}\,\,\mathrm{k}\,\pi-\mathrm{i}\,\pi\,\Phi}+\operatorname{Cp0}\,\mathrm{e}^{\mathrm{i}\,\,\mathrm{k}\,\pi-\mathrm{i}\,\pi\,\Phi}\right)\,\mathrm{i}\,\alpha\right)
                          -\left(\text{Cm0 e}^{-i k \pi - i \pi \Phi} + \text{Cp0 e}^{i k \pi - i \pi \Phi}\right) i \alpha
               \left( - \, \text{Cm0} \, \, e^{-\mathrm{i} \, \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \, k \, + \, \text{Cp0} \, e^{\mathrm{i} \, \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \, k \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \, - \, \frac{e^{-\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi + 2 \, \mathrm{i} \, \pi \, \Phi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \, \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, k}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, \right) \, \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, h}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi - \mathrm{i} \, \pi \, \Phi} \, \left( -1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi} \right) \, h}{-1 \, + \, e^{2 \, \mathrm{i} \, k \, \pi}} \right) \, \right) \, \right) \, + \\ \left( \text{Cm0} \, \left( \frac{e^{\mathrm{i} \, k \, \pi 
                                  \text{Cp0} \left( \frac{e^{ {{\tt i} \, k \, \pi - {{\tt i} \, \pi \, \Phi}} \, \left( - \, e^{ {{\tt 2} \, {{\tt i} \, k \, \pi}}} + \, e^{ {{\tt 2} \, {{\tt i} \, \pi \, \Phi}}} \right) \, \, k}{- \, 1 + e^{ {{\tt 2} \, {{\tt i} \, k \, \pi}}}} \, - \, \left( e^{ - {{\tt i} \, k \, \pi - {{\tt i} \, \pi \, \Phi}}} \, \left( - \, e^{ {{\tt 2} \, {{\tt i} \, k \, \pi}}} + \, e^{ {{\tt 2} \, {{\tt i} \, k \, \pi + 2 \, {{\tt i} \, \pi \, \Phi}}}} \right) \, \, k} \right) \, \, / \, \left( - \, 1 + e^{ {{\tt 2} \, {{\tt i} \, k \, \pi}}} \right) \, \right) \right) - \, e^{ - {{\tt i} \, k \, \pi - {{\tt i} \, \pi \, \Phi}}} \, \left( - \, e^{ {{\tt 2} \, {{\tt i} \, k \, \pi + 2 \, {{\tt i} \, \pi \, \Phi}}}} \right) \, k} \right) \, / \, \left( - \, 1 + e^{ {{\tt 2} \, {{\tt i} \, k \, \pi}}}} \right) \, \right) \, - \, e^{ - {{\tt i} \, k \, \pi - {{\tt i} \, \pi \, \Phi}}} \, \left( - \, e^{ {{\tt 2} \, {{\tt i} \, k \, \pi + 2 \, {{\tt i} \, \pi \, \Phi}}}} \right) \, k} \right) \, / \, \left( - \, 1 + e^{ {{\tt 2} \, {{\tt i} \, k \, \pi}}} \right) \, \right) \, . 
         (Cm0 e^{-i k \pi - i \pi \Phi} + Cp0 e^{i k \pi - i \pi \Phi}) i \alpha
                -\text{Cm0} e^{-i k \pi - i \pi \Phi} k + \text{Cp0} e^{i k \pi - i \pi \Phi} k +
 \text{CmO} \left( \frac{e^{ \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 + e^{2 \, \text{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} - \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -1 + e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) + \\ \text{CpO} \left( \frac{e^{ \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} - \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi + 2 \, \text{i} \, \pi \, \Phi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, k}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) - \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \, k \, \pi} \right) \, h}{-1 + e^{2 \, \text{i} \, k \, \pi}} \right) + \\ \frac{e^{ - \text{i} \, k \, \pi - \text{i} \, \pi \, \Phi} \, \left( -e^{2 \, \text{i} \, k \, \pi} + e^{2 \, \text{i} \,
       (Cm0 e^{-i k \pi - i \pi \Phi} + Cp0 e^{i k \pi - i \pi \Phi}) i \alpha
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$$- \operatorname{Cml} \ k + \operatorname{Cpl} \ k + \operatorname{Cml} \ \left(\frac{e^{-2 \ln \pi \theta} \left(- 1 + e^{2 \ln \pi \theta} \right) k}{-1 + e^{2 \ln \pi} \pi} - \frac{e^{-2 \ln \pi \theta} \left(- 1 + e^{2 \ln \pi \pi^2 \ln \pi} \right) k}{-1 + e^{2 \ln \pi} \pi} \right) + \\ \operatorname{Cpl} \ \left(\frac{e^{-2 \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi \theta} \right) k}{-1 + e^{2 \ln \pi} \pi} - \frac{e^{-2 \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi^2 \ln \pi} \right) k}{-1 + e^{2 \ln \pi}} \right) = -\operatorname{Cm0} e^{-\ln \pi - \ln \pi \theta} k + \\ \operatorname{Cpo} \ \left(\frac{e^{\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi} \right) k}{-1 + e^{2 \ln \pi}} - \frac{e^{-\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi^2 \ln \pi} \right) k}{-1 + e^{2 \ln \pi}} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi} \right) k}{-1 + e^{2 \ln \pi}} - \frac{e^{-\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi^2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi}} \right) - \\ \left(\operatorname{Cm0} \ e^{-\ln \pi - \ln \pi \theta} + \operatorname{Cpo} \ e^{\ln \pi - \ln \pi \theta} \right) \ln \alpha \\ \operatorname{Cm0} \ e^{-\ln \pi - \ln \pi \theta} + \operatorname{Cpo} \ e^{\ln \pi - \ln \pi \theta} = \operatorname{Cm1} + \operatorname{Cpl} \ln \alpha \\ -\operatorname{Cm1} \ k + \operatorname{Cpl} \ k + \operatorname{Cm1} \left(\frac{e^{-2 \ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} \right) k}{-1 + e^{2 \ln \pi}} \right) - \frac{e^{-2 \ln \pi \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi}} \right) + \\ \operatorname{Cpl} \ \left(\frac{e^{-2 \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi \theta} \right) k}{-1 + e^{2 \ln \pi}} - \frac{e^{-2 \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi}} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi \theta} \right) k}{-1 + e^{2 \ln \pi \theta}} - \frac{e^{-2 \ln \pi \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi - 2 \ln \theta}} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi} + e^{2 \ln \pi \theta} \right) k}{-1 + e^{2 \ln \pi \theta}} - \left(e^{-2 \ln \pi - 2 \ln \theta} \right) k} \right) - \left(\operatorname{CmO} \ e^{-\ln \pi - \ln \pi \theta} + \operatorname{Cpo} \ e^{\ln \pi - \ln \pi \theta} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{\ln \pi - \ln \pi \theta} \left(- e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi \theta}} - \frac{e^{-2 \ln \pi \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi - 2 \ln \theta}} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{-2 \ln \pi - 2 \ln \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi }} - \frac{e^{-2 \ln \pi - 2 \ln \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi - 2 \ln \theta}} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{-2 \ln \pi - 2 \ln \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi }} - \frac{e^{-2 \ln \pi - 2 \ln \theta} \left(- 1 + e^{2 \ln \pi - 2 \ln \theta} \right) k}{-1 + e^{2 \ln \pi - 2 \ln \theta}} \right) + \\ \operatorname{Cpo} \ \left(\frac{e^{-2 \ln \pi - 2 \ln \theta} \left(- 1 +$$

Cp1 Cm1

$$\begin{aligned} & \text{Solve} \left[\text{CmO } e^{-i \times n - i \times n \cdot n} + \text{CpO } e^{i \times n - i \times n \cdot n} \right] \times \\ & - \text{CmI } k + \text{CpI } k + \text{CmI} \left(\frac{e^{-2 i \times n} \left(-1 + e^{2 i \times n} \right) k}{1 + e^{2 i \times n}} \right) + \frac{e^{-2 i \times n} \left(-e^{2 i \times n} + e^{2 i \times n} \right) k}{1 + e^{2 i \times n}} \right) + \\ & \text{CpI} \left[\frac{e^{-2 i \times n} \left(-e^{2 i \times n} + e^{2 i \times n} \right) k}{1 + e^{2 i \times n}} \right] + \frac{e^{-2 i \times n} \left(-e^{2 i \times n} + e^{2 i \times n \times n} \right) k}{1 + e^{2 i \times n}} \right) + \\ & \text{CpO } e^{i k n - i \times n} k + \text{CmO} \left(\frac{e^{i k n - i \times n} \left(-1 + e^{2 i \times n} \right) k}{1 + e^{2 i \times n}} \right) + \frac{e^{-2 i \times n} \left(-1 + e^{2 i \times n} \right) k}{1 + e^{2 i \times n}} \right) + \\ & \text{CpO } \left(\frac{e^{i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k}{1 + e^{2 i k n}} \right) - \left(-e^{2 i k n} + e^{2 i k n + 2 i x \times n} \right) k \right) / \left(-1 + e^{2 i k n} \right) + \\ & \text{CpO } \left(\frac{e^{i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k}{1 + e^{2 i k n}} \right) - \left(-e^{2 i k n} + e^{2 i k n + 2 i x \times n} \right) k \right) / \left(-1 + e^{2 i k n} \right) - \\ & \text{CmO } e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k - \left(-e^{2 i k n} + e^{2 i x \times n} \right) k \right) / \left(-1 + e^{2 i k n} \right) - \\ & \text{CpO } \left(\frac{e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k}{1 + e^{2 i k n}} \right) + \frac{e^{-2 i n n} \left(-e^{2 i k n} + e^{2 i k n} \right) k}{1 + e^{2 i k n}} \right) + \\ & \text{CpO } \left(\frac{e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k}{1 + e^{2 i k n}} \right) + \frac{e^{-2 i n n} \left(-e^{2 i k n} + e^{2 i k n} \right) k}{1 + e^{2 i k n}} \right) + \\ & \text{CpO } \left(\frac{e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k}{1 + e^{2 i k n}} \right) + \frac{e^{-2 i n n} \left(-e^{2 i k n} + e^{2 i k n} \right) k}{1 + e^{2 i k n}} \right) + \\ & \text{CpO } \left(\frac{e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x \times n} \right) k}{1 + e^{2 i k n}} \right) + \frac{e^{-2 i n n} \left(-e^{2 i k n} + e^{2 i k n} \right) k}{1 + e^{2 i k n}} \right) + \\ & \text{CpO } \left(\frac{e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i x n} \right) k}{1 + e^{2 i k n}} \right) + \frac{e^{-2 i n n} \left(-e^{2 i k n} + e^{2 i k n} \right) k}{1 + e^{2 i k n}} \right) + \\ & \text{CpO } \left(\frac{e^{-i k n - i \times n} \left(-e^{2 i k n} + e^{2 i n n} \right) k}{1 + e^{2 i k n}} \right) - \frac{e^{-2 i n n} \left(-e^{2 i$$

$$\begin{split} &\left\{ \left\{ \text{Cp1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{k} - \text{Cm0}\,\,\text{i}\,\alpha - \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \,, \\ &\text{Cm1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cm0}\,\,\text{k} + \text{Cm0}\,\,\text{i}\,\alpha + \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \right\} \right\} \\ &\text{List} \\ &\left\{ \text{Cp1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{k} - \text{Cm0}\,\,\text{i}\,\alpha - \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \,, \\ &\text{Cm1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cm0}\,\,\text{k} + \text{Cm0}\,\,\text{i}\,\alpha + \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \right\} \\ &\text{List} \\ &\text{Cp1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{k} - \text{Cm0}\,\,\text{i}\,\alpha - \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \\ &\text{Cm1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cm0}\,\,\text{k} + \text{Cm0}\,\,\text{i}\,\alpha + \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \\ &\text{Out[81]=} \, \left\{ \left\{ \text{Cp1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{k} - \text{Cm0}\,\,\text{i}\,\alpha - \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \right\} \right\} \\ &\text{Cm1} \rightarrow \frac{1}{2\,\,\text{k}} \text{e}^{-\text{i}\,\,\text{k}\,\pi - \text{i}\,\pi\,\Phi} \, \left(2\,\,\text{Cm0}\,\,\text{k} + \text{Cm0}\,\,\text{i}\,\alpha + \text{Cp0}\,\,\text{e}^{2\,\,\text{i}\,\,\text{k}\,\pi}\,\,\text{i}\,\alpha \right) \right\} \right\} \end{split}{$$

$$\text{ M[k_, $\Phi_$] = $e^{-i\,k\,\pi-i\,\pi\,\Phi}$ / (2\,k) * $ \{ 2\,e^{2\,i\,k\,\pi}\,k - e^{2\,i\,k\,\pi}\,i\,\alpha, \, (\,i\,\alpha) \, \}, \, \{ e^{2\,i\,k\,\pi}\,i\,\alpha, \, 2\,k + i\,\alpha \} \}; $ \\ \text{M[k_, $\Phi_$] = $e^{-i\,k\,\pi-i\,\pi\,\Phi}$ / (2\,k) * $ \{ \{ e^{2\,i\,k\,\pi}\,k - e^{2\,i\,k\,\pi}\,i\,\alpha, \, (\,i\,\alpha) \, \}, \, \{ e^{2\,i\,k\,\pi}\,i\,\alpha, \, 2\,k + i\,\alpha \} \}; $ \\ \text{Out[76]= } $ \{ \{ \frac{e^{i\,k\,\pi-i\,\pi\,\Phi}~(2\,k-i\,\alpha)}{2\,k}, \, \frac{e^{-i\,k\,\pi-i\,\pi\,\Phi}~i\,\alpha}{2\,k} \}, \, \{ \frac{e^{i\,k\,\pi-i\,\pi\,\Phi}~i\,\alpha}{2\,k}, \, \frac{e^{-i\,k\,\pi-i\,\pi\,\Phi}~(2\,k + i\,\alpha)}{2\,k} \} \} $ \\ $ \end{cases}$$