

$$\text{In[*]:= Collect} \left[-\frac{1}{2} \epsilon \text{ca}_{1,2} + \epsilon \text{p}_i \text{x}_i \text{ca}_{1,2} - \epsilon \text{p}_j \text{x}_i \text{ca}_{1,2} + \frac{1}{2} \epsilon \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10} - \frac{1}{2} \text{T} \epsilon \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10} - \right. \\ \left. \frac{1}{2} \epsilon \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10} + \frac{1}{2} \text{T} \epsilon \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10} + \epsilon \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{ca}_{1,10} - \epsilon \text{p}_j^2 \text{x}_i \text{x}_j \text{ca}_{1,10}, \epsilon, \text{CF} \right]$$

Out[*]=

$$\in \left(-\frac{1}{2} + \text{p}_i \text{x}_i - \text{p}_j \text{x}_i + \frac{1}{2} (-1 + \text{T}) \text{p}_i \text{p}_j \text{x}_i^2 + \frac{1}{2} (1 - \text{T}) \text{p}_j^2 \text{x}_i^2 - \text{p}_i \text{p}_j \text{x}_i \text{x}_j + \text{p}_j^2 \text{x}_i \text{x}_j \right)$$

$$\text{In[*]:= Collect} \left[-\frac{1}{2} \epsilon \text{ca}_{1,2} - \epsilon \text{p}_k \text{x}_k \text{ca}_{1,10}, \epsilon, \text{CF} \right]$$

Out[*]=

$$\in \left(-\frac{1}{2} + \text{p}_k \text{x}_k \right)$$

$$\begin{aligned}
 \text{In[*]:= } & \left\{ \text{Collect} \left[-\frac{1}{2} \epsilon \text{ca}_{1,2} + \epsilon \text{p}_i \text{x}_i \text{ca}_{1,2} - \epsilon \text{p}_j \text{x}_i \text{ca}_{1,2} - \frac{1}{2} \epsilon^2 \text{p}_i \text{x}_i \text{ca}_{1,2}^2 + \frac{1}{2} \epsilon^2 \text{p}_j \text{x}_i \text{ca}_{1,2}^2 + \right. \right. \\
 & \frac{1}{2} \epsilon \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10} - \frac{1}{2} T \epsilon \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10} - \frac{1}{2} \epsilon \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10} + \frac{1}{2} T \epsilon \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10} + \epsilon \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{ca}_{1,10} - \\
 & \epsilon \text{p}_j^2 \text{x}_i \text{x}_j \text{ca}_{1,10} - \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,2} \text{ca}_{1,10} + T \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,2} \text{ca}_{1,10} + \frac{1}{2} \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,2} \text{ca}_{1,10} - \\
 & T \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,2} \text{ca}_{1,10} - 2 \epsilon^2 \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{ca}_{1,2} \text{ca}_{1,10} + 2 \epsilon^2 \text{p}_j^2 \text{x}_i \text{x}_j \text{ca}_{1,2} \text{ca}_{1,10} + \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10}^2 - \\
 & \frac{1}{2} T \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10}^2 - \frac{1}{2} \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10}^2 + \frac{1}{2} T \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10}^2 - \frac{1}{3} \epsilon^2 \text{p}_i^2 \text{p}_j \text{x}_i^3 \text{ca}_{1,10}^2 + \\
 & \frac{1}{3} T \epsilon^2 \text{p}_i^2 \text{p}_j \text{x}_i^3 \text{ca}_{1,10}^2 + \frac{5}{6} \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^3 \text{ca}_{1,10}^2 - \frac{2}{3} T \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^3 \text{ca}_{1,10}^2 - \frac{1}{6} T^2 \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^3 \text{ca}_{1,10}^2 - \\
 & \frac{1}{2} \epsilon^2 \text{p}_j^3 \text{x}_i^3 \text{ca}_{1,10}^2 + \frac{1}{3} T \epsilon^2 \text{p}_j^3 \text{x}_i^3 \text{ca}_{1,10}^2 + \frac{1}{6} T^2 \epsilon^2 \text{p}_j^3 \text{x}_i^3 \text{ca}_{1,10}^2 + \epsilon^2 \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{ca}_{1,10}^2 - \\
 & \epsilon^2 \text{p}_j^2 \text{x}_i \text{x}_j \text{ca}_{1,10}^2 - \frac{1}{2} \epsilon^2 \text{p}_i^2 \text{p}_j \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 + \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 + \frac{1}{2} T \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 - \\
 & \frac{1}{2} \epsilon^2 \text{p}_j^3 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 - \frac{1}{2} T \epsilon^2 \text{p}_j^3 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 - \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i \text{x}_j^2 \text{ca}_{1,10}^2 + \frac{1}{2} \epsilon^2 \text{p}_j^3 \text{x}_i \text{x}_j^2 \text{ca}_{1,10}^2 + \\
 & \epsilon^2 \text{ca}_{2,1} - 2 \epsilon^2 \text{p}_i \text{x}_i \text{ca}_{2,1} + 2 \epsilon^2 \text{p}_j \text{x}_i \text{ca}_{2,1} - \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{cb}_{2,10} + \frac{1}{2} T \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{cb}_{2,10} + \\
 & \left. \frac{1}{2} \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{cb}_{2,10} - \frac{1}{2} T \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{cb}_{2,10} - \epsilon^2 \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{cb}_{2,10} + \epsilon^2 \text{p}_j^2 \text{x}_i \text{x}_j \text{cb}_{2,10}, \epsilon, \text{CF} \right],
 \end{aligned}$$

$$\begin{aligned}
 & \text{Collect} \left[\frac{1}{2} \epsilon \text{ca}_{1,2} - \epsilon \text{p}_i \text{x}_i \text{ca}_{1,2} + \epsilon \text{p}_j \text{x}_i \text{ca}_{1,2} - \frac{1}{2} \epsilon^2 \text{p}_i \text{x}_i \text{ca}_{1,2}^2 + \frac{1}{2} \epsilon^2 \text{p}_j \text{x}_i \text{ca}_{1,2}^2 - \right. \\
 & \frac{1}{2} \epsilon \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10} + \frac{\epsilon \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,10}}{2 T} + \frac{1}{2} \epsilon \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10} - \frac{\epsilon \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,10}}{2 T} - \epsilon \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{ca}_{1,10} + \\
 & \epsilon \text{p}_j^2 \text{x}_i \text{x}_j \text{ca}_{1,10} + \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{ca}_{1,2} \text{ca}_{1,10} - \frac{1}{2} \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{ca}_{1,2} \text{ca}_{1,10} - \frac{1}{3} \epsilon^2 \text{p}_i^2 \text{p}_j \text{x}_i^3 \text{ca}_{1,10}^2 + \\
 & \frac{\epsilon^2 \text{p}_i^2 \text{p}_j \text{x}_i^3 \text{ca}_{1,10}^2}{3 T} + \frac{5}{6} \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^3 \text{ca}_{1,10}^2 - \frac{\epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^3 \text{ca}_{1,10}^2}{6 T^2} - \frac{2 \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^3 \text{ca}_{1,10}^2}{3 T} - \frac{1}{2} \epsilon^2 \text{p}_j^3 \text{x}_i^3 \text{ca}_{1,10}^2 + \\
 & \frac{\epsilon^2 \text{p}_j^3 \text{x}_i^3 \text{ca}_{1,10}^2}{6 T^2} + \frac{\epsilon^2 \text{p}_j^3 \text{x}_i^3 \text{ca}_{1,10}^2}{3 T} - \frac{1}{2} \epsilon^2 \text{p}_i^2 \text{p}_j \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 + \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 + \frac{\epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2}{2 T} - \\
 & \frac{1}{2} \epsilon^2 \text{p}_j^3 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2 - \frac{\epsilon^2 \text{p}_j^3 \text{x}_i^2 \text{x}_j \text{ca}_{1,10}^2}{2 T} - \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j^2 \text{x}_i \text{x}_j^2 \text{ca}_{1,10}^2 + \frac{1}{2} \epsilon^2 \text{p}_j^3 \text{x}_i \text{x}_j^2 \text{ca}_{1,10}^2 - \\
 & \epsilon^2 \text{ca}_{2,1} + 2 \epsilon^2 \text{p}_i \text{x}_i \text{ca}_{2,1} - 2 \epsilon^2 \text{p}_j \text{x}_i \text{ca}_{2,1} + \frac{1}{2} \epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{cb}_{2,10} - \frac{\epsilon^2 \text{p}_i \text{p}_j \text{x}_i^2 \text{cb}_{2,10}}{2 T} - \\
 & \left. \frac{1}{2} \epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{cb}_{2,10} + \frac{\epsilon^2 \text{p}_j^2 \text{x}_i^2 \text{cb}_{2,10}}{2 T} + \epsilon^2 \text{p}_i \text{p}_j \text{x}_i \text{x}_j \text{cb}_{2,10} - \epsilon^2 \text{p}_j^2 \text{x}_i \text{x}_j \text{cb}_{2,10}, \epsilon, \text{CF} \right] \\
 & \left. \right\} /. \{ \text{ca}_{2,1} \rightarrow 0, \text{cb}_{2,10} \rightarrow 3 / 2 \}
 \end{aligned}$$

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$$\begin{aligned} & \left\{ \epsilon \left(-\frac{1}{2} + p_i x_i - p_j x_j + \frac{1}{2} (-1 + T) p_i p_j x_i^2 + \frac{1}{2} (1 - T) p_j^2 x_i^2 - p_i p_j x_i x_j + p_j^2 x_i x_j \right) + \right. \\ & \quad \epsilon^2 \left(-\frac{1}{2} p_i x_i + \frac{p_j x_j}{2} + \frac{1}{2} \left(\frac{1}{2} - \frac{3T}{2} \right) p_i p_j x_i^2 + \frac{1}{2} \left(-\frac{1}{2} + \frac{3T}{2} \right) p_j^2 x_i^2 + \frac{1}{3} (-1 + T) p_i^2 p_j x_i^3 - \right. \\ & \quad \quad \frac{1}{6} (-1 + T) (5 + T) p_i p_j^2 x_i^3 + \frac{1}{6} (-1 + T) (3 + T) p_j^3 x_i^3 + \frac{3}{2} p_i p_j x_i x_j - \frac{3}{2} p_j^2 x_i x_j - \\ & \quad \quad \left. \frac{1}{2} p_i^2 p_j x_i^2 x_j + \frac{1}{2} (2 + T) p_i p_j^2 x_i^2 x_j + \frac{1}{2} (-1 - T) p_j^3 x_i^2 x_j - \frac{1}{2} p_i p_j^2 x_i x_j^2 + \frac{1}{2} p_j^3 x_i x_j^2 \right), \\ & \quad \epsilon \left(\frac{1}{2} - p_i x_i + p_j x_j + \frac{(-1 + T) p_i p_j x_i^2}{2T} - \frac{(-1 + T) p_j^2 x_i^2}{2T} + p_i p_j x_i x_j - p_j^2 x_i x_j \right) + \\ & \quad \epsilon^2 \left(-\frac{1}{2} p_i x_i + \frac{p_j x_j}{2} + \frac{\left(-\frac{3}{2} + \frac{T}{2}\right) p_i p_j x_i^2}{2T} - \frac{\left(-\frac{3}{2} + \frac{T}{2}\right) p_j^2 x_i^2}{2T} - \frac{(-1 + T) p_i^2 p_j x_i^3}{3T} + \right. \\ & \quad \quad \frac{(-1 + T) (1 + 5T) p_i p_j^2 x_i^3}{6T^2} - \frac{(-1 + T) (1 + 3T) p_j^3 x_i^3}{6T^2} + \frac{3}{2} p_i p_j x_i x_j - \frac{3}{2} p_j^2 x_i x_j - \\ & \quad \quad \left. \frac{1}{2} p_i^2 p_j x_i^2 x_j + \frac{(1 + 2T) p_i p_j^2 x_i^2 x_j}{2T} - \frac{(1 + T) p_j^3 x_i^2 x_j}{2T} - \frac{1}{2} p_i p_j^2 x_i x_j^2 + \frac{1}{2} p_j^3 x_i x_j^2 \right) \Big\} \end{aligned}$$

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$$\begin{aligned} & \text{Column} \left[\left\{ \right. \right. \\ & \quad \text{Collect} \left[\frac{1}{2} \epsilon ca_{1,2} + \epsilon p_k x_k ca_{1,10} - \epsilon^2 p_k x_k ca_{1,2} ca_{1,10} - \epsilon^2 ca_{2,1} - \epsilon^2 p_k x_k cb_{2,10}, \epsilon, CF \right], \\ & \quad \text{Collect} \left[\right. \\ & \quad \quad \left. -\frac{1}{2} \epsilon ca_{1,2} - \epsilon p_k x_k ca_{1,10} + \epsilon^2 p_k x_k ca_{1,2} ca_{1,10} - \epsilon^2 p_k x_k ca_{1,10}^2 + \epsilon^2 ca_{2,1} + \epsilon^2 p_k x_k cb_{2,10}, \epsilon, CF \right] \\ & \quad \left. \right\} /. \{ca_{2,1} \rightarrow 0, cb_{2,10} \rightarrow 3 / 2\} \end{aligned}$$

Out[*]=

$$\begin{aligned} & -\frac{1}{2} \epsilon^2 p_k x_k + \epsilon \left(\frac{1}{2} - p_k x_k \right) \\ & -\frac{1}{2} \epsilon^2 p_k x_k + \epsilon \left(-\frac{1}{2} + p_k x_k \right) \end{aligned}$$