

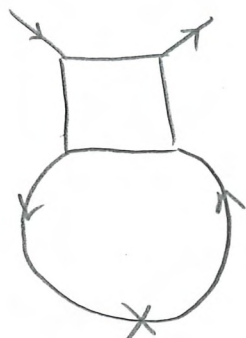
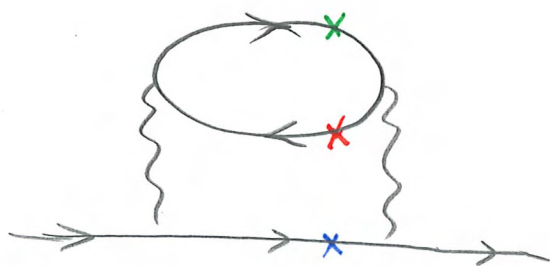
$$\text{Crossed lines} = \text{Wavy line with four external legs} + \text{Zigzag line with four external legs}$$

$$\text{Square loop} = \text{Two vertices connected by two wavy lines} + \text{Two vertices connected by two zigzag lines}$$

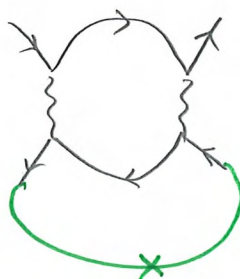
$$= \text{Bubble diagram with wavy internal lines} + 2 \times \text{Bubble diagram with one wavy and one zigzag internal line} + \text{Bubble diagram with zigzag internal lines}$$

$$+ \text{Bubble diagram with wavy external lines}$$

$$= \text{Two vertices connected by two wavy lines with external wavy lines}$$

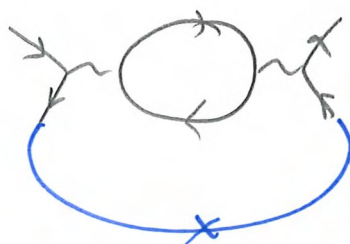


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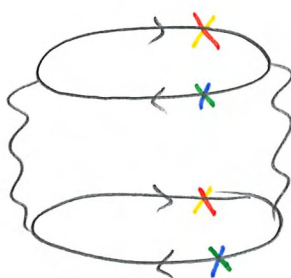
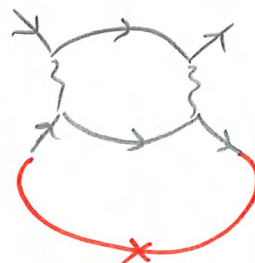


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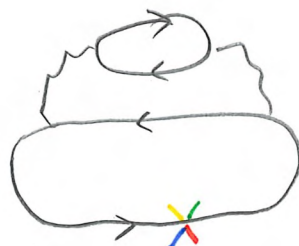
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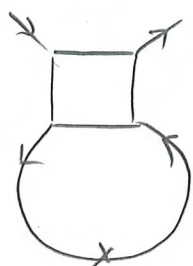
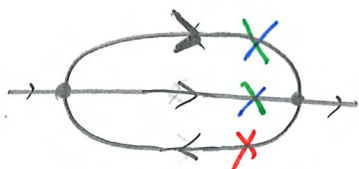


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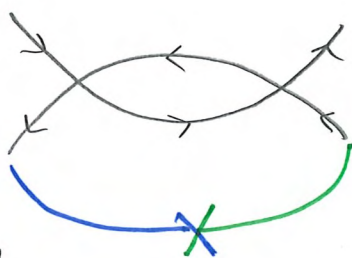


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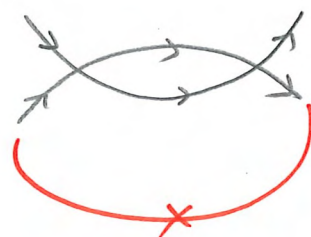




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this contains both expansions

Note:

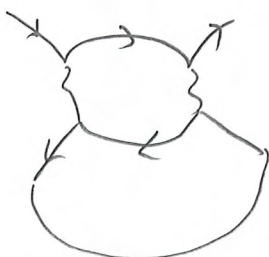


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2x



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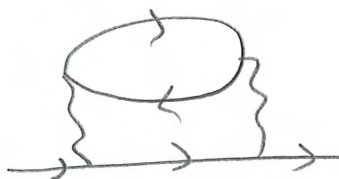


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~ 2x



$$1 \text{ --- } 1' = \frac{1}{2} \sum_{1,1'} c_1^+ c_1 c_{1'}^+ c_{1'}$$

$\Rightarrow \frac{1}{2!} \cdot \frac{1}{g^2} C_0^- C_0^- C_1^- C_1^- C_1^+ C_1^+ C_2^+ C_2^+ C_2^+ C_2^+$

Diagram illustrating the decomposition of a cylinder into two sheets, each with a boundary component, and the corresponding algebraic expression:

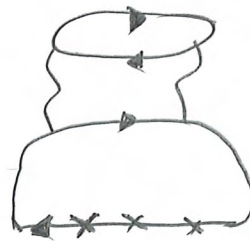
$$\frac{1}{2!} \frac{1}{2^2} \underbrace{C_1^+ C_1 C_1^+ C_1 C_2^+ C_2 C_2^+ C_2}_{\times 2}$$

Only 1 factor is compensated ↗

2 factors are compensated

2 factors are compensated

$\Rightarrow \frac{1}{2!} \frac{1}{2^2} \left\{ \begin{array}{l} \begin{array}{l} C_1^+ C_1 \quad C_1^+ C_1 \end{array} \\ \begin{array}{l} \begin{array}{l} \text{---} \end{array} \\ \text{---} \end{array} \end{array} \right. \begin{array}{l} C_2^+ C_2 \quad C_2^+ C_2 \\ \begin{array}{l} \text{---} \\ \text{---} \end{array} \end{array}$



5

$$1) \text{---} \times \text{---} \Rightarrow 2) \times$$

$$\frac{1}{2} \left[\text{Diagram of two loops} \right] \Rightarrow \text{---} + \text{---} \times + \text{---} \times \times + \text{---} \times \times \times$$

for this specific diagram

$$\frac{1}{2} \times \frac{1}{2} \times \left[\text{Diagram 1} + \text{Diagram 2} + \text{Diagram 3} + \text{Diagram 4} \right] = 1 \times \text{Diagram 5}$$

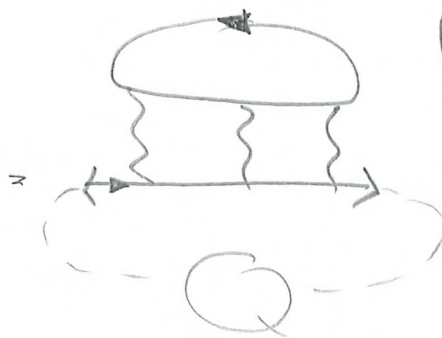
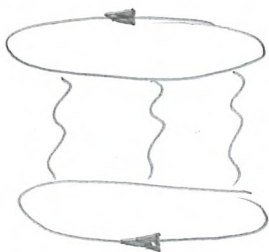
$$1) \times \Rightarrow 2) \text{---} \times \text{---}$$

$$\frac{1}{3} \left[\text{Diagram of a circle with 6 points} \right] \Rightarrow \text{---} + \text{---} \circ + \text{---} \text{---} \text{---} + \text{---} \text{---} \text{---} \text{---} + \text{---} \text{---} \text{---} \text{---} \text{---} + \text{---} \text{---} \text{---} \text{---} \text{---} \text{---} + \text{---} \text{---} \text{---} \text{---} \text{---} \text{---} \text{---} + \text{---} \text{---} \text{---} \text{---} \text{---} \text{---} \text{---} \text{---}$$

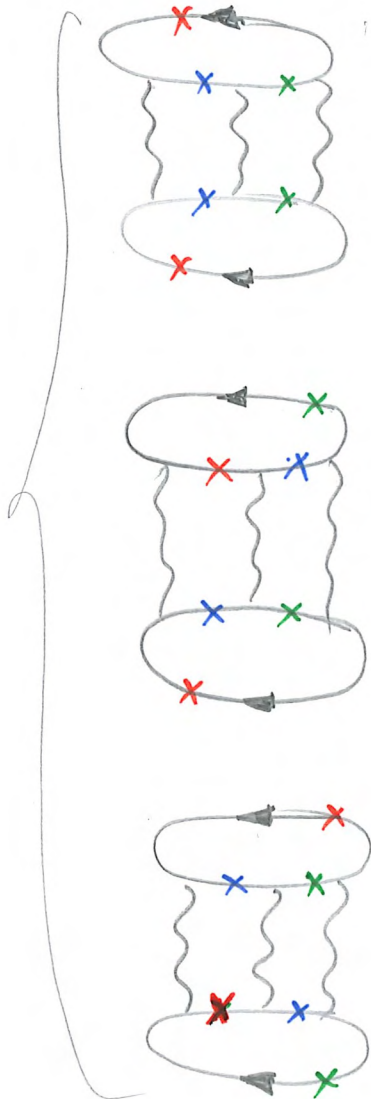
$$\frac{1}{3} \times \left[\text{Diagram 1} + \text{Diagram 2} + \text{Diagram 3} \right] = 1 \times \text{Diagram 4}$$



$$6 \times \frac{1}{2 \cdot 3}$$



$$3 \times \frac{1}{2 \cdot 3}$$



$$= \frac{1}{2 \cdot 3} \times$$

