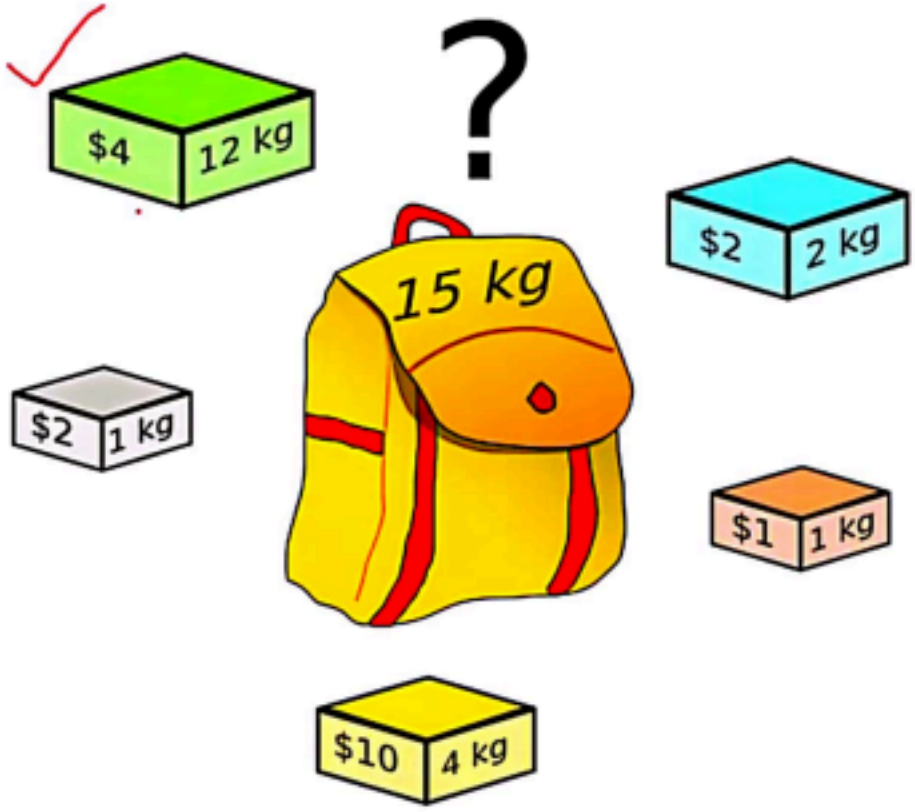
What is 0/1 Knapsack?



What is Dynamic Algorithm?

- Complex problem by breaking it down into a collection of simpler sub-problems
- Solving each of those sub-problems just once, and storing their solutions
- Next time the same sub-problem occurs, instead of re-computing its solution, one simply looks up the previously computed solution
- Combine sub-solutions to give the best solution for the given problem

Item i	Value v_i	Weight w_i
1	15	1
2	10	5
3	9	3
4	5	4

Capacity of Knapsack = 8

Finally

Item i	Value v_i	Weight w_i
1	15	1
2	10	5
3	9	3
4	5	4

Capacity of Knapsack = 8

Total Profit = 29

Item Selection: [1 0 1 1]

Complexity

- **O(n*w)**

Where **n** is the number of items

And **w** is the knapsack size

Value / Profits: 4 3 6 5

i ↓ \ w →	0	1	2	3	4	5
0	0	0	0	0	0	0
1	0	0	0	4	4	4
2	0	0	3	4	4	7
3	0	0	3	4	4	7
4	0	0	3	4	5	7

$$B[i,w] = \max(B[i-1,w],\ B[i-1, w-w[i]] + v[i])$$

$$B[4,4] = \max(B[3,4],\ B[3,4-4]+5)$$

$$= \max(4,\ B[3,0]+5)$$

$$= \max(4,\ 0+5=5)$$

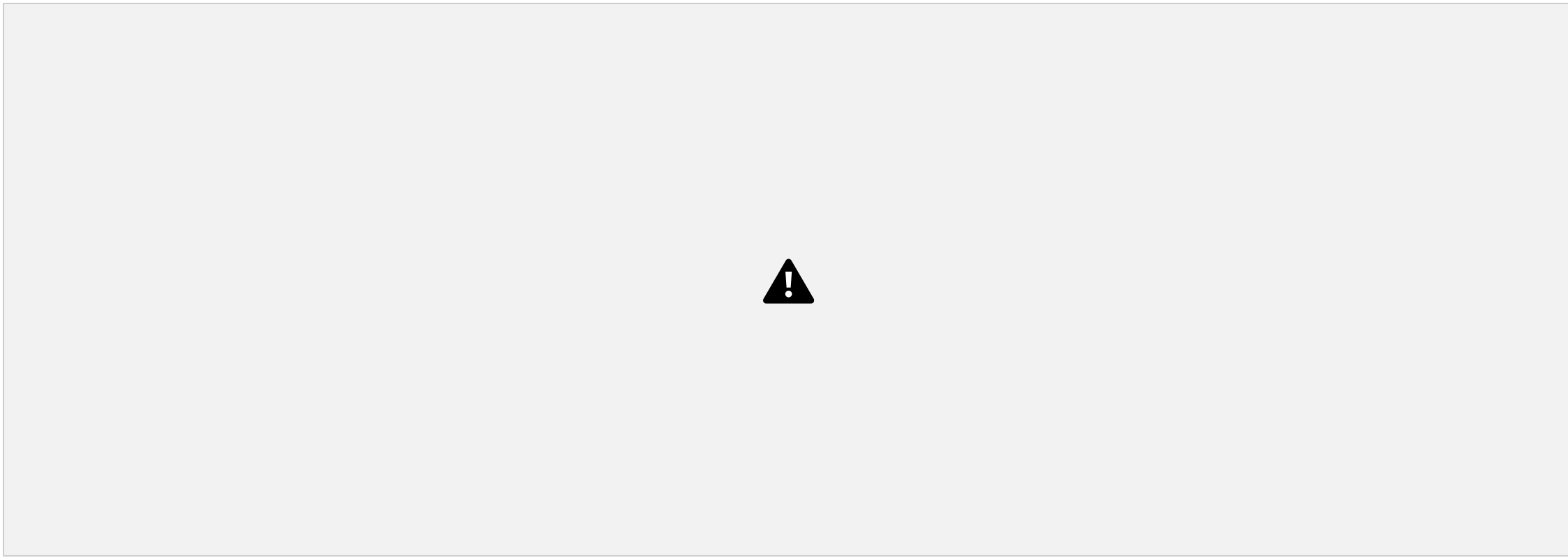
$$= \max(4,5)$$

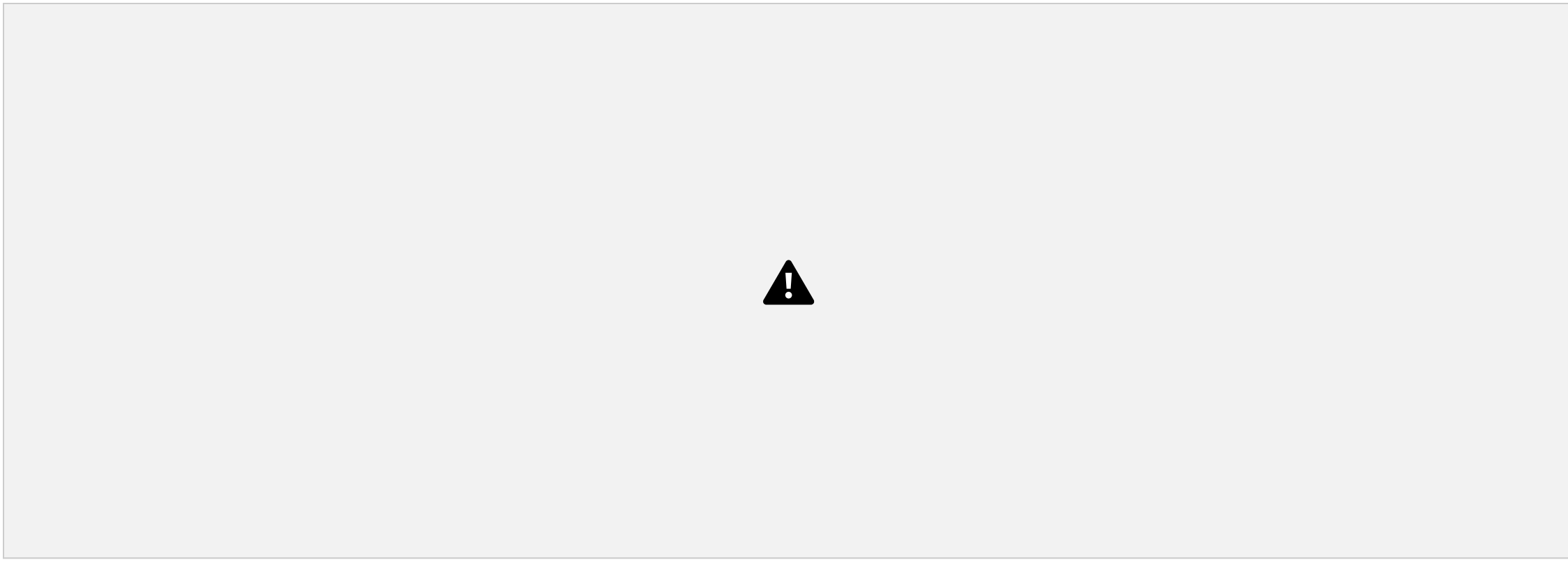
$$= 5$$

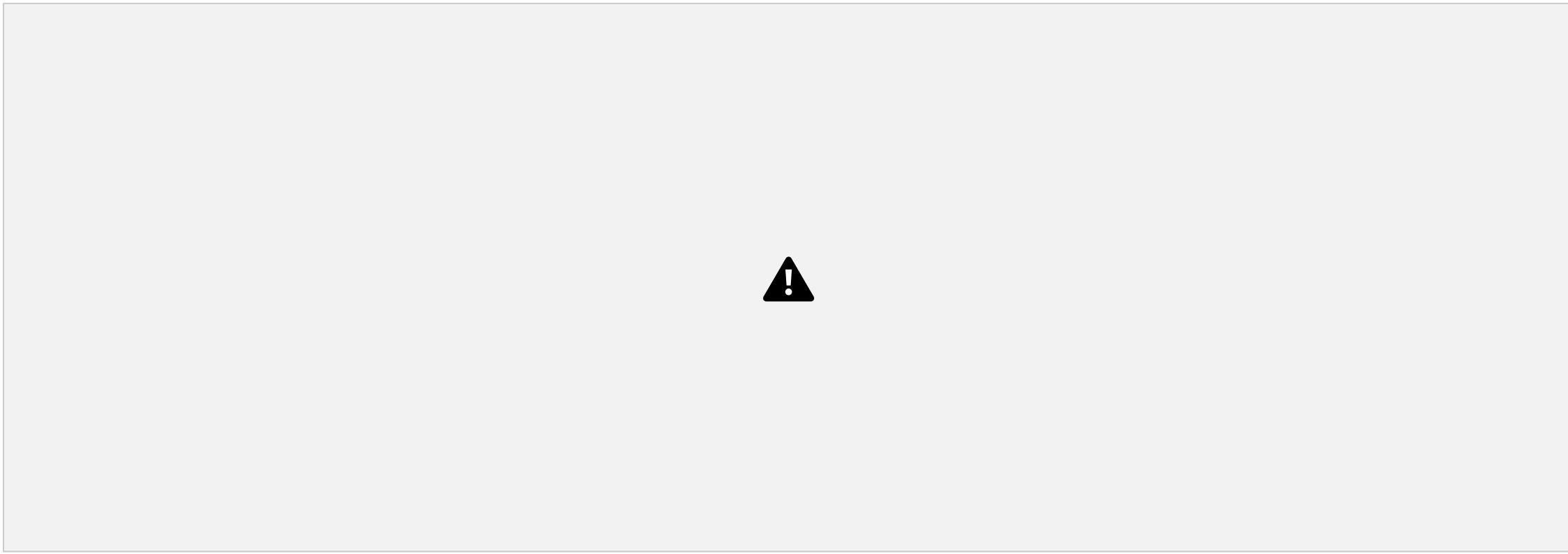
Example

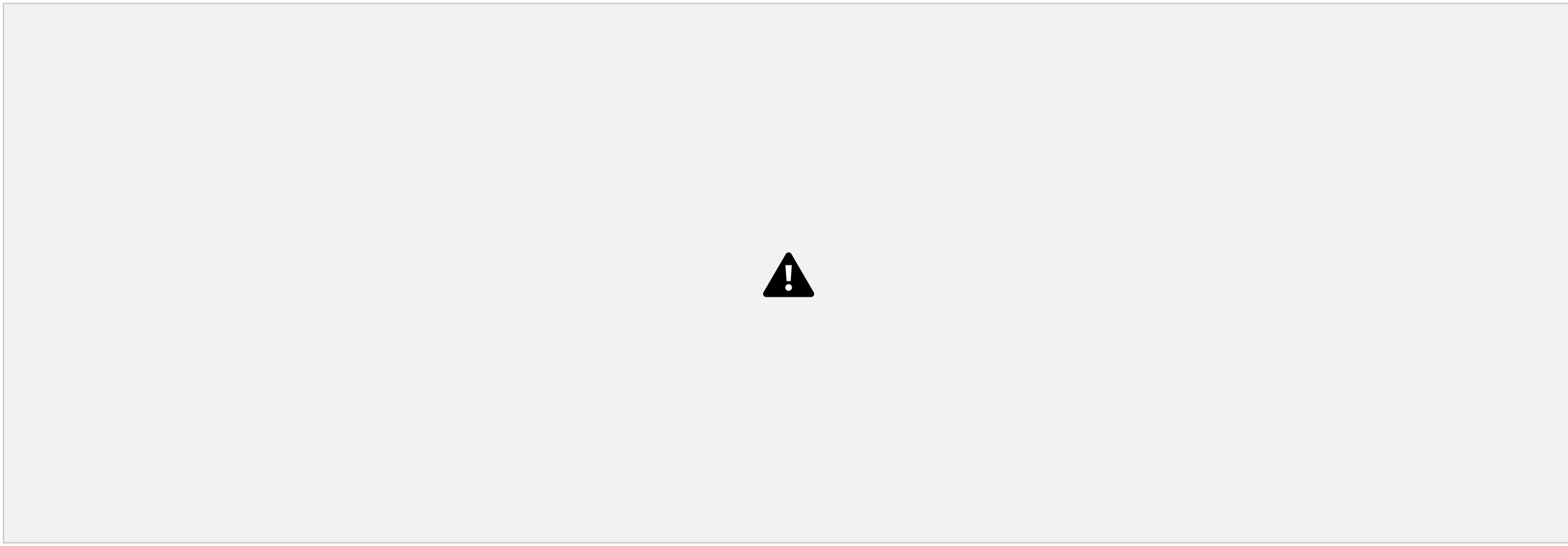
Capacity of Knapsack

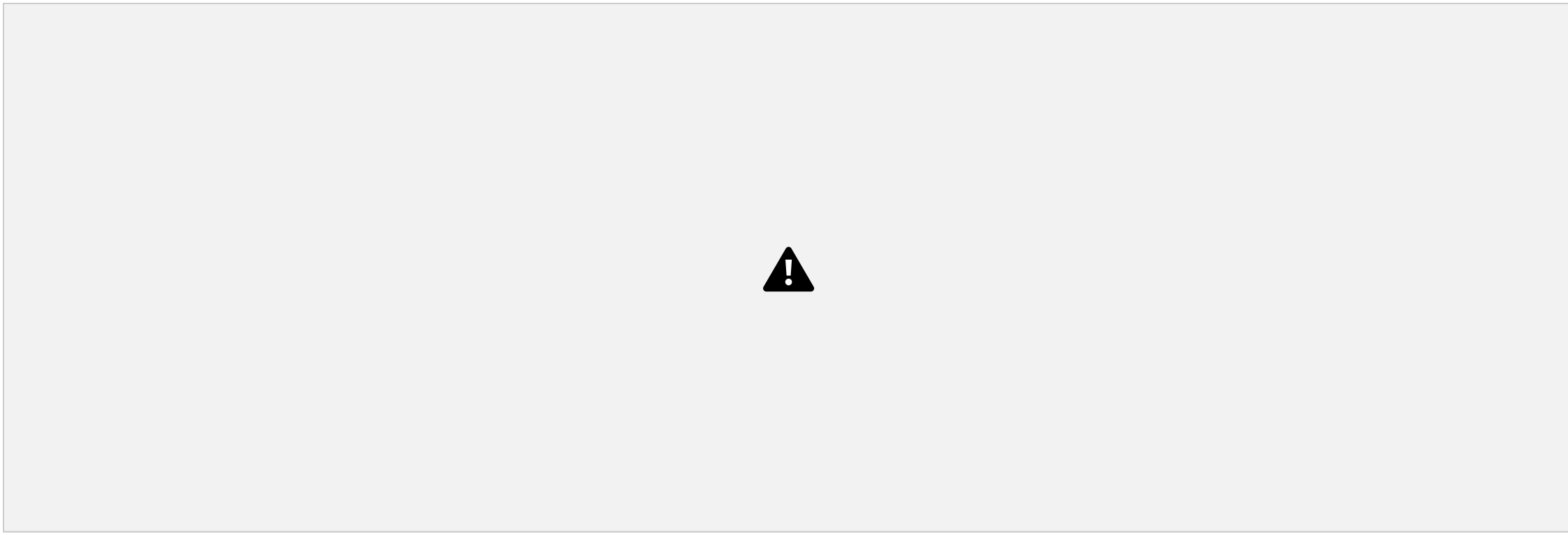
Items	K=0	K=1	K=2	K=3	K=4	K=5	K=6	K=7	K=8
1 (15,1)									
2 (10,5)									
3 (9,3)									
4 (5,4)									

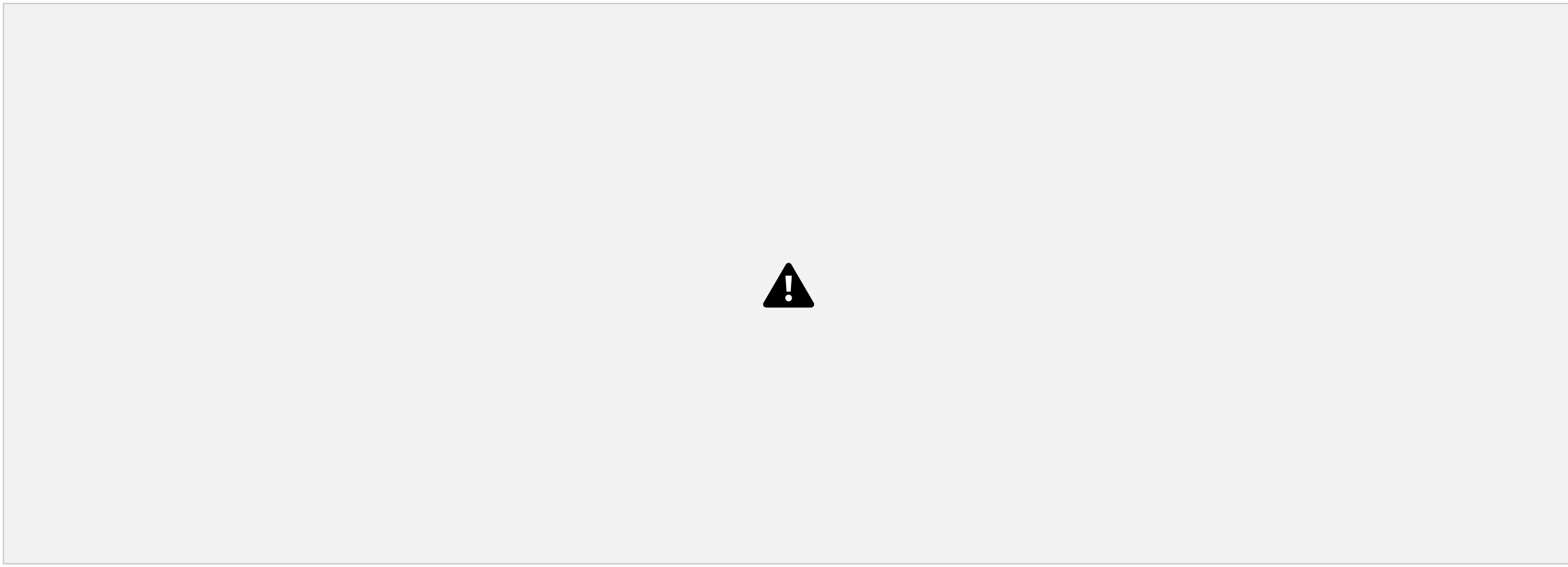


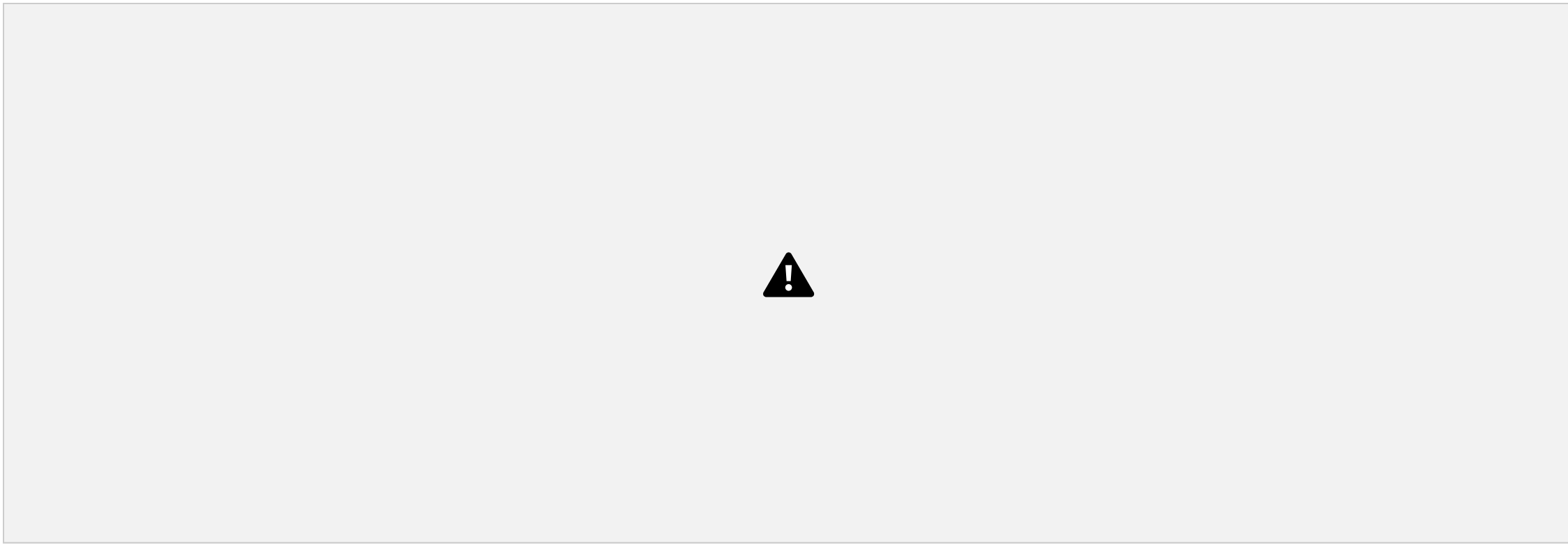


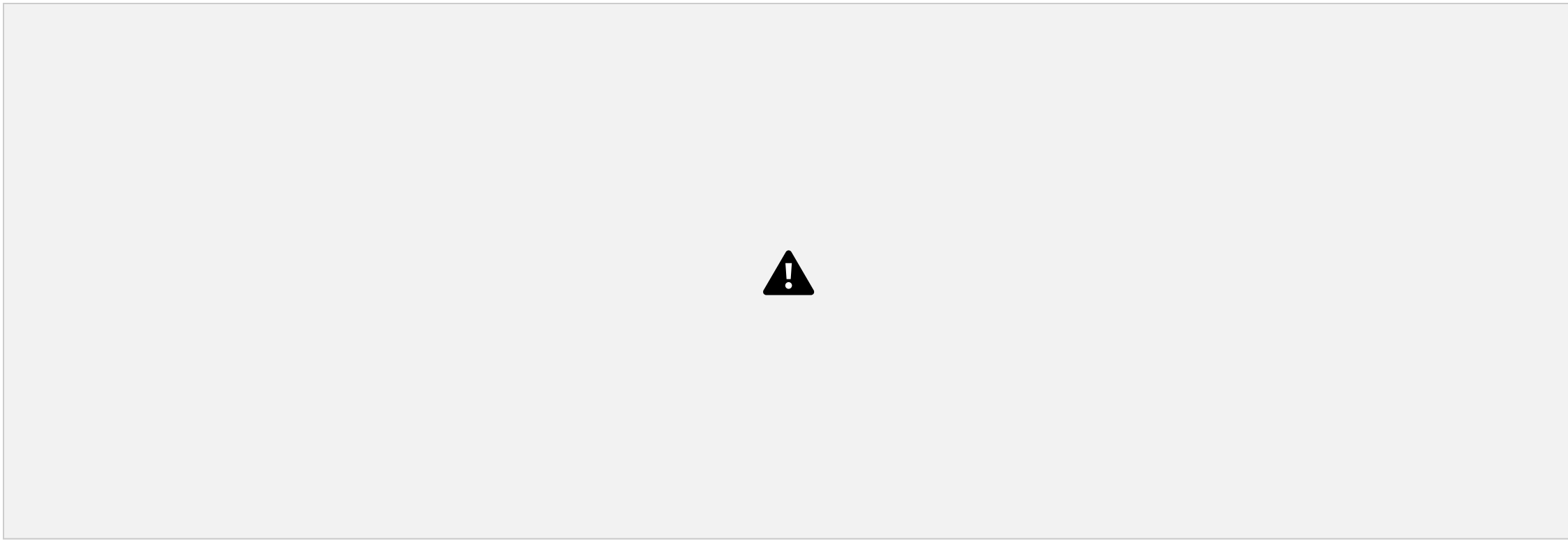


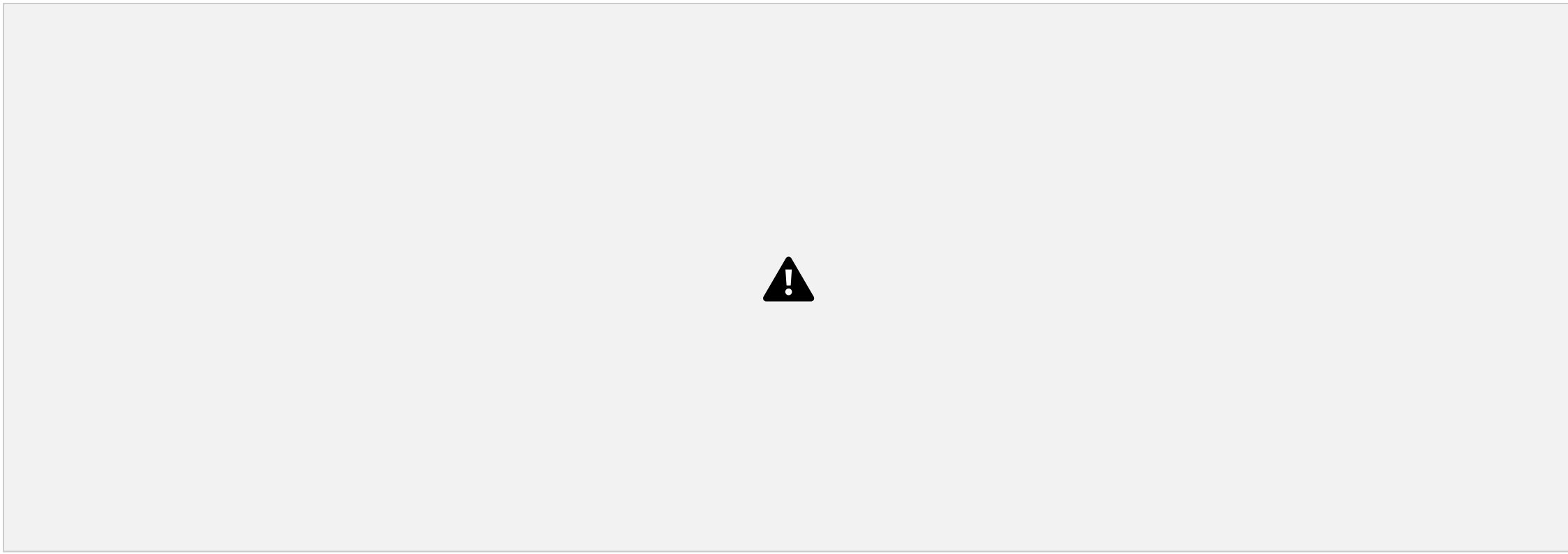


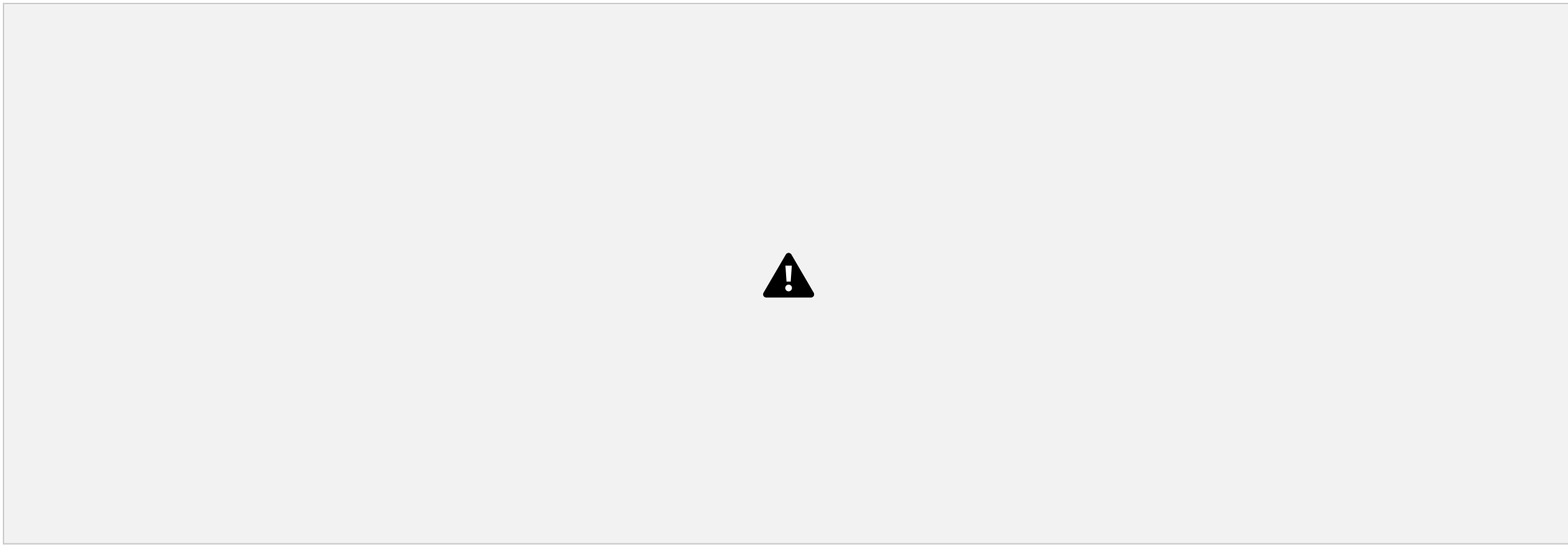


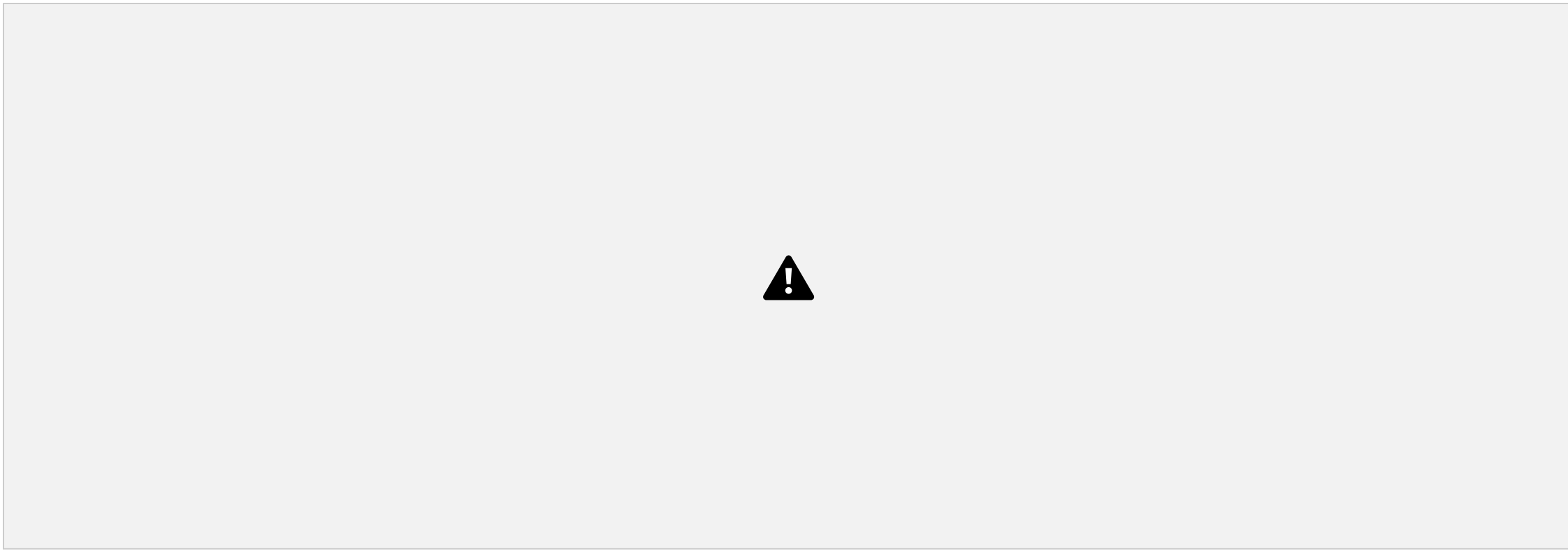












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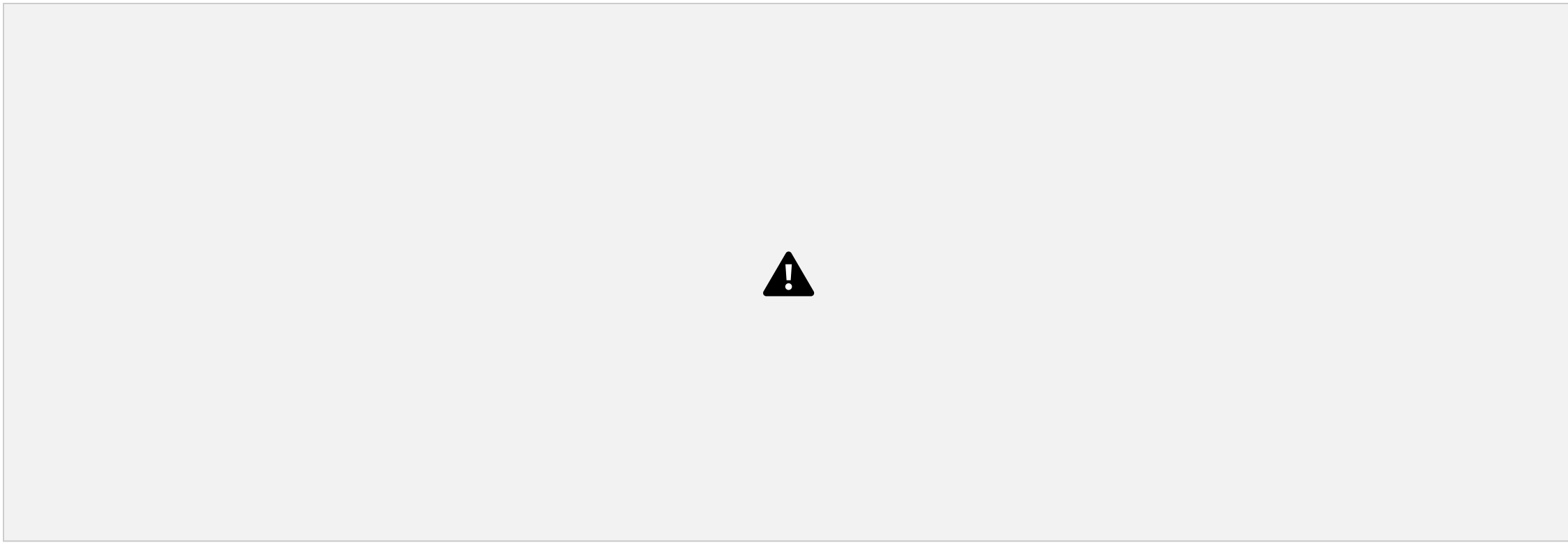

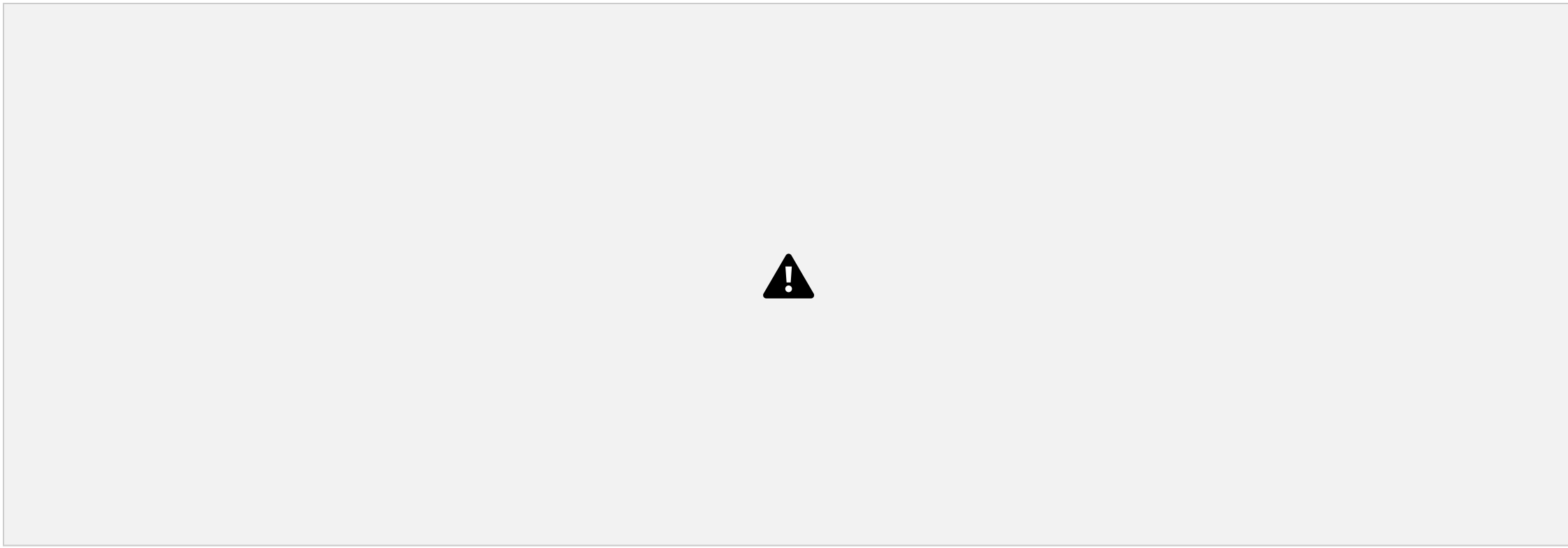

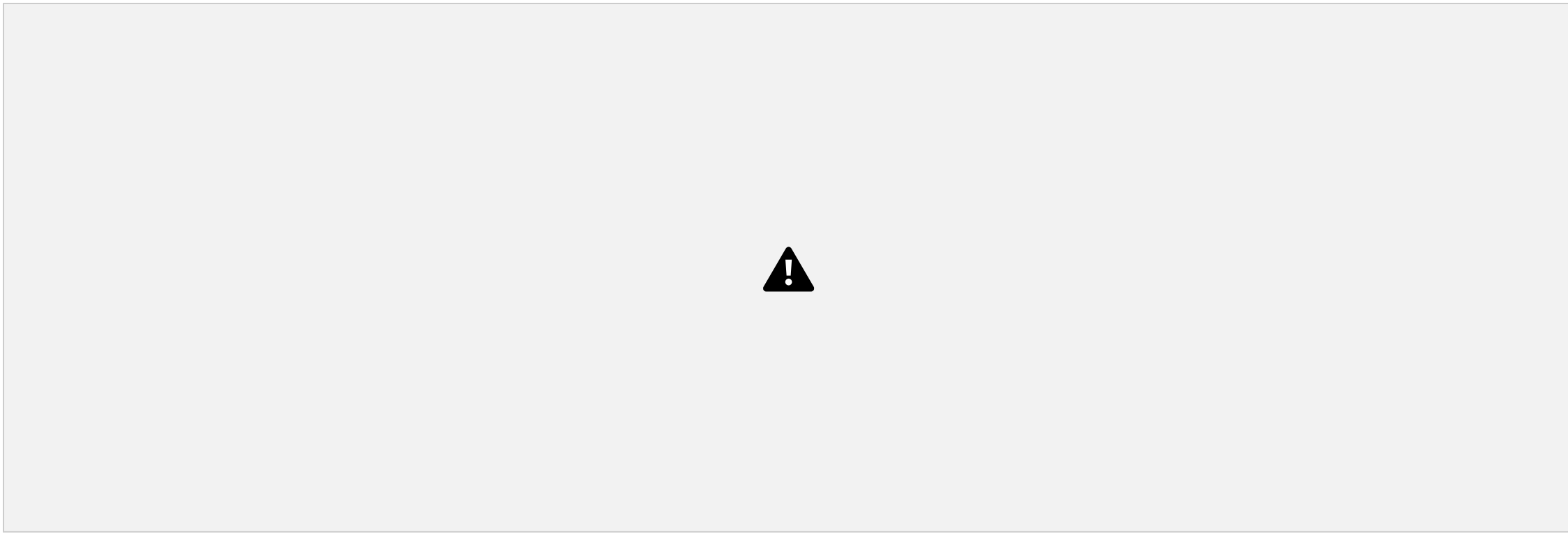

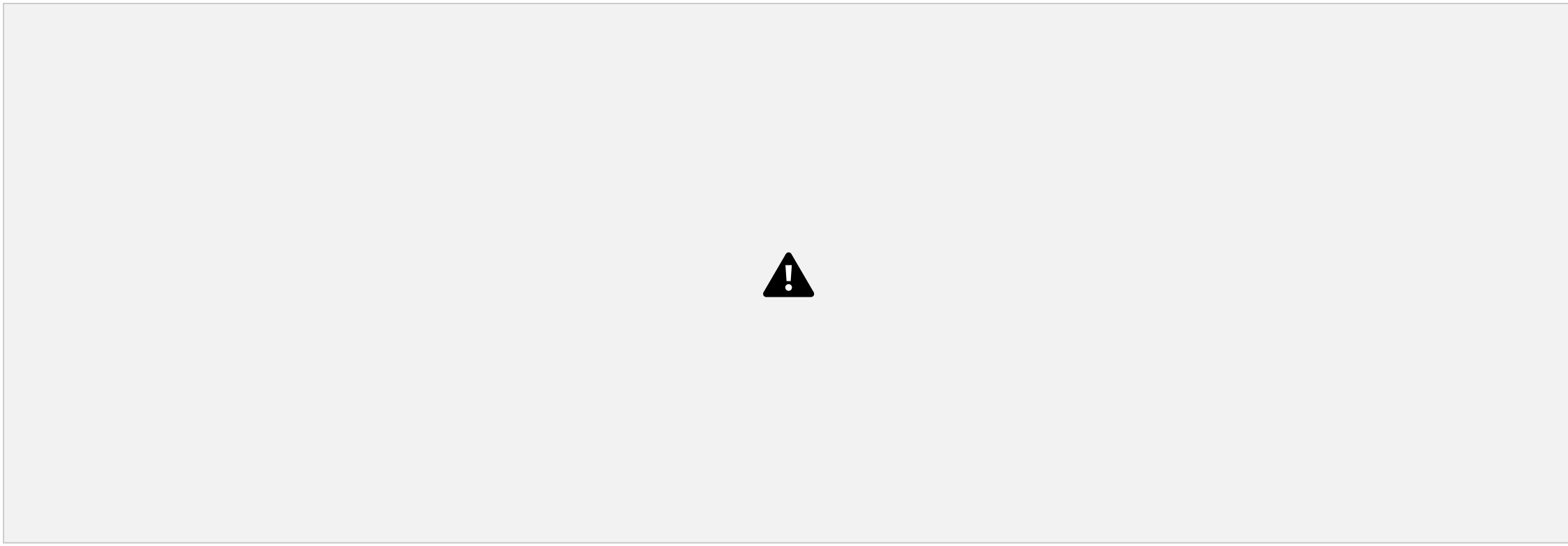

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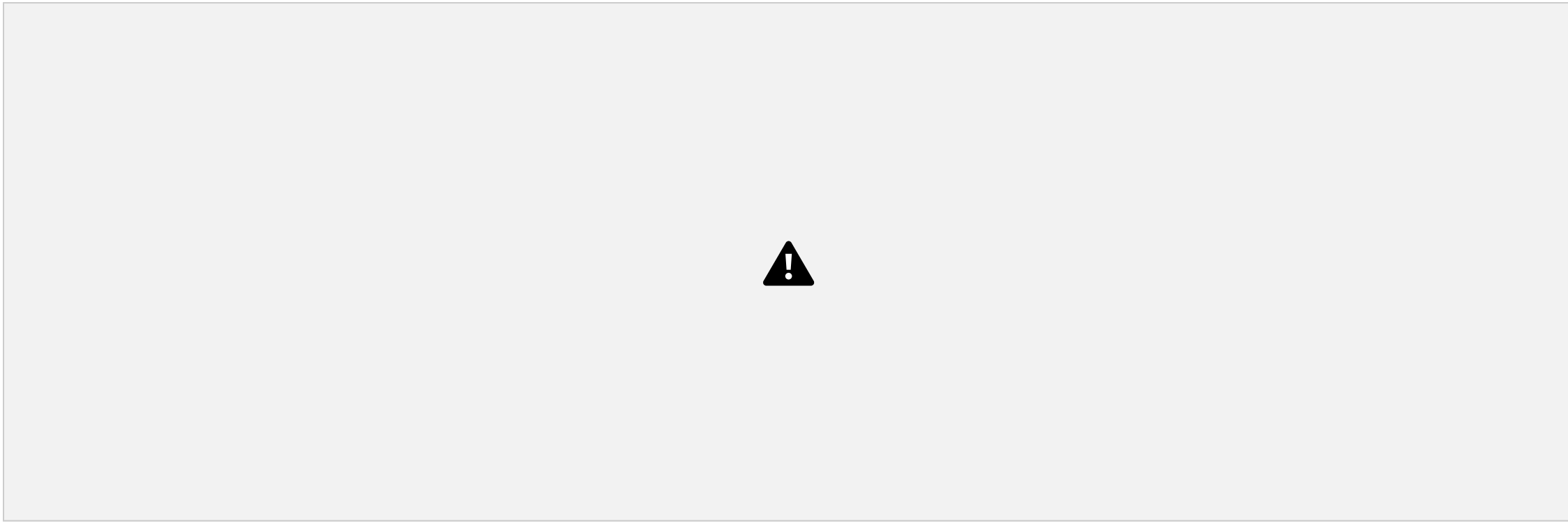

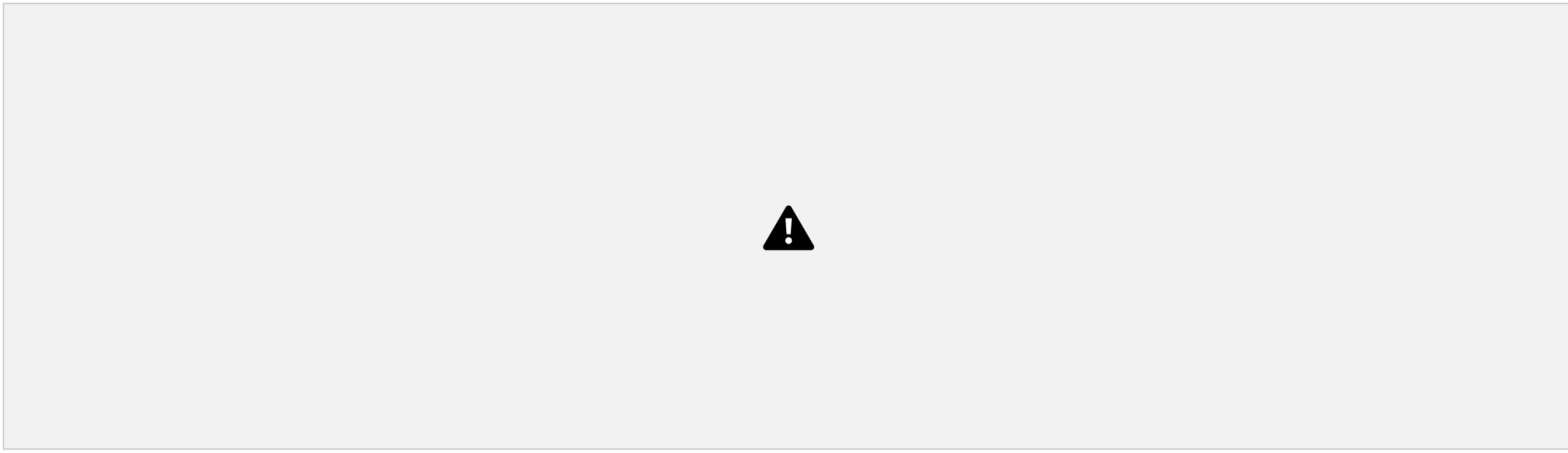

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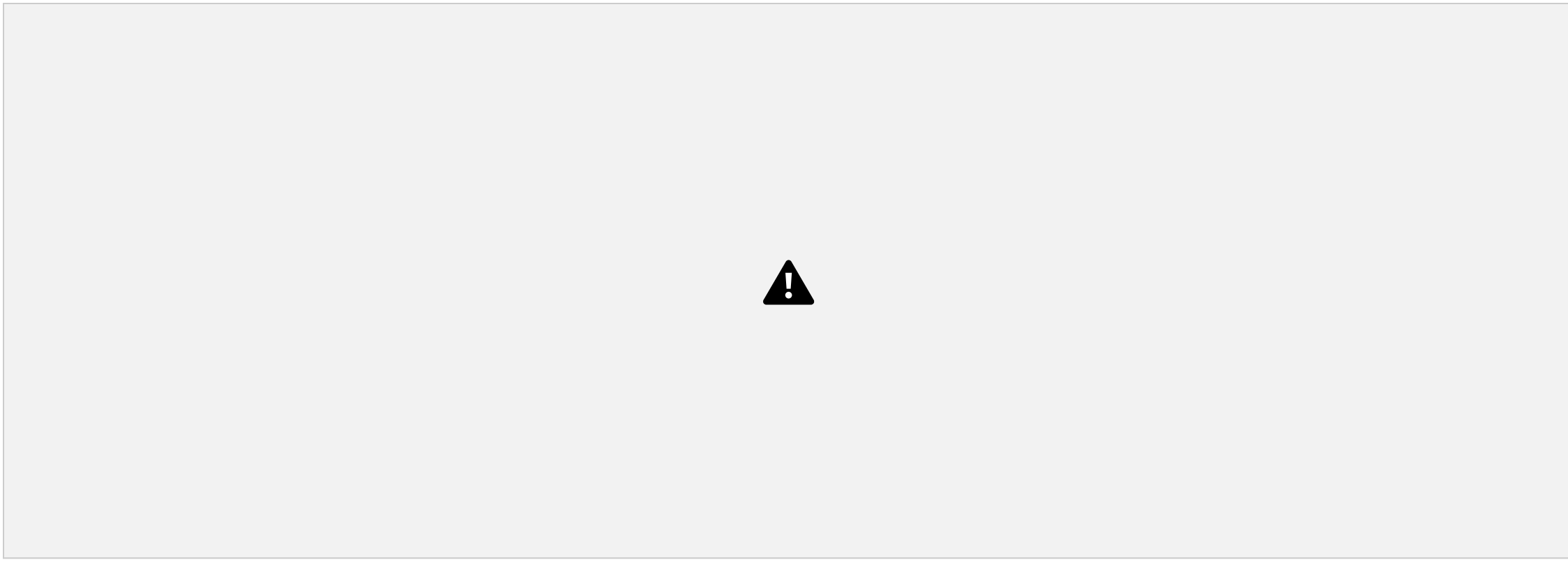

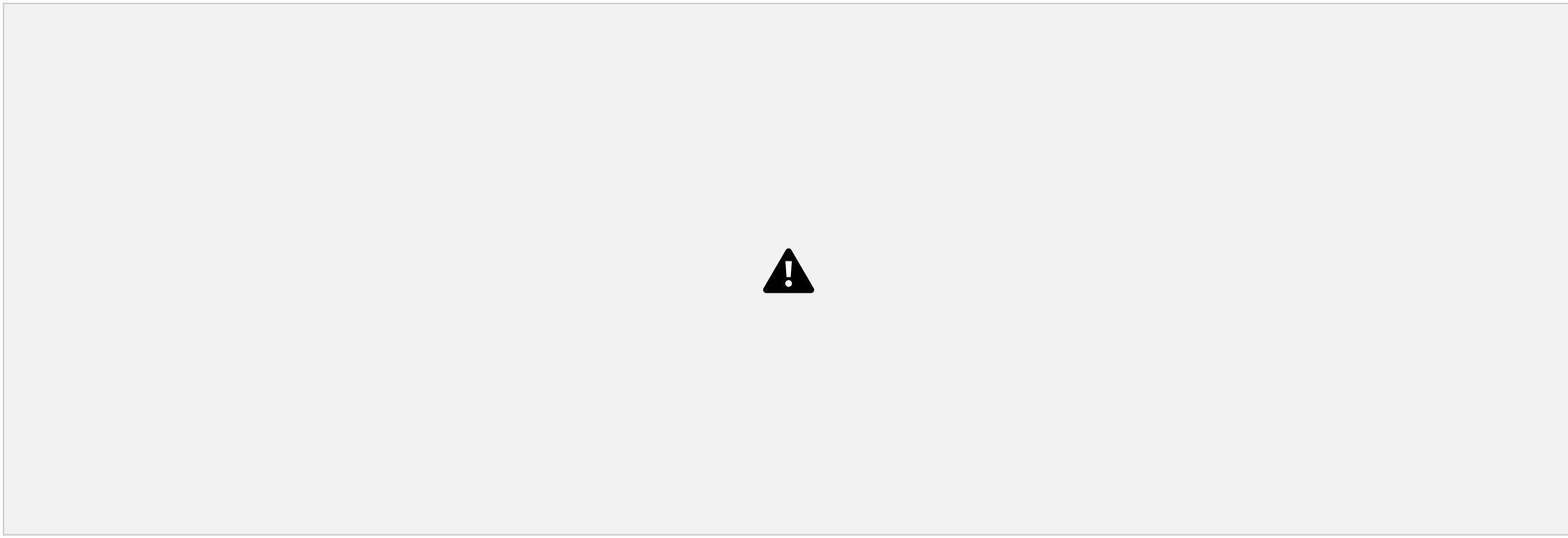

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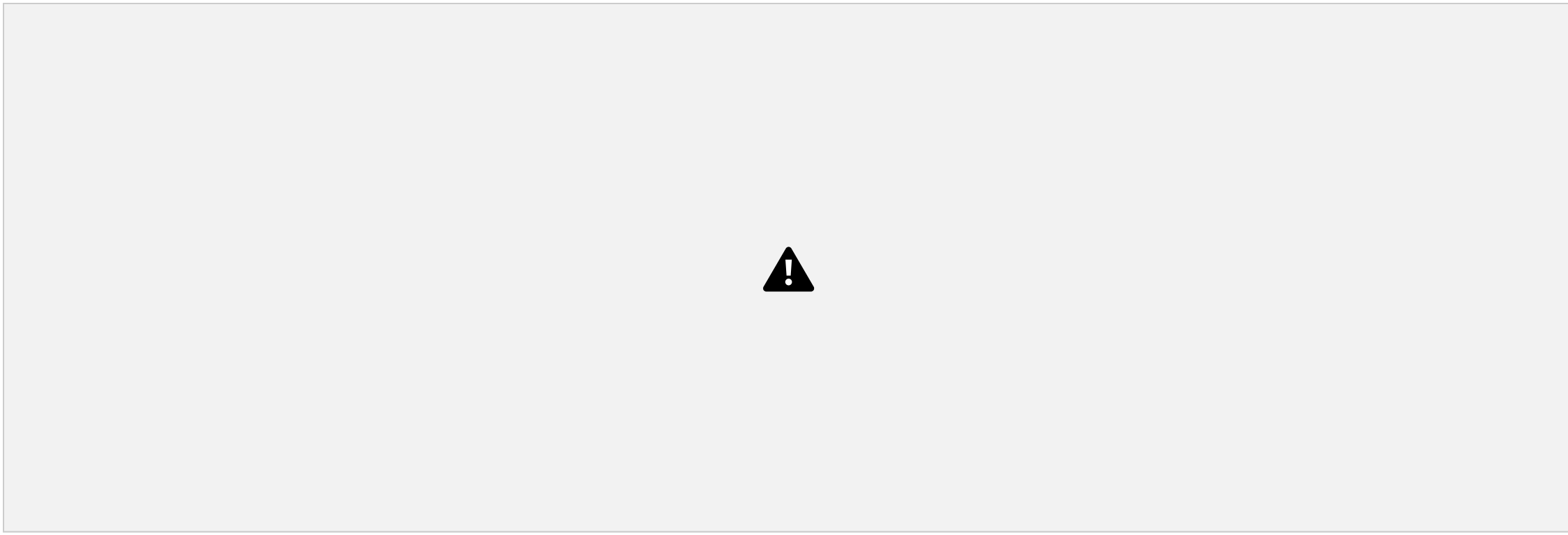

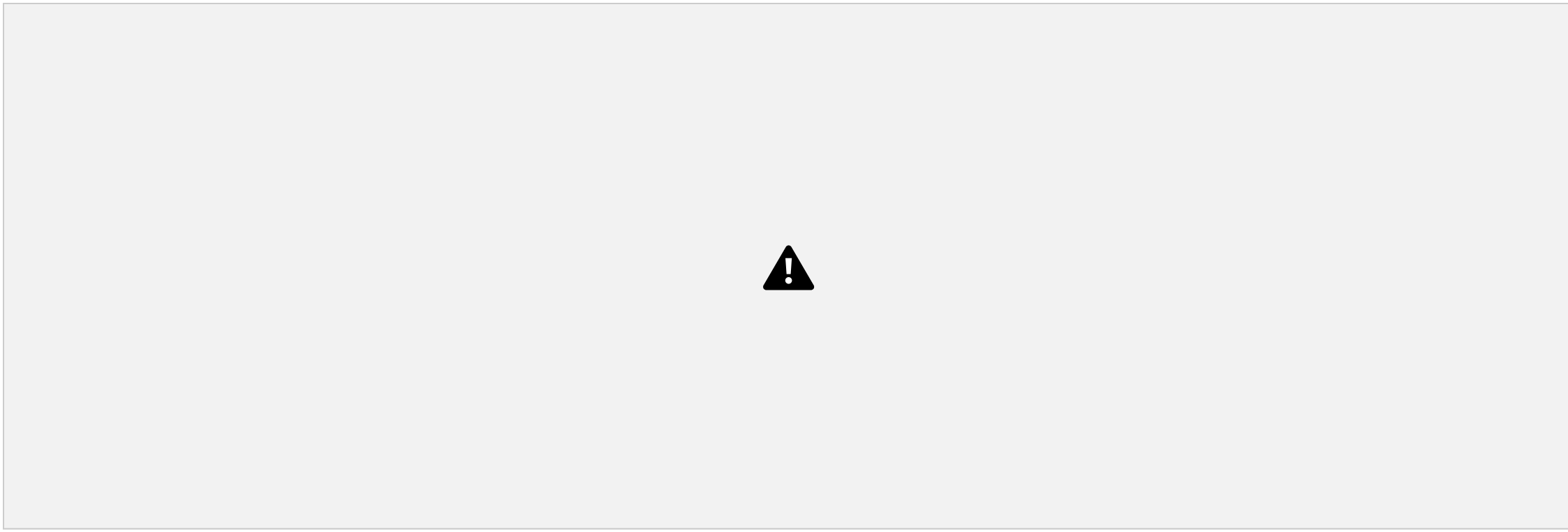

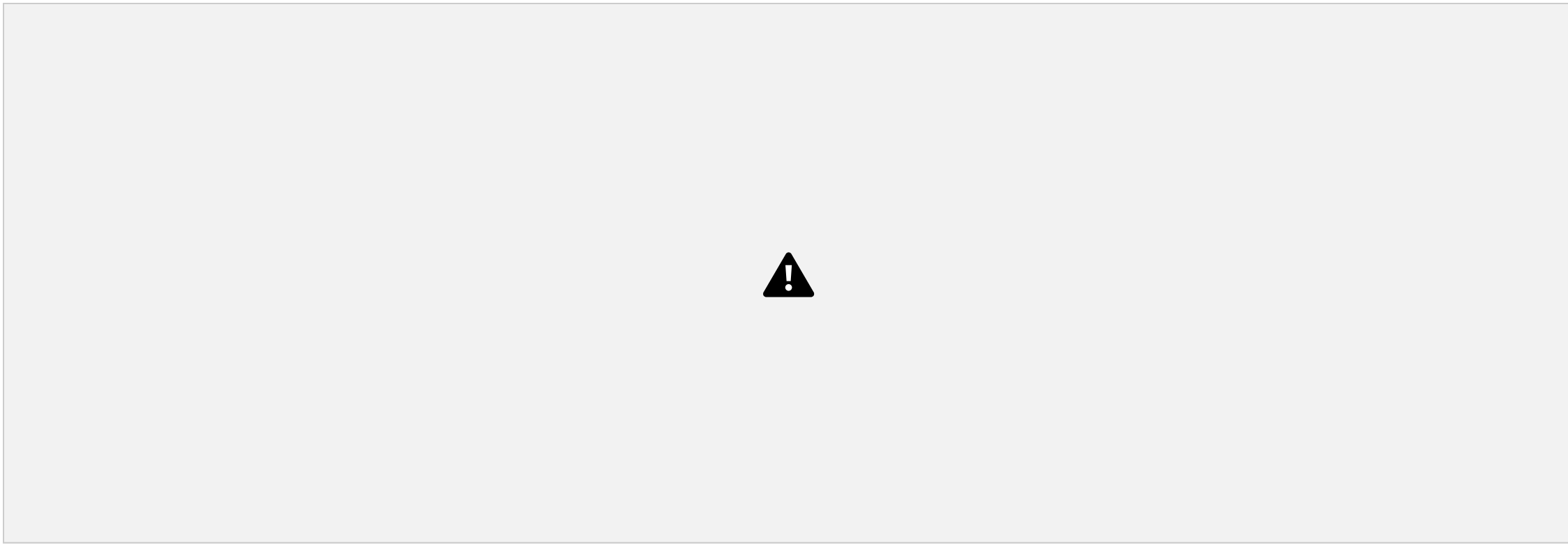

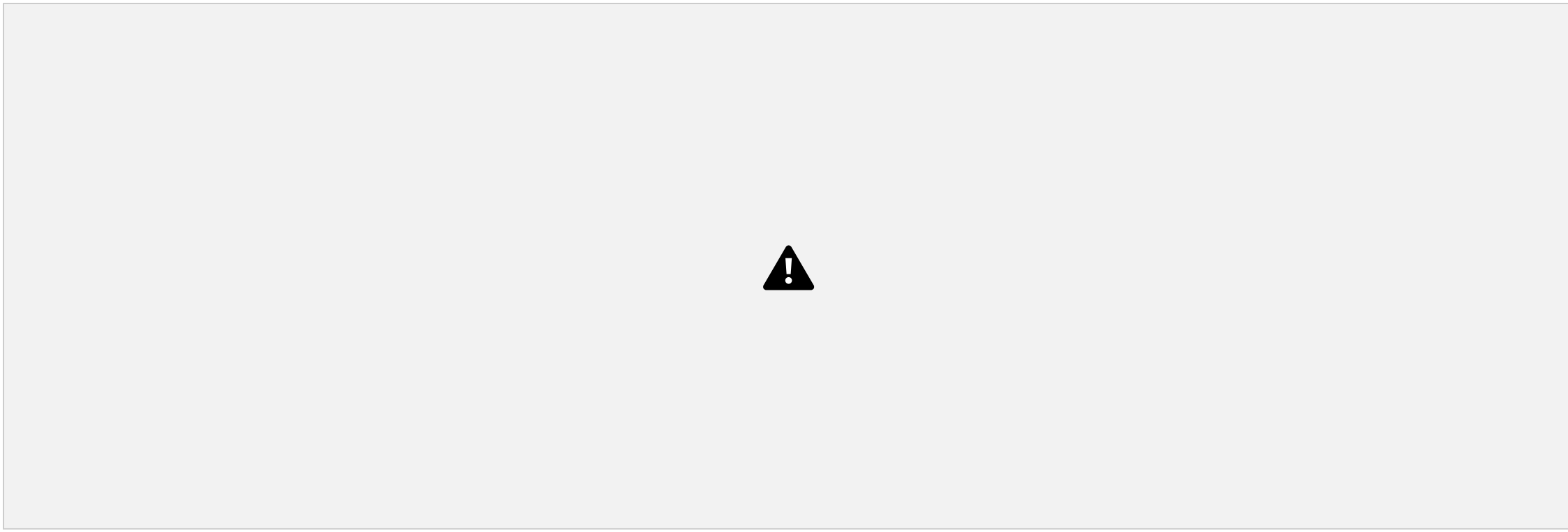

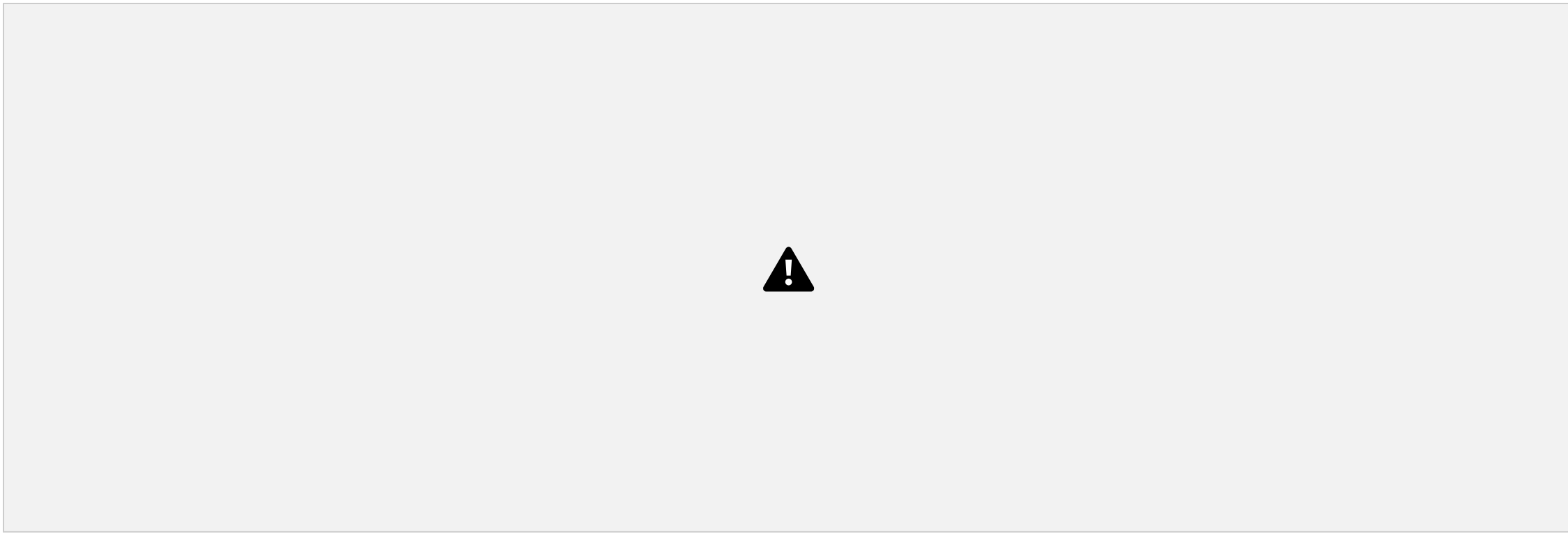

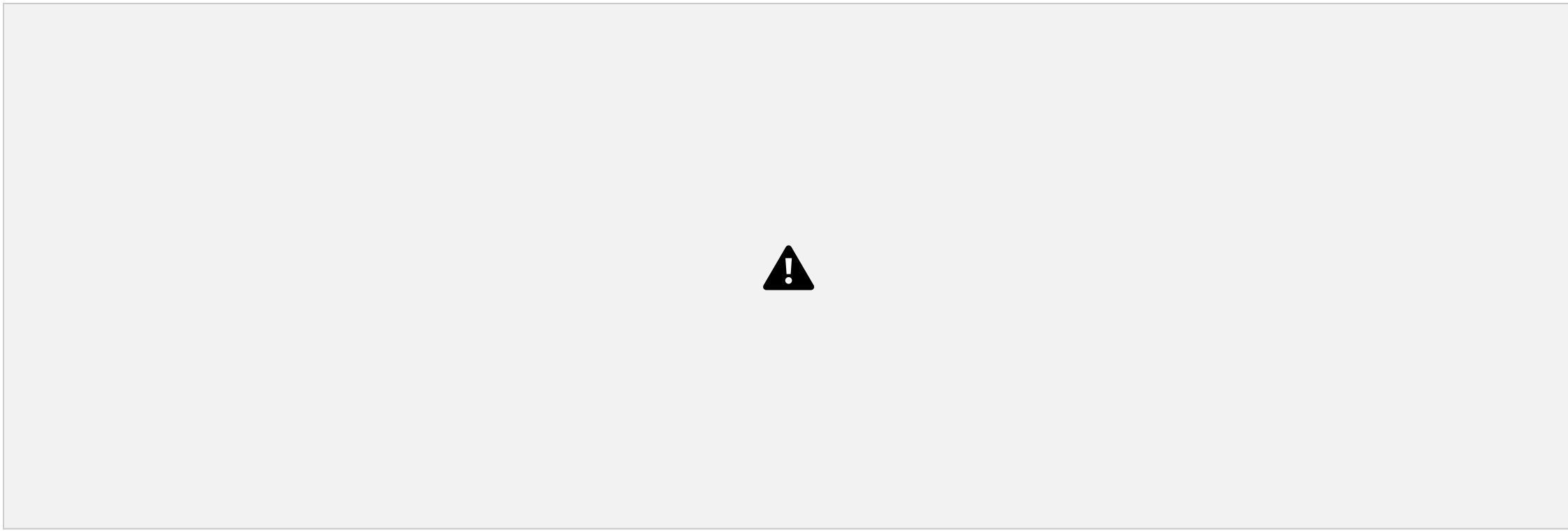

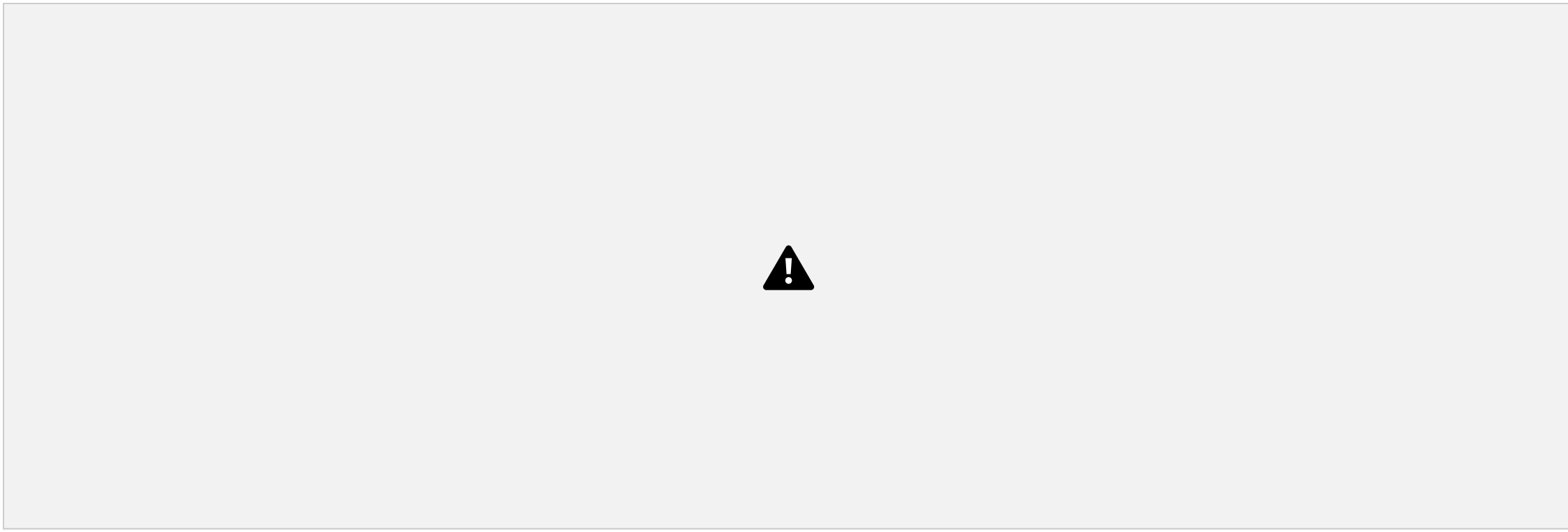

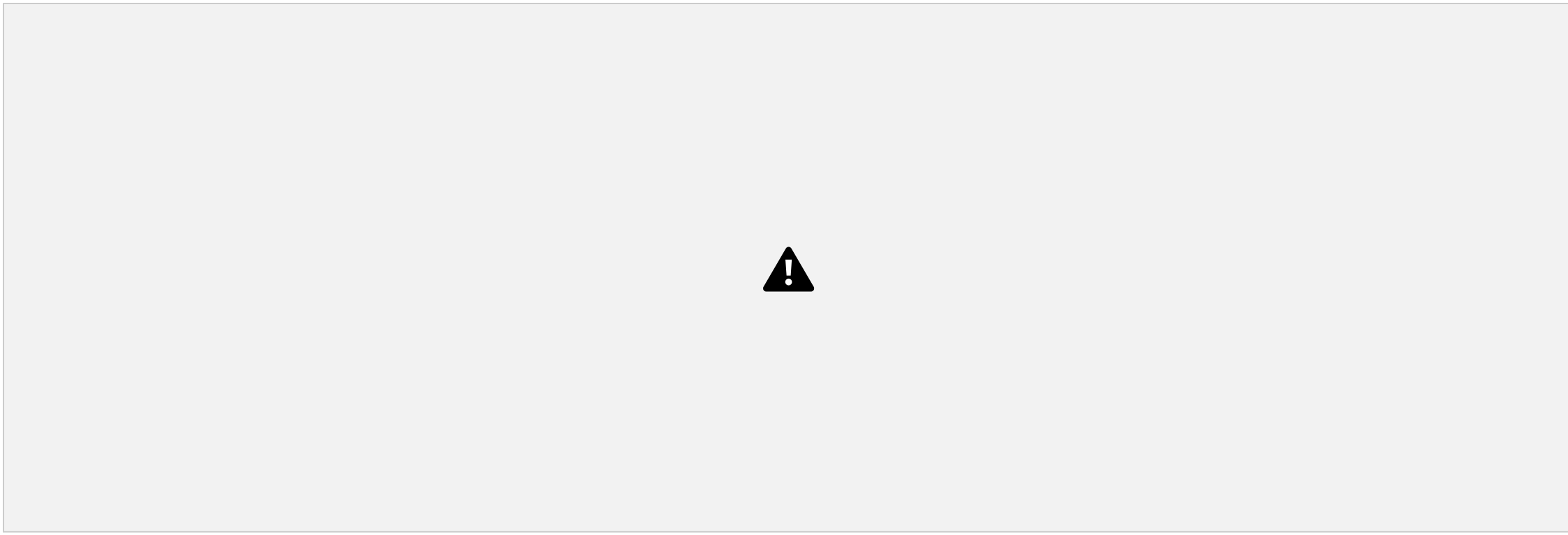

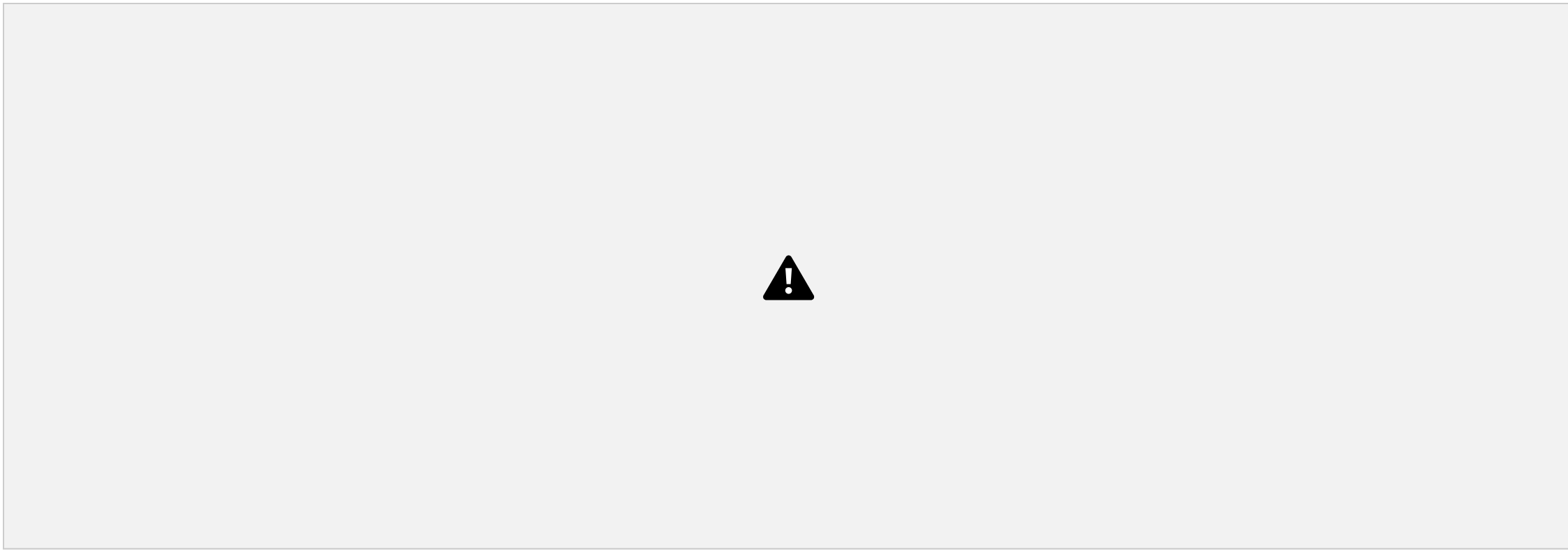

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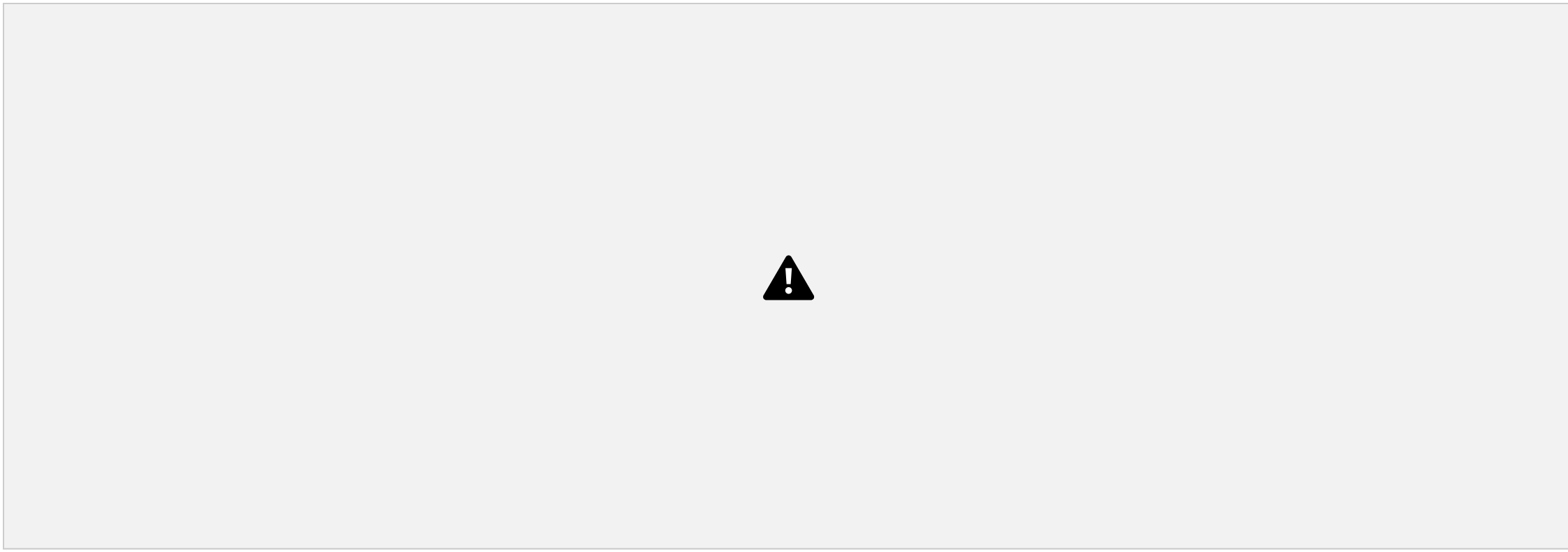

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