Statistical Physics (MSc)
Homework 3.

Pál Balázs

2019. november 28.

QUESTION

(On the next page there is a table.) Next to your name you can find five numbers under the column $G(X, X')$. Give the contribution of those graphs to $G(X, X')$ in coordinate space. Choose appropriate coordinates at the vertices and write it on your figures in the solutions. Next to your name you can find another five numbers under the column $G(\boldsymbol{k}, i\omega_n)$. Give the contribution of those graphs to $G(\boldsymbol{k}, i\omega_n)$. Once again, use clear notations for your conventions together with a picture showing the newly introduced momenta and frequencies. Classify your graphs if they are reducible or irreducible.

The row of the table with my name:

No.	Name	$G(X, X')$					$G(\boldsymbol{k}, i\omega_n)$				
⋮	⋮	⋮					⋮				
17	Pál Balázs	8	5	6	10	3	7	2	4	1	9
⋮	⋮	⋮					⋮				

REDUCIBILITY

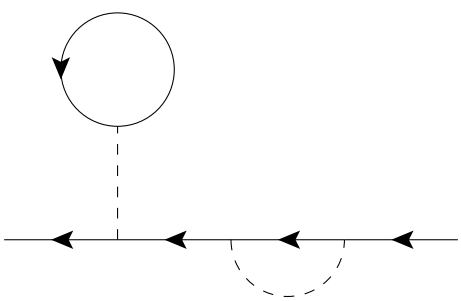
Def. We call a diagram **reducible** which fall into two disjunct pieces if we cut one internal propagator line.
Def. Similarly, we call a diagram **irreducible** which does not fall into two disjunct pieces if we cut one internal propagator line.

Using these definitions, we can easily identify the reducible and irreducible graphs:

Reducible graphs				Irreducible graphs					
1	3	7	8	2	4	5	6	9	10

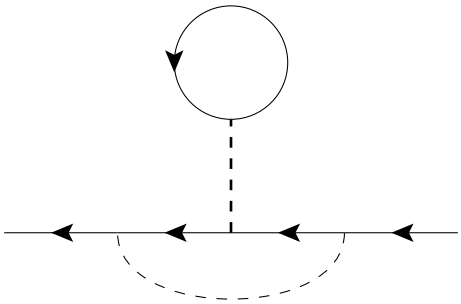
EXPRESSING THE GRAPHS

GRAPH 1. — FREQUENCY SPACE



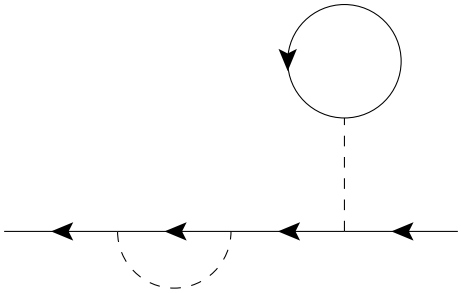
SOLUTION

GRAPH 2. — FREQUENCY SPACE



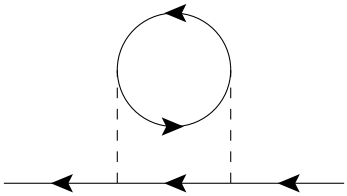
SOLUTION

GRAPH 3. — COORDINATE SPACE



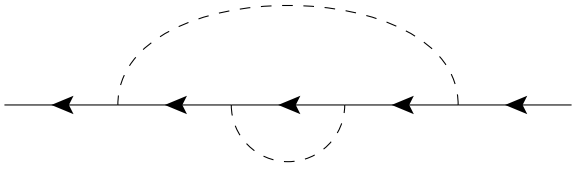
SOLUTION

GRAPH 4. — FREQUENCY SPACE



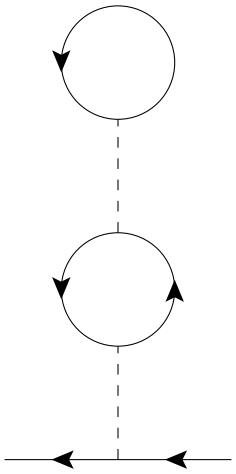
SOLUTION

GRAPH 5. — COORDINATE SPACE



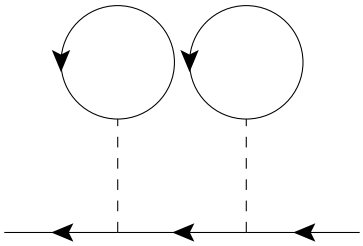
SOLUTION

GRAPH 6. — COORDINATE SPACE



SOLUTION

GRAPH 7. — FREQUENCY SPACE

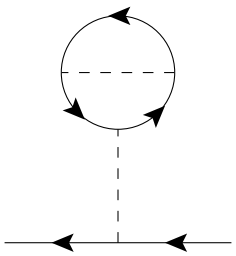


SOLUTION

GRAPH 8. — COORDINATE SPACE

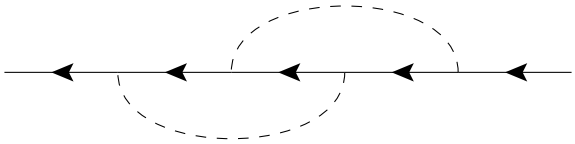
SOLUTION

GRAPH 9. — FREQUENCY SPACE



SOLUTION

GRAPH 10. — COORDINATE SPACE



SOLUTION