

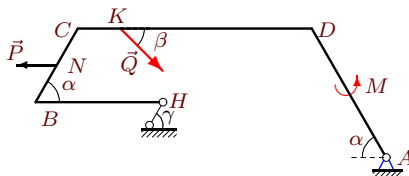
Определение реакций опор рамы

Тяжелая однородная рама расположена в вертикальной плоскости и опирается на неподвижный шарнир A и наклонный невесомый стержень H . К раме приложены горизонтальная сила P , наклонная сила Q и момент M . Учитывая погонный вес рамы ρ , найти реакции опор.

Курсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.: ФИЗМАТЛИТ, 2008. — 384 с. (с.31.)

Задача S4.1.

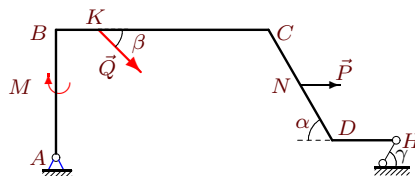
9



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 21 \text{ кН}$,
 $M = 70 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 4 \text{ м}$, $CD = 11 \text{ м}$,
 $DA = 7 \text{ м}$, $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.2.

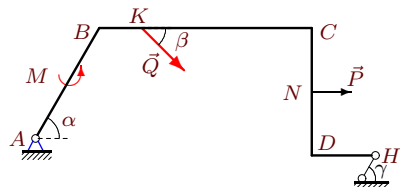
9



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 32 \text{ кН}$,
 $M = 20 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 10 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 3 \text{ м}$, $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.3.

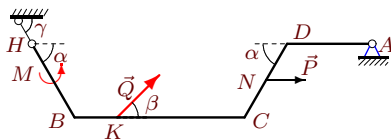
9



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$, $Q = 14 \text{ кН}$,
 $M = 30 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 10 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 3 \text{ м}$, $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.4.

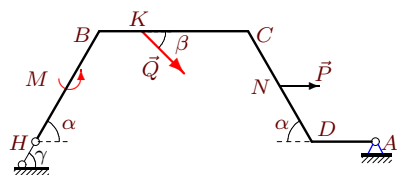
9



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$, $Q = 20 \text{ кН}$,
 $M = 70 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 8 \text{ м}$, $CD = 4 \text{ м}$,
 $DA = 4 \text{ м}$, $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.5.

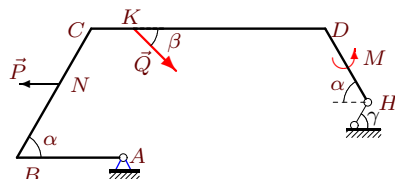
9



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$, $Q = 18 \text{ кН}$,
 $M = 70 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 7 \text{ м}$, $CD = 6 \text{ м}$,
 $DA = 3 \text{ м}$, $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

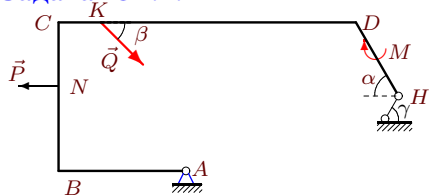
Задача S4.6.

9

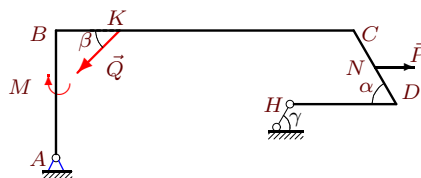


$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$, $Q = 19 \text{ кН}$,
 $M = 30 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 7 \text{ м}$, $CD = 11 \text{ м}$,
 $DH = 4 \text{ м}$, $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

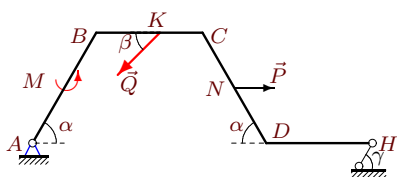
Задача S4.7.


$$\begin{aligned} \rho &= 1 \text{ kH/M}, P = 6 \text{ kH}, Q = 35 \text{ kH}, \\ M &= 15 \text{ kH/M}, \alpha = 60^\circ, \beta = 45^\circ, \gamma = 30^\circ, \\ AB &= 6 \text{ M}, BC = 7 \text{ M}, CD = 14 \text{ M}, \\ DH &= 4 \text{ M}, CK = 2 \text{ M}, CN = 3 \text{ M}. \end{aligned}$$

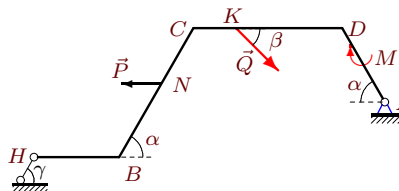
Задача S4.8.


$$\begin{aligned} \rho &= 1 \text{ kH/M}, P = 5 \text{ kH}, Q = 31 \text{ kH}, \\ M &= 15 \text{ kH/M}, \alpha = 60^\circ, \beta = 30^\circ, \gamma = 30^\circ, \\ AB &= 6 \text{ M}, BC = 14 \text{ M}, CD = 4 \text{ M}, \\ DH &= 5 \text{ M}, BK = 3 \text{ M}, CN = 2 \text{ M}. \end{aligned}$$

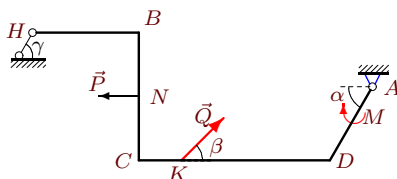
Задача S4.9.


$$\begin{aligned} \rho &= 1 \text{ kH/M}, P = 6 \text{ kH}, Q = 20 \text{ kH}, \\ M &= 30 \text{ kH/M}, \alpha = 60^\circ, \beta = 45^\circ, \gamma = 30^\circ, \\ AB &= 6 \text{ m}, BC = 5 \text{ m}, CD = 6 \text{ m}, \\ DH &= 5 \text{ m}, BK = 3 \text{ m}, CN = 3 \text{ m}. \end{aligned}$$

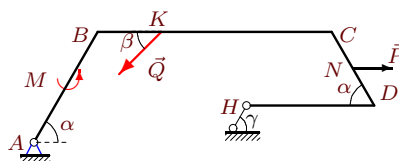
Задача S4.10.


$$\begin{aligned} \rho &= 3 \text{ кН/м}, P = 7 \text{ кН}, Q = 25 \text{ кН}, \\ M &= 25 \text{ кНм}, \alpha = 60^\circ, \beta = 30^\circ, \gamma = 60^\circ, \\ HB &= 4 \text{ м}, BC = 7 \text{ м}, CD = 7 \text{ м}, \\ DA &= 4 \text{ м}, CK = 2 \text{ м}, CN = 3 \text{ м}. \end{aligned}$$

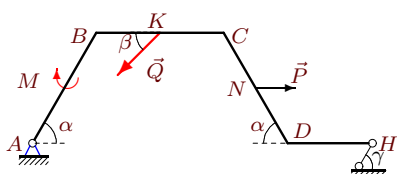
Задача S4.11.


$$\begin{aligned} \rho &= 3 \text{ kH/M}, P = 7 \text{ kH}, Q = 31 \text{ kH}, \\ M &= 25 \text{ kH/M}, \alpha = 60^\circ, \beta = 30^\circ, \gamma = 60^\circ, \\ HB &= 5 \text{ m}, BC = 6 \text{ m}, CD = 9 \text{ m}, \\ DA &= 4 \text{ m}, CK = 2 \text{ m}, CN = 3 \text{ m}. \end{aligned}$$

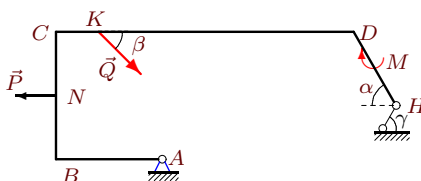
Задача S4.12.


$$\begin{aligned} \rho &= 1 \text{ kH/M}, P = 5 \text{ kH}, Q = 17 \text{ kH}, \\ M &= 30 \text{ kH/M}, \alpha = 60^\circ, \beta = 30^\circ, \gamma = 30^\circ, \\ AB &= 6 \text{ M}, BC = 11 \text{ M}, CD = 4 \text{ M}, \\ DH &= 6 \text{ M}, BK = 3 \text{ M}, CN = 2 \text{ M}. \end{aligned}$$

Задача S4.13.

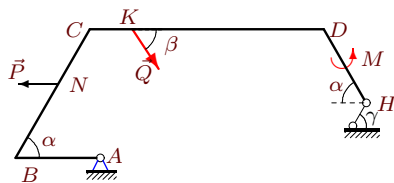

$$\begin{aligned} \rho &= 1 \text{ kH/M}, P = 5 \text{ kH}, Q = 24 \text{ kH}, \\ M &= 15 \text{ kH/M}, \alpha = 60^\circ, \beta = 30^\circ, \gamma = 30^\circ, \\ AB &= 6 \text{ M}, BC = 6 \text{ M}, CD = 6 \text{ M}, \\ DH &= 4 \text{ M}, BK = 3 \text{ M}, CN = 3 \text{ M}. \end{aligned}$$

Задача S4.14.


$$\begin{aligned} \rho &= 1 \text{ kH/M}, P = 6 \text{ kH}, Q = 27 \text{ kH}, \\ M &= 15 \text{ kH/M}, \alpha = 60^\circ, \beta = 45^\circ, \gamma = 30^\circ, \\ AB &= 5 \text{ M}, BC = 6 \text{ M}, CD = 14 \text{ M}, \\ DH &= 4 \text{ M}, CK = 2 \text{ M}, CN = 3 \text{ M}. \end{aligned}$$

Задача S4.15.

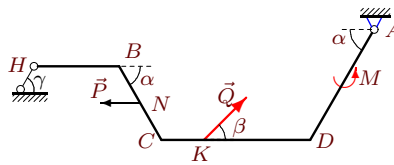
9



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 17 \text{ кН}$,
 $M = 30 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 7 \text{ м}$, $CD = 11 \text{ м}$,
 $DH = 4 \text{ м}$, $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.16.

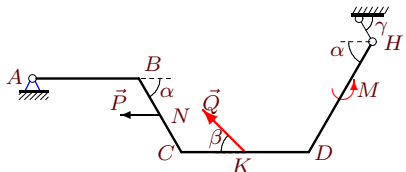
9



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 20 \text{ кН}$,
 $M = 70 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 4 \text{ м}$, $CD = 7 \text{ м}$,
 $DA = 6 \text{ м}$, $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.17.

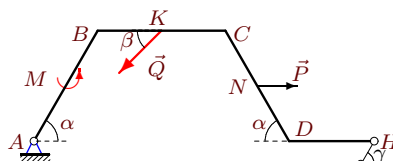
9



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 17 \text{ кН}$,
 $M = 50 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 6 \text{ м}$, $CK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.18.

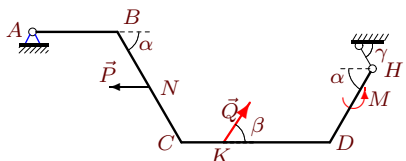
9



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$, $Q = 21 \text{ кН}$,
 $M = 50 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 6 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 4 \text{ м}$, $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.19.

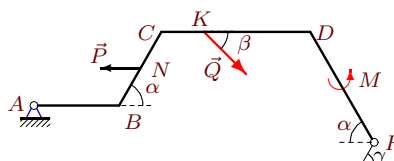
9



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 18 \text{ кН}$,
 $M = 30 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$, $CD = 7 \text{ м}$,
 $DH = 4 \text{ м}$, $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.20.

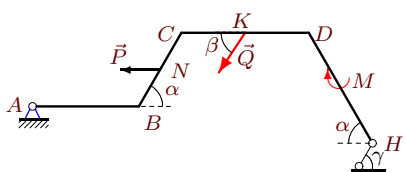
9



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$, $Q = 17 \text{ кН}$,
 $M = 30 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$, $CD = 7 \text{ м}$,
 $DH = 6 \text{ м}$, $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.21.

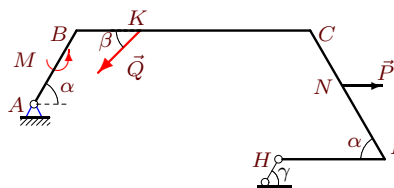
9



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$, $Q = 22 \text{ кН}$,
 $M = 20 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 6 \text{ м}$, $CK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.22.

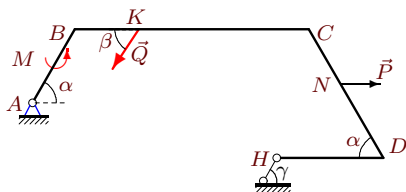
9



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$, $Q = 19 \text{ кН}$,
 $M = 30 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$, $CD = 7 \text{ м}$,
 $DH = 5 \text{ м}$, $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.23.

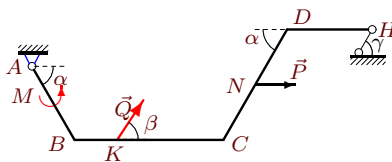
9



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$, $Q = 16 \text{ кН}$,
 $M = 50 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$, $CD = 7 \text{ м}$,
 $DH = 5 \text{ м}$, $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.24.

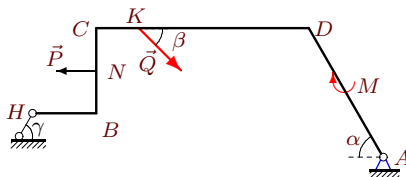
9



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$, $Q = 21 \text{ кН}$,
 $M = 50 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 7 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 4 \text{ м}$, $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.25.

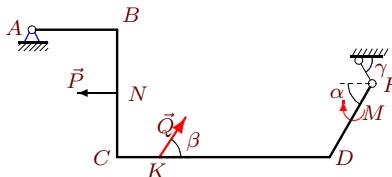
9



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 35 \text{ кН}$,
 $M = 25 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 3 \text{ м}$, $BC = 4 \text{ м}$, $CD = 10 \text{ м}$,
 $DA = 7 \text{ м}$, $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.26.

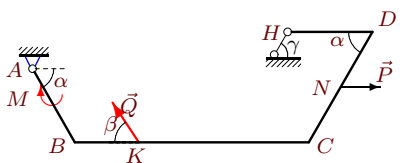
9



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 34 \text{ кН}$,
 $M = 15 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$, $CD = 10 \text{ м}$,
 $DH = 4 \text{ м}$, $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.27.

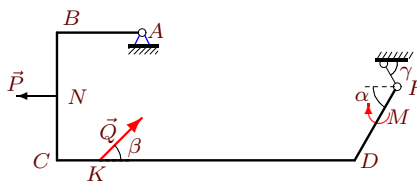
9



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$, $Q = 26 \text{ кН}$,
 $M = 15 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 4 \text{ м}$, $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.28.

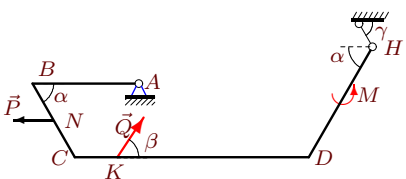
9



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$, $Q = 33 \text{ кН}$,
 $M = 15 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$, $CD = 14 \text{ м}$,
 $DH = 4 \text{ м}$, $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Задача S4.29.

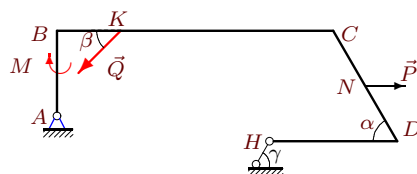
9



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$, $Q = 20 \text{ кН}$,
 $M = 50 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$, $CD = 11 \text{ м}$,
 $DH = 6 \text{ м}$, $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Задача S4.30.

9



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$, $Q = 35 \text{ кН}$,
 $M = 20 \text{ кНм}$, $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 13 \text{ м}$, $CD = 6 \text{ м}$,
 $DH = 6 \text{ м}$, $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

S4 Ответы.
Определение реакций опор рамы

08.04.2012

	$M_A(Q)$	$M_A(P)$	$\Sigma_k M_A(G_k)$	h	X_A	Y_A	R_H
1	21.000	30.311	762.8	-10.392	-53.721	20.828	85.069
2	-181.019	-23.813	-325.0	10.745	-65.810	36.445	51.170
3	-100.937	-13.177	-210.5	8.696	-45.239	17.960	33.879
4	-120.716	13.856	504.0	-13.856	-5.286	16.662	33.713
5	73.871	-20.785	555.0	-13.856	-45.196	36.348	48.937
6	-104.500	17.321	-50.8	3.500	-38.160	21.082	30.837
7	-74.246	24.000	10.0	1.938	-43.439	41.494	28.509
8	114.581	-21.340	-225.5	3.304	-16.754	22.214	44.572
9	-11.368	-15.588	-161.0	8.000	-8.957	26.270	19.745
10	12.500	6.062	527.3	-12.990	-34.697	43.779	40.092
11	-46.500	-3.249	588.0	-15.124	-36.814	27.111	33.935
12	25.500	-17.321	-240.5	3.500	-40.339	6.597	57.806
13	36.000	-12.990	-164.0	8.000	-1.102	24.251	19.499
14	-57.276	18.000	-25.5	3.304	-34.003	36.019	24.146
15	-73.612	24.249	-77.3	4.000	-22.417	28.646	24.153
16	10.000	-24.249	463.5	-12.990	-30.306	18.383	39.972
17	78.567	-12.124	-367.0	12.538	33.151	15.849	19.983
18	31.500	-15.588	-328.0	11.314	-4.194	38.119	23.166
19	187.061	-18.187	-174.5	6.500	-5.248	7.287	-3.750
20	-137.808	10.392	-181.5	9.500	-31.447	18.341	29.360
21	-152.420	13.856	-367.0	12.538	-10.639	31.413	41.916
22	9.500	-4.330	-259.8	8.000	-12.857	22.464	28.073
23	-41.569	-6.928	-519.5	9.969	-36.742	31.114	51.962
24	109.119	6.928	-323.0	10.089	-29.500	12.813	15.557
25	17.500	28.435	588.8	-15.321	-43.209	55.036	39.795
26	278.669	-21.000	-182.0	5.804	-19.053	-0.218	-10.453
27	67.550	6.062	-229.5	4.500	-26.887	-16.504	37.975
28	93.338	-18.000	-54.0	3.804	-18.778	5.499	-1.666
29	17.321	-13.856	-112.0	9.003	2.598	30.082	6.502
30	68.744	-8.412	-499.0	7.917	-16.656	34.533	57.935

S4 файл о4s9B