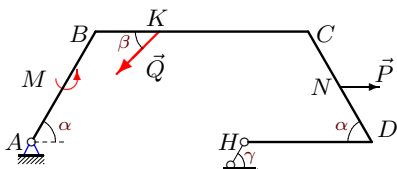
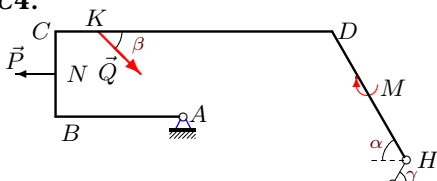
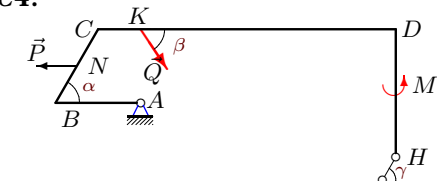
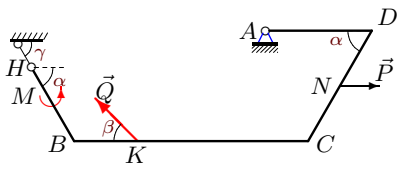
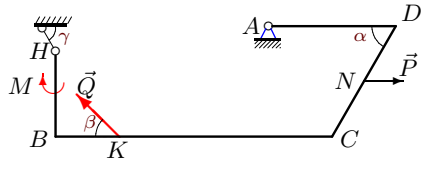
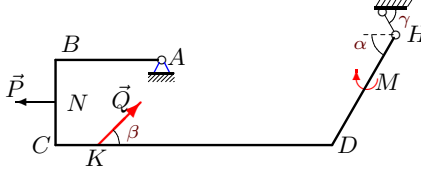


Равновесие тяжелой рамы

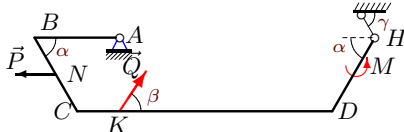
Тяжелая однородная рама расположена в вертикальной плоскости и опирается на неподвижный шарнир A и наклонный невесомый стержень H . К раме приложены горизонтальная сила P , наклонная сила Q и момент M . Учитывая погонный вес рамы ρ , найти реакции опор.

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<p>Вариант 1</p> <p>С4.</p> 	<p>$\rho = 2 \text{ кН/м}, P = 6 \text{ кН},$ $Q = 17 \text{ кН}, M = 50 \text{ кНм},$ $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 45^\circ,$ $AB = 6 \text{ м}, BC = 10 \text{ м},$ $CD = 6 \text{ м}, DH = 6 \text{ м},$ $BK = 3 \text{ м}, CN = 3 \text{ м}.$</p>
<p>Вариант 2</p> <p>С4.</p> 	<p>$\rho = 2 \text{ кН/м}, P = 7 \text{ кН},$ $Q = 33 \text{ кН}, M = 20 \text{ кНм},$ $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 45^\circ,$ $AB = 6 \text{ м}, BC = 4 \text{ м},$ $CD = 13 \text{ м}, DH = 7 \text{ м},$ $CK = 2 \text{ м}, CN = 2 \text{ м}.$</p>
<p>Вариант 3</p> <p>С4.</p> 	<p>$\rho = 2 \text{ кН/м}, P = 8 \text{ кН},$ $Q = 11 \text{ кН}, M = 50 \text{ кНм},$ $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 45^\circ,$ $AB = 4 \text{ м}, BC = 4 \text{ м},$ $CD = 14 \text{ м}, DH = 6 \text{ м},$ $CK = 2 \text{ м}, CN = 2 \text{ м}.$</p>
<p>Вариант 4</p> <p>С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 8 \text{ кН},$ $Q = 19 \text{ кН}, M = 70 \text{ кНм},$ $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 60^\circ,$ $HB = 4 \text{ м}, BC = 11 \text{ м},$ $CD = 6 \text{ м}, DA = 5 \text{ м},$ $BK = 3 \text{ м}, CN = 3 \text{ м}.$</p>
<p>Вариант 5</p> <p>С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 8 \text{ кН},$ $Q = 29 \text{ кН}, M = 25 \text{ кНм},$ $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 60^\circ,$ $HB = 4 \text{ м}, BC = 13 \text{ м},$ $CD = 6 \text{ м}, DA = 6 \text{ м},$ $BK = 3 \text{ м}, CN = 3 \text{ м}.$</p>
<p>Вариант 6</p> <p>С4.</p> 	<p>$\rho = 2 \text{ кН/м}, P = 6 \text{ кН},$ $Q = 28 \text{ кН}, M = 20 \text{ кНм},$ $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 45^\circ,$ $AB = 5 \text{ м}, BC = 4 \text{ м},$ $CD = 13 \text{ м}, DH = 6 \text{ м},$ $CK = 2 \text{ м}, CN = 2 \text{ м}.$</p>

Вариант 7

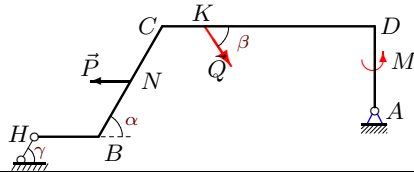
С4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 12 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 8

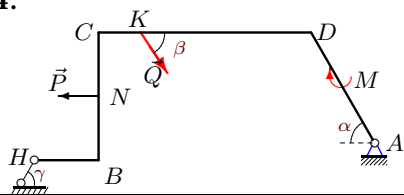
С4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 12 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 3 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 10 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 9

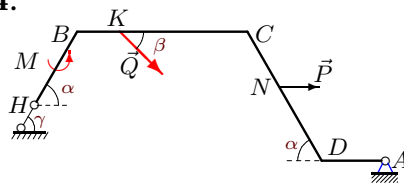
С4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 3 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 10 \text{ м}$, $DA = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 10

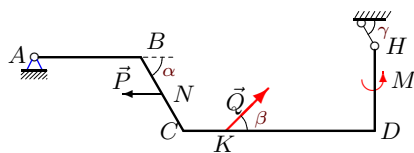
С4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 7 \text{ м}$, $DA = 3 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 11

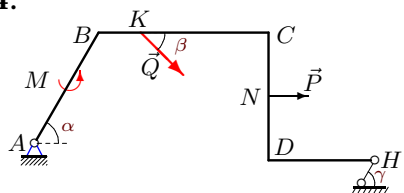
С4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 11 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 9 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 12

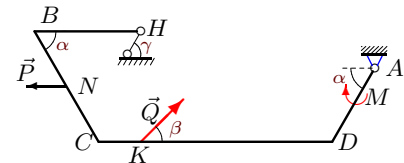
С4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 14 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 13

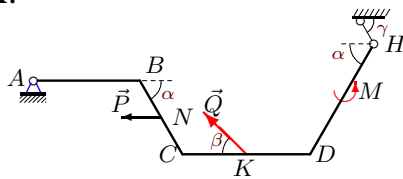
С4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 25 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 14

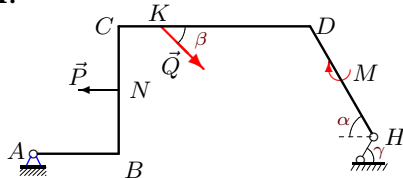
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 15

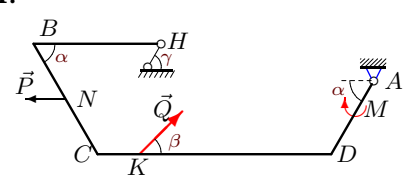
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 28 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 9 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 16

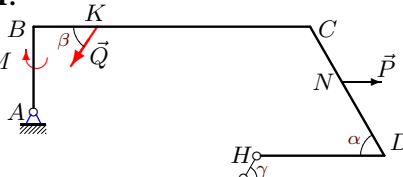
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 24 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 17

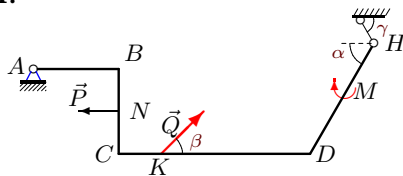
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 7 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 18

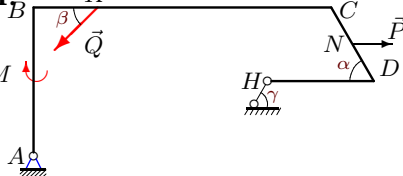
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 9 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 19

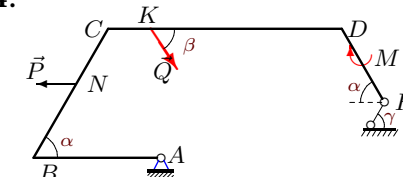
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 28 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 7 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 20

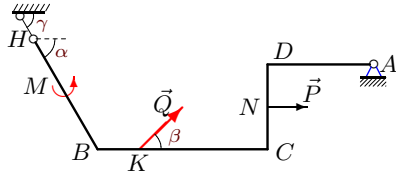
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 26 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 21

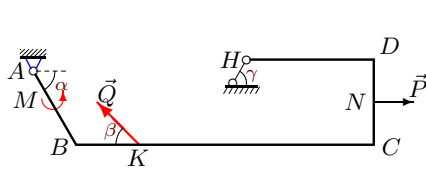
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 15 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 22

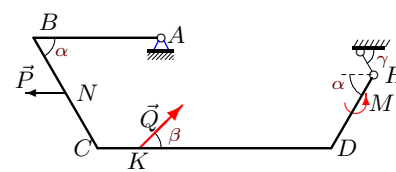
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 12 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 23

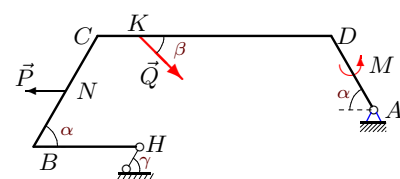
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 18 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 24

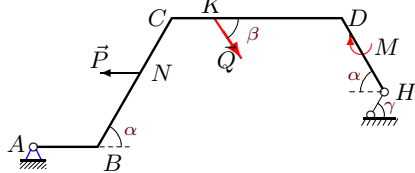
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 18 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 25

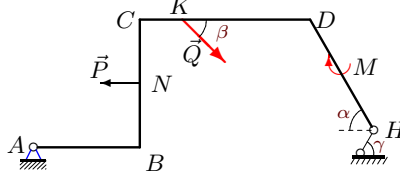
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 23 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 3 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 26

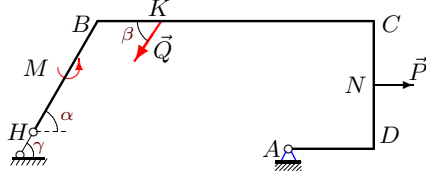
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 33 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 27

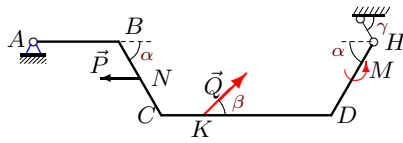
C4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 14 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 4 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 28

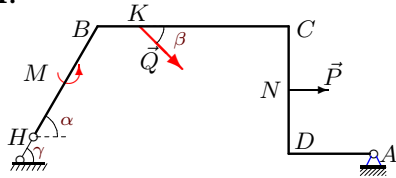
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 29

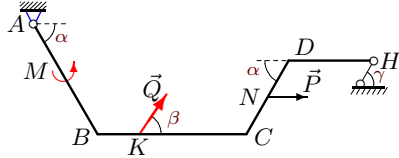
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 14 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 9 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 4 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 30

C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 19 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 4 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Ответы

	$M_A(Q)$	$M_A(P)$	$\Sigma_k M_A(G_k)$	h	X_A	Y_A	R_H
1	25.500	-15.588	-508.0	7.071	-36.086	19.691	63.369
2	0.000	14.000	-51.5	8.883	-20.912	78.757	6.473
3	-19.053	13.856	-244.0	10.278	-11.204	51.823	19.380
4	-150.421	20.785	135.0	-10.392	9.061	58.285	7.252
5	-250.095	20.785	121.5	-9.258	5.334	78.917	-14.345
6	54.995	-12.000	-88.0	8.624	-12.919	36.670	7.538
7	36.373	-13.856	-144.0	8.485	3.457	23.857	8.424
8	59.138	12.617	487.5	-13.258	-20.731	38.290	47.461
9	214.774	19.765	631.5	-13.454	-37.755	47.712	62.510
10	20.000	-24.249	551.3	-15.588	-44.111	41.722	39.581
11	96.948	-12.124	-408.0	11.693	15.742	19.702	23.363
12	-98.000	-10.981	-198.5	8.696	-44.758	16.046	31.908
13	-133.217	-6.928	723.0	-10.392	-36.517	13.834	53.680
14	73.945	-12.124	-367.0	12.538	32.705	16.295	20.352
15	-237.588	18.000	-195.5	7.304	-64.795	15.356	58.885
16	-60.000	-6.062	754.5	-9.526	-48.606	8.687	69.643
17	-20.933	-9.813	-268.8	7.036	-28.210	37.961	44.699
18	247.487	-12.000	-187.5	9.036	-21.910	0.077	-3.651
19	127.741	-31.608	-451.0	5.278	-31.974	23.777	71.026
20	-67.550	27.713	-46.5	5.588	-18.457	65.060	19.031
21	-30.538	14.000	574.5	-13.258	3.691	20.482	47.364
22	13.033	10.249	-544.0	6.692	-48.252	-2.223	70.339
23	53.408	-15.588	-18.5	3.500	-18.931	21.318	-14.091
24	95.916	6.928	723.0	-8.660	-56.450	1.143	103.443
25	-239.023	27.713	-367.5	9.830	-46.574	20.845	60.916
26	-286.973	18.000	-403.0	10.745	-68.115	20.964	64.398
27	114.746	-27.000	190.5	-10.794	-18.131	71.184	32.262
28	162.127	-12.124	-336.0	11.314	1.358	17.358	12.021
29	4.254	-21.000	586.5	-14.258	-41.559	43.142	44.869
30	131.636	24.249	-154.5	9.500	-13.639	6.197	-3.304