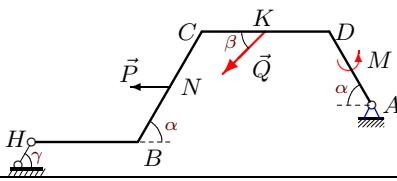
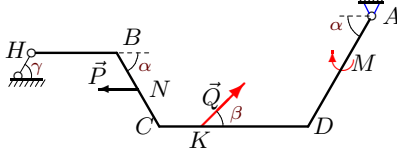
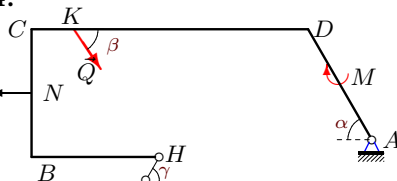
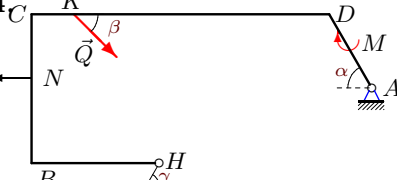
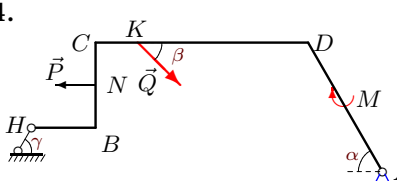
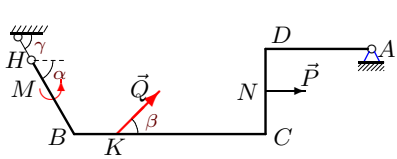


Равновесие тяжелой рамы

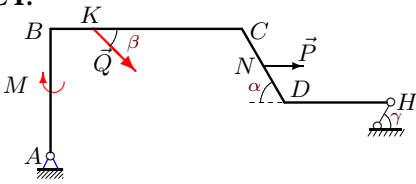
Тяжелая однородная рама расположена в вертикальной плоскости и опирается на неподвижный шарнир A и наклонный невесомый стержень H . К раме приложены горизонтальная сила P , наклонная сила Q и момент M . Учитывая погонный вес рамы ρ , найти реакции опор.

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<p>Вариант 1 С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 7 \text{ кН},$ $Q = 17 \text{ кН}, M = 70 \text{ кНм},$ $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 60^\circ,$ $HB = 5 \text{ м}, BC = 6 \text{ м},$ $CD = 6 \text{ м}, DA = 4 \text{ м},$ $CK = 3 \text{ м}, CN = 3 \text{ м}.$</p>
<p>Вариант 2 С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 8 \text{ кН},$ $Q = 25 \text{ кН}, M = 25 \text{ кНм},$ $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 60^\circ,$ $HB = 4 \text{ м}, BC = 4 \text{ м},$ $CD = 7 \text{ м}, DA = 6 \text{ м},$ $CK = 2 \text{ м}, CN = 2 \text{ м}.$</p>
<p>Вариант 3 С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 9 \text{ кН},$ $Q = 32 \text{ кН}, M = 25 \text{ кНм},$ $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 60^\circ,$ $HB = 6 \text{ м}, BC = 6 \text{ м},$ $CD = 13 \text{ м}, DA = 6 \text{ м},$ $CK = 2 \text{ м}, CN = 3 \text{ м}.$</p>
<p>Вариант 4 С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 8 \text{ кН},$ $Q = 35 \text{ кН}, M = 25 \text{ кНм},$ $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 60^\circ,$ $HB = 6 \text{ м}, BC = 7 \text{ м},$ $CD = 14 \text{ м}, DA = 4 \text{ м},$ $CK = 2 \text{ м}, CN = 3 \text{ м}.$</p>
<p>Вариант 5 С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 8 \text{ кН},$ $Q = 34 \text{ кН}, M = 25 \text{ кНм},$ $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 60^\circ,$ $HB = 3 \text{ м}, BC = 4 \text{ м},$ $CD = 10 \text{ м}, DA = 7 \text{ м},$ $CK = 2 \text{ м}, CN = 2 \text{ м}.$</p>
<p>Вариант 6 С4.</p> 	<p>$\rho = 3 \text{ кН/м}, P = 7 \text{ кН},$ $Q = 13 \text{ кН}, M = 70 \text{ кНм},$ $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 60^\circ,$ $HB = 4 \text{ м}, BC = 9 \text{ м},$ $CD = 4 \text{ м}, DA = 5 \text{ м},$ $BK = 2 \text{ м}, CN = 2 \text{ м}.$</p>

Вариант 7

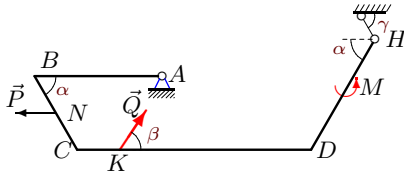
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 30 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 9 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 8

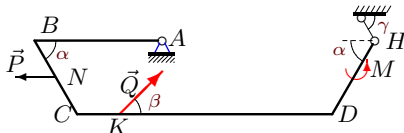
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 9

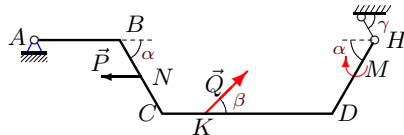
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 12 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 10

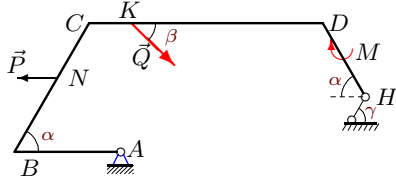
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 23 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 11

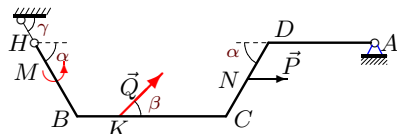
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 26 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 12

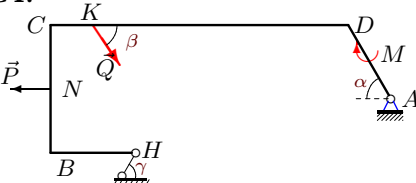
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 19 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 13

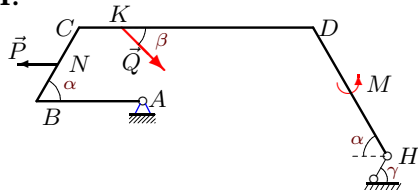
C4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 14

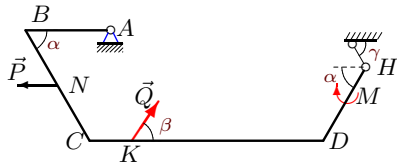
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 7 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 15

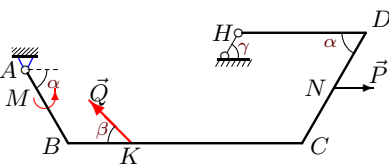
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 22 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 16

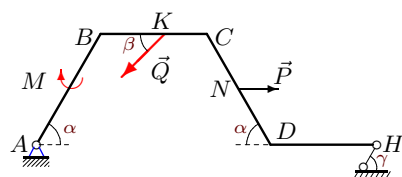
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 17

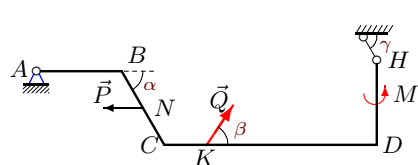
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 22 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 5 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 18

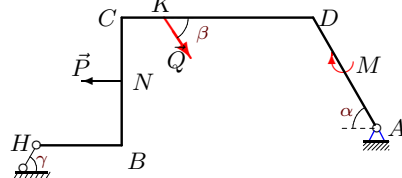
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 13 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 10 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 19

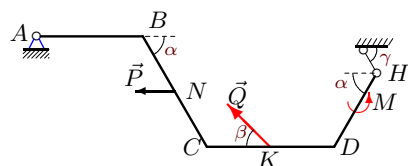
C4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 28 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 9 \text{ м}$, $DA = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 20

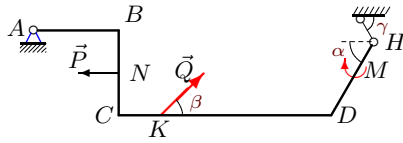
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 21

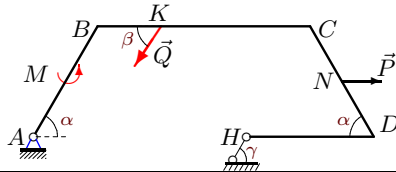
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 34 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 10 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 22

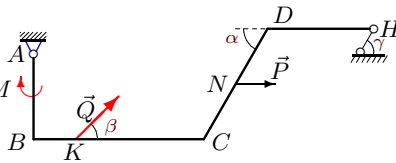
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 18 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 10 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 23

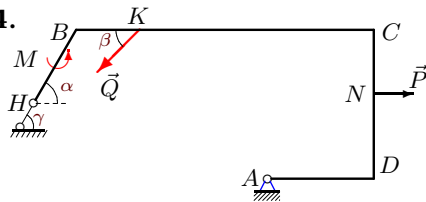
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 24

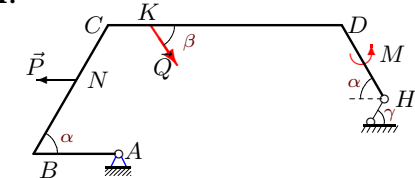
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 14 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 7 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 25

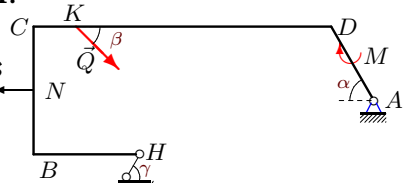
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 18 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 26

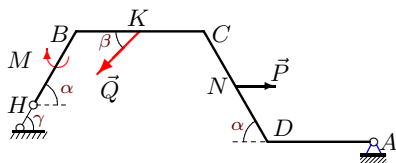
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 27

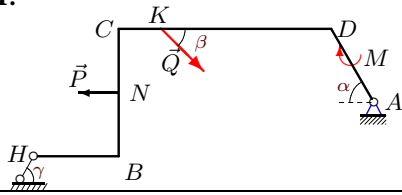
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 26 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 28

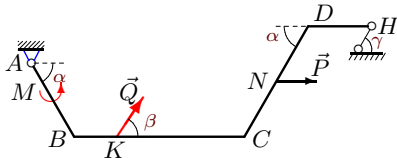
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 29 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 10 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 29

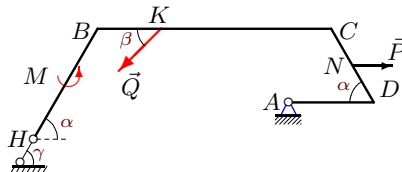
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 3 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 30

C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 4 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Ответы

	$M_A(Q)$	$M_A(P)$	$\Sigma_k M_A(G_k)$	h	X_A	Y_A	R_H
1	93.500	6.062	475.5	-12.990	-3.106	28.496	49.657
2	-49.565	-27.713	463.5	-12.990	-23.581	21.241	27.807
3	304.841	19.765	919.5	-8.258	-80.811	-7.131	147.621
4	260.750	3.713	960.0	-6.892	-103.763	-32.965	174.029
5	130.734	32.497	588.7	-15.321	-39.767	54.947	47.452
6	-32.967	14.000	534.0	-14.124	2.452	23.629	41.420
7	-185.885	-25.608	-296.0	9.521	-71.158	23.822	55.406
8	-0.000	-12.124	-29.5	6.500	0.549	12.249	1.788
9	16.564	-12.124	-44.0	7.071	-5.358	41.730	-1.476
10	186.446	-10.392	-168.0	8.000	-9.511	3.302	0.868
11	-143.000	17.321	-50.7	3.500	-64.883	12.653	54.694
12	-114.680	13.856	510.0	-13.856	-4.144	16.616	34.582
13	322.161	4.177	846.0	-9.124	-69.372	1.949	125.745
14	-52.500	8.660	-67.2	8.000	-21.965	32.432	10.136
15	76.210	-20.785	-141.0	7.261	7.282	20.666	14.541
16	17.377	5.196	-251.5	3.500	-43.908	-12.732	56.836
17	33.000	-12.990	-161.0	8.000	-2.834	23.251	19.499
18	112.583	-13.856	-404.0	11.693	16.938	17.304	21.832
19	169.741	19.765	613.5	-13.454	-33.913	49.171	57.825
20	65.663	-15.588	-177.5	6.500	30.294	2.192	14.989
21	219.779	-10.000	-174.0	7.536	-26.833	6.379	-2.757
22	-46.765	-20.785	-508.0	7.071	-51.555	19.033	74.324
23	131.522	8.412	-156.5	6.964	-31.846	-1.187	4.533
24	128.693	-32.000	61.5	-11.294	-8.203	82.402	20.204
25	-77.942	27.713	-154.5	7.002	-16.626	51.962	22.099
26	140.000	3.249	880.5	-8.258	-83.780	-0.236	120.938
27	297.763	-20.785	532.5	-14.722	-16.257	35.239	53.285
28	58.000	3.249	606.0	-12.588	-43.624	42.316	51.019
29	103.923	6.928	-329.0	10.089	-29.785	12.894	16.667
30	133.843	-13.856	244.5	-9.526	-16.662	49.643	45.609