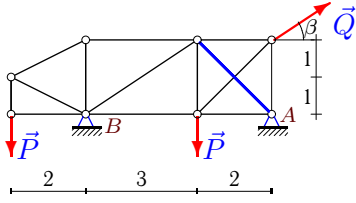


Расчет статически неопределимой фермы (2)

Найти реакции опор фермы и усилие S в дополнительном раскосе, выделенном утолщенной линией.

Задача M24.1.

4



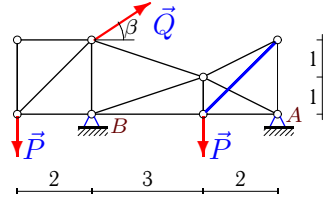
$$P = 5 \text{ кН},$$

$$Q = 3 \text{ кН},$$

$$\beta = 15^\circ.$$

Задача M24.2.

4



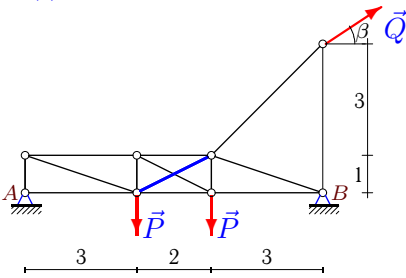
$$P = 6 \text{ кН},$$

$$Q = 6 \text{ кН},$$

$$\beta = 45^\circ.$$

Задача M24.3.

4



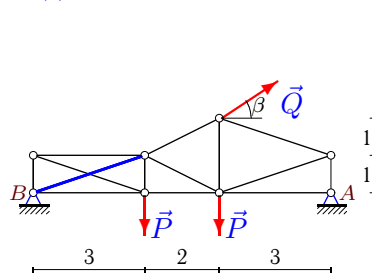
$$P = 8 \text{ кН},$$

$$Q = 6 \text{ кН},$$

$$\beta = 45^\circ.$$

Задача M24.4.

4



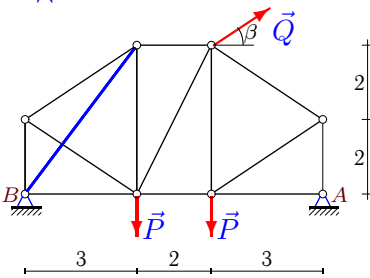
$$P = 5 \text{ кН},$$

$$Q = 3 \text{ кН},$$

$$\beta = 45^\circ.$$

Задача M24.5.

4



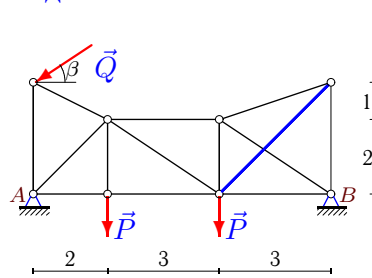
$$P = 7 \text{ кН},$$

$$Q = 4 \text{ кН},$$

$$\beta = 30^\circ.$$

Задача M24.6.

4



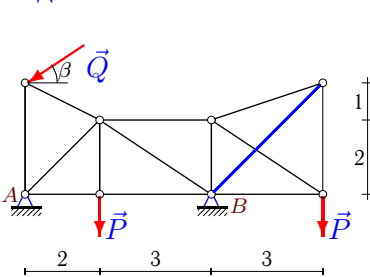
$$P = 5 \text{ кН},$$

$$Q = 3 \text{ кН},$$

$$\beta = 15^\circ.$$

Задача M24.7.

4



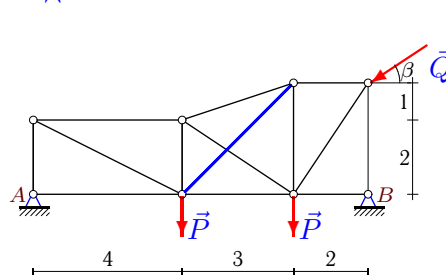
$$P = 6 \text{ кН},$$

$$Q = 7 \text{ кН},$$

$$\beta = 45^\circ.$$

Задача M24.8.

4



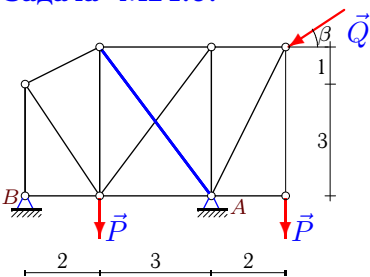
$$P = 5 \text{ кН},$$

$$Q = 4 \text{ кН},$$

$$\beta = 45^\circ.$$

Задача M24.9.

4



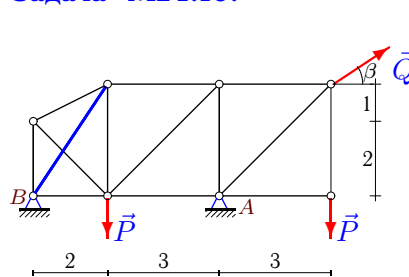
$$P = 9 \text{ кН},$$

$$Q = 6 \text{ кН},$$

$$\beta = 15^\circ.$$

Задача M24.10.

4



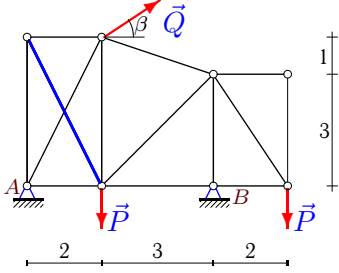
$$P = 10 \text{ кН},$$

$$Q = 4 \text{ кН},$$

$$\beta = 45^\circ.$$

Задача M24.11.

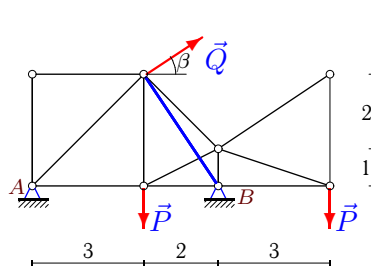
4



$P = 13 \text{ кН},$
 $Q = 7 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.12.

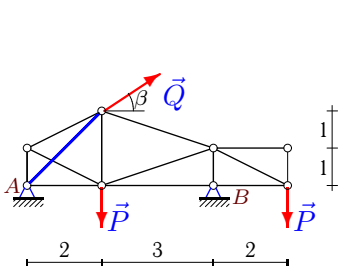
4



$P = 7 \text{ кН},$
 $Q = 9 \text{ кН},$
 $\beta = 15^\circ.$

Задача M24.13.

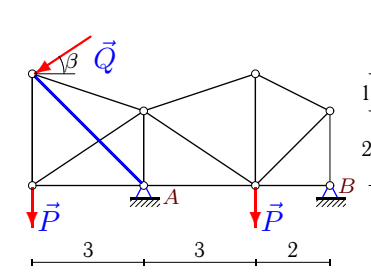
4



$P = 11 \text{ кН},$
 $Q = 5 \text{ кН},$
 $\beta = 45^\circ.$

Задача M24.14.

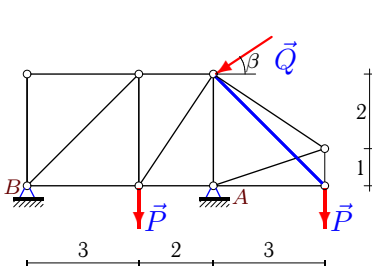
4



$P = 7 \text{ кН},$
 $Q = 3 \text{ кН},$
 $\beta = 15^\circ.$

Задача M24.15.

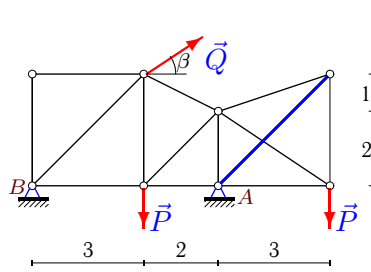
4



$P = 13 \text{ кН},$
 $Q = 8 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.16.

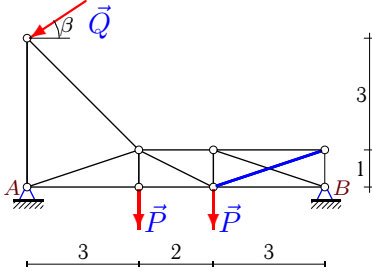
4



$P = 12 \text{ кН},$
 $Q = 4 \text{ кН},$
 $\beta = 15^\circ.$

Задача M24.17.

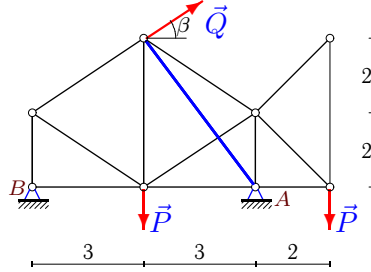
4



$P = 5 \text{ кН},$
 $Q = 7 \text{ кН},$
 $\beta = 45^\circ.$

Задача M24.18.

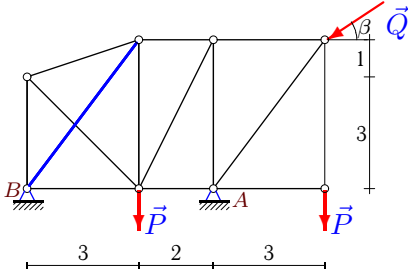
4



$P = 9 \text{ кН},$
 $Q = 6 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.19.

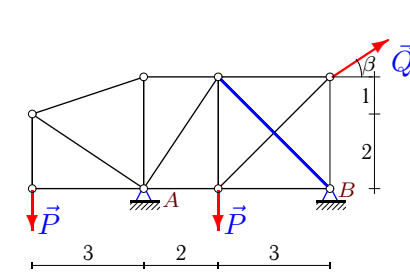
4



$P = 7 \text{ кН},$
 $Q = 7 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.20.

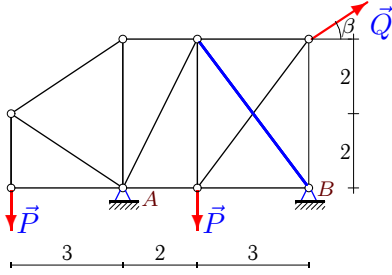
4



$P = 11 \text{ кН},$
 $Q = 4 \text{ кН},$
 $\beta = 45^\circ.$

Задача M24.21.

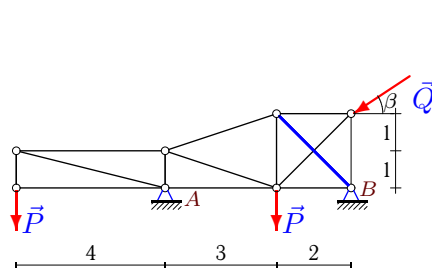
4



$P = 8 \text{ кН},$
 $Q = 5 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.22.

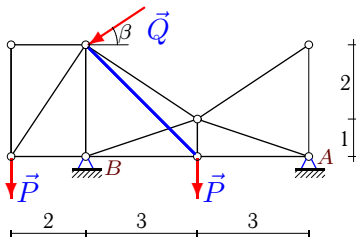
4



$P = 7 \text{ кН},$
 $Q = 8 \text{ кН},$
 $\beta = 15^\circ.$

Задача M24.23.

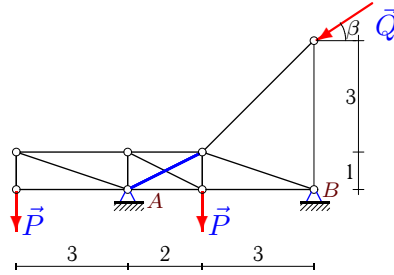
4



$P = 12 \text{ кН},$
 $Q = 5 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.24.

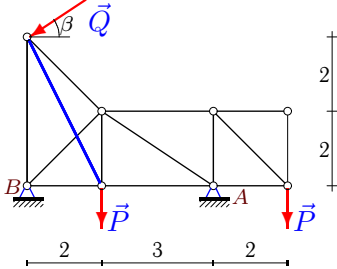
4



$P = 10 \text{ кН},$
 $Q = 7 \text{ кН},$
 $\beta = 45^\circ.$

Задача M24.25.

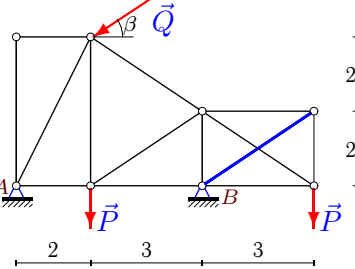
4



$P = 9 \text{ кН},$
 $Q = 7 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.26.

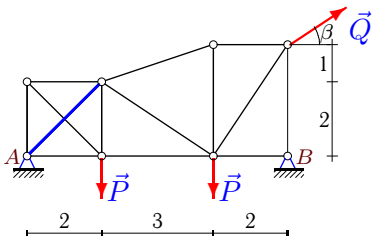
4



$P = 9 \text{ кН},$
 $Q = 6 \text{ кН},$
 $\beta = 30^\circ.$

Задача M24.27.

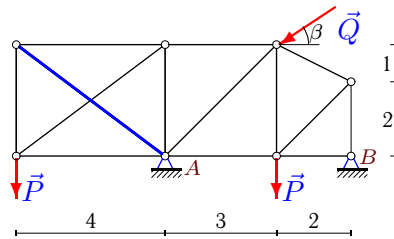
4



$P = 9 \text{ кН},$
 $Q = 6 \text{ кН},$
 $\beta = 45^\circ.$

Задача M24.28.

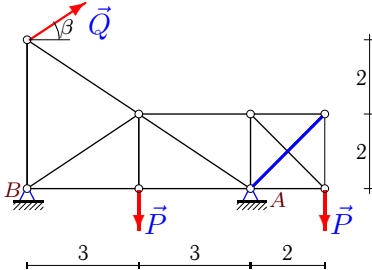
4



$P = 5 \text{ кН},$
 $Q = 9 \text{ кН},$
 $\beta = 15^\circ.$

Задача M24.29.

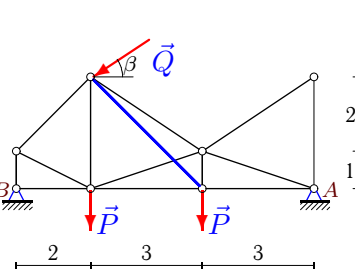
4



$P = 7 \text{ кН},$
 $Q = 3 \text{ кН},$
 $\beta = 15^\circ.$

Задача M24.30.

4



$P = 12 \text{ кН},$
 $Q = 9 \text{ кН},$
 $\beta = 15^\circ.$

М24 Ответы.**Расчет статически неопределимой фермы (2)**

16.06.2012

	δ_{11}	δ_{12}	δ_{22}	Δ_{1p}	Δ_{2p}	X_B	S	X_A	Y_A	Y_B
1	5.000	1.414	9.657	8.012	9.628	-1.377	-0.795	-1.520	1.383	7.841
2	5.000	1.414	7.374	-7.757	-17.888	0.915	2.251	-5.158	2.897	4.860
3	8.000	-1.789	8.072	109.393	-31.261	-13.476	0.886	9.233	5.879	5.879
4	8.000	2.846	11.925	-15.681	68.855	4.387	-6.821	-6.508	4.205	3.674
5	8.000	1.800	11.750	6.097	24.791	-0.298	-2.064	-3.166	7.482	4.518
6	8.000	-2.121	11.770	26.623	-33.278	-2.707	2.339	5.605	7.488	3.288
7	5.000	0.000	11.770	-22.274	60.721	4.455	-5.159	0.495	7.920	9.030
8	9.000	-2.121	11.770	9.191	-14.589	-0.761	1.102	3.590	4.832	7.997
9	5.000	1.800	17.280	-1.557	29.743	0.967	-1.822	4.828	13.738	5.815
10	5.000	1.109	9.129	30.000	-0.000	-6.166	0.749	3.338	17.172	-0.000
11	5.000	-0.894	16.144	-18.225	16.676	3.495	-0.839	-9.557	-4.350	26.850
12	5.000	-1.109	7.745	-38.563	80.607	5.581	-9.609	-14.274	-7.548	19.218
13	5.000	-1.414	7.374	-58.929	-13.770	13.020	4.365	-16.556	-1.336	19.800
14	5.000	-0.000	11.770	-48.034	95.390	9.607	-8.104	-6.709	16.981	-2.205
15	5.000	0.000	10.770	7.473	-72.317	-1.495	6.715	8.423	28.443	1.557
16	5.000	-0.000	11.770	59.124	144.206	-11.825	-12.252	7.961	28.097	-5.132
17	8.000	-2.846	11.925	35.854	-47.610	-3.345	3.194	8.295	12.425	2.525
18	6.000	1.800	11.750	42.588	94.656	-4.907	-7.304	-0.289	18.464	-3.464
19	5.000	1.800	13.760	3.626	9.717	-0.494	-0.642	6.556	16.150	1.350
20	5.000	-2.121	14.485	-1.006	-41.553	1.512	3.090	-4.341	22.503	-3.331
21	5.000	-1.800	17.280	2.796	-15.297	-0.250	0.859	-4.080	14.136	-0.636
22	5.000	-1.414	9.657	-107.182	-18.335	22.923	5.256	-15.196	18.491	-2.420
23	6.000	2.121	10.770	-23.010	-75.366	1.463	6.710	2.867	-0.165	26.665
24	5.000	-1.789	8.072	-78.990	155.556	9.670	-17.128	-4.720	25.960	-1.010
25	5.000	0.894	9.535	-2.938	-16.343	0.286	1.687	5.776	11.350	10.150
26	5.000	0.000	12.596	-44.935	108.887	8.987	-8.645	-3.791	5.957	15.043
27	7.000	-1.414	9.657	42.758	40.468	-7.167	-5.240	2.924	7.182	6.576
28	5.000	0.000	17.280	-9.637	72.000	1.927	-4.167	6.766	17.148	-4.818
29	6.000	0.000	9.657	-10.500	47.799	1.750	-4.950	-4.648	14.765	-1.542
30	8.000	2.121	10.770	-192.962	-121.330	22.298	6.874	-13.604	7.822	18.507

М24 файл о24т4В

В первой строке — усилия от действия основной нагрузки, во второй — от единичной горизонтальной силы в опоре B, в третьей — от единичных сил в дополнительном раскосе.

	U_1	U_2	U_3	V_1	V_2	V_3	V_4	O_1	O_2	O_3	D_1	D_2	D_3
1	0.000 0.000 0.000	-0.739 1.000 0.000	-2.898 -1.000 -0.707	5.000 0.000 0.000	-2.500 0.000 -0.000	2.841 0.000 -0.707	-1.383 0.000 -0.707	5.590 0.000 0.000	5.000 0.000 0.000	0.739 0.000 -0.707	-5.590 0.000 0.000	-5.121 0.000 0.000	3.053 0.000 1.000
2	-6.000 0.000 0.000	1.551 -1.000 -0.000	1.551 -1.000 -0.707	0.000 0.000 0.000	-2.343 0.000 0.000	6.000 0.000 -0.707	0.000 0.000 -0.354	0.000 0.000 0.000	1.852 0.000 -0.000	0.000 0.000 -0.791	8.485 0.000 -0.000	-7.960 0.000 0.000	-6.478 0.000 0.791
3	4.243 1.000 0.000	21.879 1.000 -0.894	17.636 1.000 0.000	-5.879 0.000 -0.000	2.121 0.000 -0.447	10.121 0.000 -0.447	-0.000 0.000 0.000	-17.636 0.000 -0.000	-13.393 0.000 -0.894	6.000 0.000 0.000	18.590 0.000 0.000	-4.743 0.000 1.000	-18.590 0.000 -0.000
4	0.000 -1.000 -0.949	11.023 -1.000 0.000	-2.121 -1.000 0.000	-3.674 0.000 -0.316	1.326 0.000 -0.316	6.316 0.000 0.000	-4.205 0.000 -0.000	-11.023 0.000 -0.949	-4.679 0.000 0.000	-6.648 0.000 0.000	11.619 0.000 1.000	-7.644 0.000 -0.000	6.648 0.000 -0.000
5	0.000 -1.000 -0.600	2.147 -1.000 0.000	-3.464 -1.000 0.000	-4.518 0.000 -0.800	2.259 0.000 -0.400	3.259 0.000 0.000	-7.482 0.000 0.000	-4.072 0.000 -0.721	-3.388 0.000 0.000	-6.744 0.000 0.000	4.072 0.000 0.721	2.775 0.000 -0.000	6.744 0.000 -0.000
6	2.365 1.000 0.000	2.365 1.000 0.000	4.933 1.000 -0.707	-2.225 0.000 0.000	5.000 0.000 0.000	3.288 0.000 -0.707	-0.000 0.000 -0.471	3.240 0.000 0.000	-4.933 0.000 0.000	0.000 0.000 -0.745	-7.443 0.000 0.000	3.086 0.000 -0.000	-5.928 0.000 0.850
7	-4.455 1.000 0.000	-4.455 1.000 0.000	-9.000 0.000 -0.707	-7.425 0.000 0.000	6.000 0.000 0.000	-6.000 0.000 -0.707	-0.000 0.000 -0.471	5.534 0.000 0.000	9.000 0.000 0.000	0.000 0.000 -0.745	-0.700 0.000 0.000	-5.463 0.000 0.000	10.817 0.000 0.850
8	-2.828 1.000 0.000	6.835 1.000 -0.707	0.000 1.000 0.000	-4.832 0.000 0.000	0.168 0.000 -0.707	2.091 0.000 -0.471	-7.997 0.000 -0.000	-9.663 0.000 0.000	-6.613 0.000 -0.745	-6.274 0.000 0.000	10.804 0.000 0.000	-4.074 0.000 0.850	6.212 0.000 0.000
9	0.000 -1.000 0.000	0.519 -1.000 -0.600	0.000 0.000 0.000	-5.815 0.000 0.000	1.454 0.000 -0.800	-3.185 0.000 -0.800	9.000 0.000 0.000	-3.251 0.000 0.000	-2.908 0.000 -0.600	-0.519 0.000 0.000	5.242 0.000 0.000	3.981 0.000 1.000	-11.799 0.000 0.000
10	0.000 -1.000 -0.555	-10.000 -1.000 0.000	0.000 0.000 0.000	0.000 0.000 -0.832	-0.000 0.000 -0.555	-10.000 0.000 0.000	10.000 0.000 0.000	0.000 0.000 -0.620	0.000 0.000 0.000	10.000 0.000 0.000	-0.000 0.000 0.784	14.142 0.000 -0.000	-10.142 0.000 0.000
11	3.887 1.000 -0.447	-8.667 1.000 0.000	-8.667 0.000 0.000	-0.000 0.000 -0.894	0.446 0.000 -0.894	-26.850 0.000 0.000	0.000 0.000 0.000	0.000 0.000 -0.447	-4.098 0.000 0.000	0.000 0.000 0.000	4.863 0.000 1.000	17.754 0.000 -0.000	15.624 0.000 0.000
12	1.146 1.000 0.000	-21.000 1.000 -0.555	-21.000 0.000 -0.000	0.000 0.000 -0.000	-4.073 0.000 -0.277	-19.218 0.000 -0.832	0.000 0.000 -0.000	0.000 0.000 0.000	-1.620 0.000 -0.784	0.000 0.000 0.000	10.674 0.000 0.000	24.760 0.000 0.620	22.136 0.000 0.000
13	3.536 1.000 -0.707	-22.000 1.000 0.000	-22.000 0.000 0.000	1.336 0.000 -0.707	3.601 0.000 -0.354	-19.800 0.000 0.000	0.000 0.000 0.000	1.493 0.000 -0.791	-2.319 0.000 0.000	-0.000 0.000 0.000	-1.493 0.000 0.791	25.509 0.000 0.000	24.597 0.000 0.000
14	-13.114 0.000 -0.707	-16.011 1.000 -0.000	-0.000 1.000 0.000	-1.742 0.000 -0.471	-16.981 0.000 -0.707	-1.225 0.000 0.000	2.205 0.000 0.000	3.055 0.000 -0.745	1.549 0.000 0.000	1.643 0.000 0.000	15.761 0.000 0.850	17.477 0.000 0.000	-2.078 0.000 -0.000
15	1.557 -1.000 0.000	-6.072 -1.000 0.000	0.000 0.000 -0.707	-0.000 0.000 -0.000	1.557 0.000 0.000	-24.110 0.000 -0.236	13.000 0.000 -0.707	0.000 0.000 0.000	-1.557 0.000 0.000	15.624 0.000 -0.850	-2.202 0.000 0.000	13.753 0.000 0.000	-13.703 0.000 0.745
16	-5.132 -1.000 0.000	-21.864 -1.000 0.000	-18.000 0.000 -0.707	0.000 0.000 0.000	-4.731 0.000 0.000	-28.097 0.000 -0.707	0.000 0.000 -0.471	0.000 0.000 0.000	1.418 0.000 -0.000	-0.000 0.000 -0.745	7.258 0.000 -0.000	23.662 0.000 -0.000	21.633 0.000 0.850
17	2.626 1.000 0.000	2.626 1.000 0.000	7.575 1.000 -0.949	-9.899 0.000 -0.000	5.000 0.000 0.000	2.525 0.000 -0.316	0.000 0.000 0.000	7.000 0.000 0.000	-7.575 0.000 0.000	0.000 0.000 -0.949	-7.985 0.000 0.000	5.534 0.000 0.000	-7.985 0.000 1.000
18	0.000 -1.000 0.000	-14.196 -1.000 -0.600	-9.000 0.000 0.000	3.464 0.000 -0.000	3.000 0.000 -0.400	-18.464 0.000 -0.800	0.000 0.000 0.000	3.122 0.000 -0.000	-3.122 0.000 -0.721	-0.000 0.000 -0.000	-3.122 0.000 0.000	13.939 0.000 0.721	12.728 0.000 0.000
19	0.000 -1.000 -0.600	-1.813 -1.000 0.000	-0.000 0.000 0.000	-1.350 0.000 -0.800	0.337 0.000 -0.600	-5.650 0.000 0.000	7.000 0.000 0.000	-1.067 0.000 -0.632	-1.012 0.000 0.000	1.813 0.000 0.000	1.432 0.000 0.849	6.317 0.000 -0.000	-13.125 0.000 0.000
20	0.000 0.000 0.000	-0.503 1.000 0.000	-0.000 1.000 -0.707	11.000 0.000 0.000	-3.667 0.000 0.000	11.503 0.000 -0.707	3.331 0.000 -0.707	11.595 0.000 0.000	11.000 0.000 0.000	3.331 0.000 -0.707	-13.220 0.000 0.000	-13.825 0.000 0.000	-0.711 0.000 1.000
21	0.000 0.000 0.000	1.398 1.000 0.000	-0.000 1.000 -0.600	8.000 0.000 0.000	-4.000 0.000 0.000	6.136 0.000 -0.800	0.636 0.000 -0.800	7.211 0.000 -0.000	6.000 0.000 -0.000	2.932 0.000 -0.600	-7.211 0.000 0.000	-6.860 0.000 0.000	2.330 0.000 1.000
22	0.000 0.000 0.000	-35.727 1.000 0.000	-0.000 1.000 -0.707	7.000 0.000 0.000	-11.491 0.000 0.000	1.079 0.000 -0.707	2.420 0.000 -0.707	28.000 0.000 0.000	-3.412 0.000 0.000	-3.236 0.000 -0.707	-28.862 0.000 0.000	32.926 0.000 -0.000	-6.351 0.000 1.000
23	-8.000 0.000 0.000	3.835 -1.000 -0.707	3.835 -1.000 -0.000	0.000 0.000 0.000	-22.720 0.000 -0.236	12.000 0.000 -0.707	-0.000 0.000 -0.000	0.000 0.000 0.000	14.819 0.000 -0.850	-0.000 0.000 0.000	14.422 0.000 0.000	-12.475 0.000 0.745	0.522 0.000 0.000
24	0.000 0.000 0.000	-34.950 1.000 -0.894	-3.030 1.000 0.000	10.000 0.000 0.000	-15.960 0.000 -0.447	-5.960 0.000 -0.447	0.000 0.000 0.000	30.000 0.000 0.000	-1.920 0.000 -0.894	-7.000 0.000 0.000	-31.623 0.000 0.000	35.687 0.000 1.000	3.194 0.000 -0.000
25	0.588 -1.000 -0.447	0.588 -1.000 0.000	-9.000 0.000 0.000	-9.562 0.000 -0.447	9.000 0.000 -0.894	-9.000 0.000 0.000	0.000 0.000 0.000	8.573 0.000 -0.632	9.000 0.000 0.000	0.000 0.000 0.000	-0.831 0.000 0.632	-4.237 0.000 0.000	12.728 0.000 0.000
26	-2.218 1.000 0.000	-13.500 1.000 0.000	-13.500 0.000 -0.832	0.000 0.000 0.000	1.478 0.000 0.000	-15.043 0.000 -0.555	0.000 0.000 -0.555	0.000 0.000 0.000	2.665 0.000 -0.000	-0.000 0.000 -0.832	-6.660 0.000 -0.000	13.560 0.000 -0.000	16.225 0.000 1.000
27	4.243 1.000 -0.707	11.424 1.000 0.000	-0.000 1.000 0.000	-7.182 0.000 -0.707	1.818 0.000 -0.707	0.990 0.000 0.000	-6.576 0.000 0.000	-7.182 0.000 -0.707	-3.130 0.000 0.000	-2.970 0.000 0.000	10.156 0.000 1.000	-5.062 0.000 0.000	13.002 0.000 -0.000
28	-6.667 0.000 -0.800	-3.212 1.000 0.000	0.000 1.000 0.000	0.000 0.000 -0.600	-5.000 0.000 -0.600	8.212 0.000 0.000	4.818 0.000 0.000	0.000 0.000 -0.800	6.667 0.000 0.000	3.591 0.000 0.000	8.333 0.000 1.000	-17.180 0.000 -0.000	-4.543 0.000 -0.000
29	1.750 -1.000 0.000	1.750 -1.000 0.000	-7.000 0.000 -0.707	2.708 0.000 0.000	7.000 0.000 0.000	-7.000 0.000 -0.707	0.000 0.000 -0.707	-3.483 0.000 0.000	7.000 0.000 0.000	0.000 0.000 -0.707	-2.103 0.000 0.000	-13.999 0.000 0.000	9.899 0.000 1.000
30	0.000 -1.000 0.000	32.160 -1.000 -0.707	32.160 -1.000 -0.000	-18.507 0.000 0.000	12.438 0.000 -0.236	12.000 0.000 -0.707	0.000 0.000 -0.000	-17.449 0.000 0.000	-4.380 0.000 -0.850	-0.000 0.000 0.000	13.794 0.000 -0.000	-20.895 0.000 0.745	-24.736 0.000 0.000