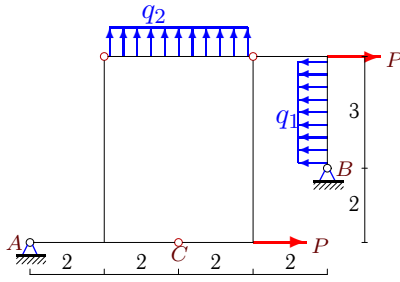


## Статически определимая рама

Построить эпюры  $M$ ,  $Q$ ,  $N$  в раме. Найти горизонтальное ( $\Delta x_C$ ) или вертикальное ( $\Delta y_C$ ) смещение шарнира  $C$ . Все стержни имеют одинаковую жесткость  $EJ$ .

**Задача 21.1.**

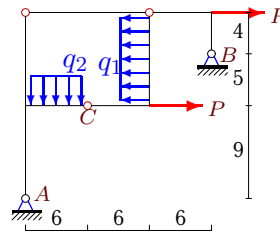
2



$q_1 = 5 \text{ кН/м},$   
 $q_2 = 7 \text{ кН/м},$   
 $P = 45 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.2.**

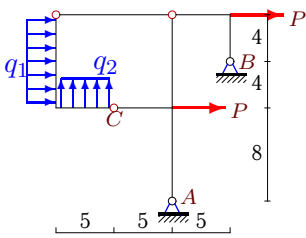
2



$q_1 = 4 \text{ кН/м},$   
 $q_2 = 1 \text{ кН/м},$   
 $P = 25 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.3.**

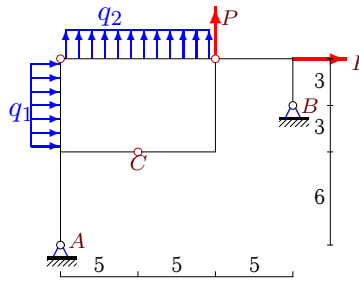
2



$q_1 = 10 \text{ кН/м},$   
 $q_2 = 5 \text{ кН/м},$   
 $P = 40 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.4.**

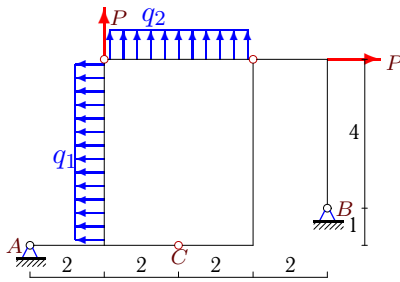
2



$q_1 = 2 \text{ кН/м},$   
 $q_2 = 4 \text{ кН/м},$   
 $P = 5 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.5.**

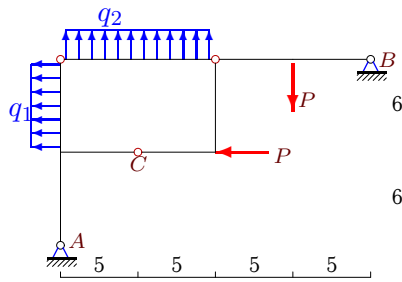
2



$q_1 = 3 \text{ кН/м},$   
 $q_2 = 7 \text{ кН/м},$   
 $P = 45 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.6.**

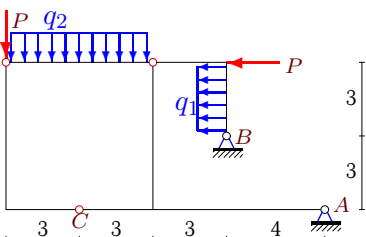
2



$q_1 = 4 \text{ кН/м},$   
 $q_2 = 9 \text{ кН/м},$   
 $P = 5 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.7.**

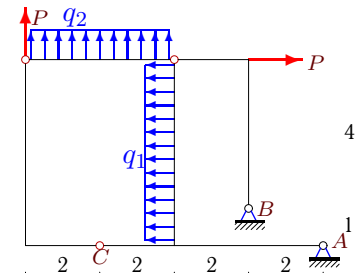
2



$q_1 = 3 \text{ кН/м},$   
 $q_2 = 1 \text{ кН/м},$   
 $P = 20 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.8.**

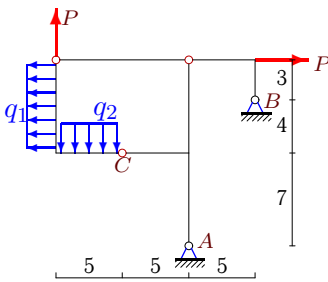
2



$q_1 = 2 \text{ кН/м},$   
 $q_2 = 8 \text{ кН/м},$   
 $P = 55 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.9.**

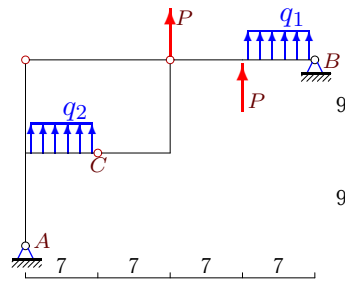
2



$q_1 = 2 \text{ кН/м},$   
 $q_2 = 6 \text{ кН/м},$   
 $P = 5 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.10.**

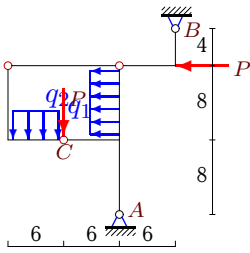
2



$q_1 = 4 \text{ кН/м},$   
 $q_2 = 2 \text{ кН/м},$   
 $P = 60 \text{ кН}.$   
 $\Delta y_C = ?$

**Задача 21.11.**

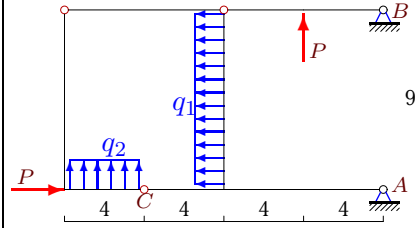
2



$q_1 = 2 \text{ кН/м},$   
 $q_2 = 1 \text{ кН/м},$   
 $P = 10 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.12.**

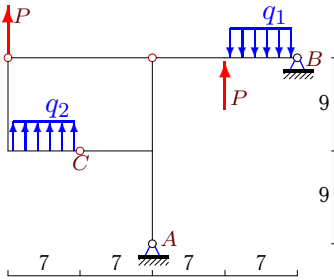
2



$q_1 = 5 \text{ кН/м},$   
 $q_2 = 7 \text{ кН/м},$   
 $P = 65 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.13.**

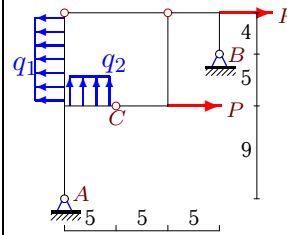
2



$q_1 = 3 \text{ кН/м},$   
 $q_2 = 4 \text{ кН/м},$   
 $P = 45 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.14.**

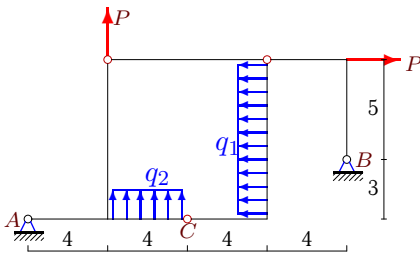
2



$q_1 = 5 \text{ кН/м},$   
 $q_2 = 4 \text{ кН/м},$   
 $P = 30 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.15.**

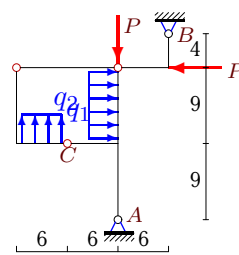
2



$q_1 = 1 \text{ кН/м},$   
 $q_2 = 5 \text{ кН/м},$   
 $P = 65 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.16.**

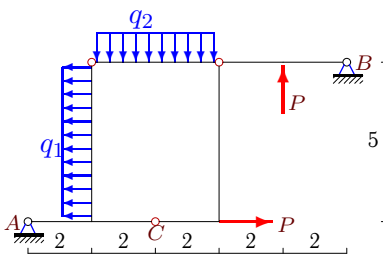
2



$q_1 = 5 \text{ кН/м},$   
 $q_2 = 7 \text{ кН/м},$   
 $P = 20 \text{ кН}.$   
 $\Delta x_C - ?$

**Задача 21.17.**

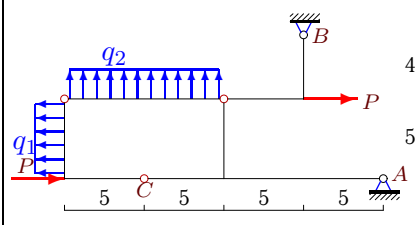
2



$q_1 = 6 \text{ кН/м},$   
 $q_2 = 3 \text{ кН/м},$   
 $P = 45 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.18.**

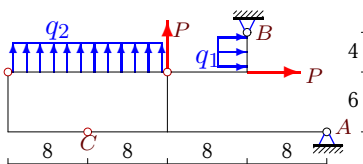
2



$q_1 = 5 \text{ кН/м},$   
 $q_2 = 7 \text{ кН/м},$   
 $P = 50 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.19.**

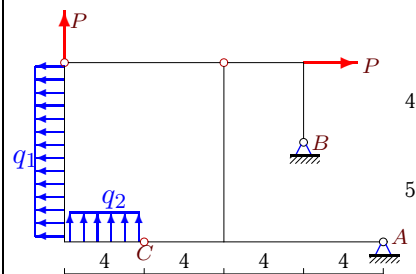
2



$q_1 = 2 \text{ кН/м},$   
 $q_2 = 10 \text{ кН/м},$   
 $P = 25 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.20.**

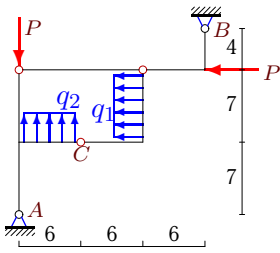
2



$q_1 = 3 \text{ кН/м},$   
 $q_2 = 9 \text{ кН/м},$   
 $P = 35 \text{ кН}.$   
 $\Delta y_C - ?$

**Задача 21.21.**

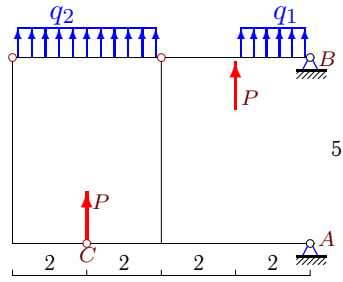
2



$q_1 = 3\text{кН/м},$   
 $q_2 = 12\text{кН/м},$   
 $P = 10\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.22.**

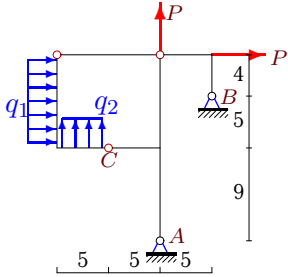
2



$q_1 = 1\text{кН/м},$   
 $q_2 = 13\text{кН/м},$   
 $P = 60\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.23.**

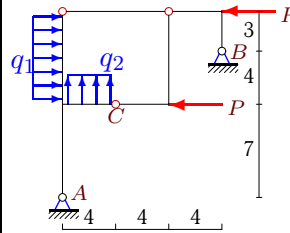
2



$q_1 = 2\text{кН/м},$   
 $q_2 = 6\text{кН/м},$   
 $P = 40\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.24.**

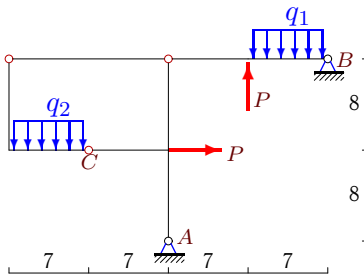
2



$q_1 = 8\text{кН/м},$   
 $q_2 = 4\text{кН/м},$   
 $P = 15\text{кН}.$   
 $\Delta x_C - ?$

**Задача 21.25.**

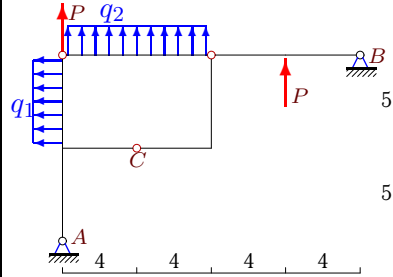
2



$q_1 = 12\text{кН/м},$   
 $q_2 = 6\text{кН/м},$   
 $P = 60\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.26.**

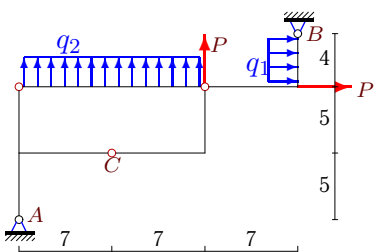
2



$q_1 = 2\text{кН/м},$   
 $q_2 = 9\text{кН/м},$   
 $P = 35\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.27.**

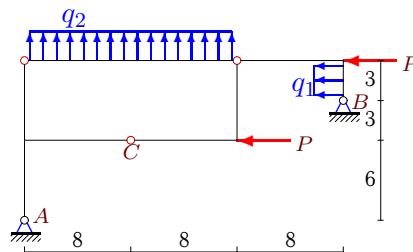
2



$q_1 = 3\text{кН/м},$   
 $q_2 = 8\text{кН/м},$   
 $P = 60\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.28.**

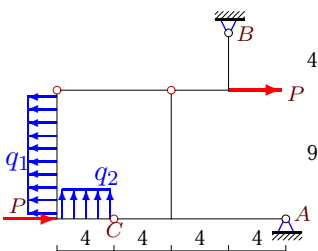
2



$q_1 = 4\text{кН/м},$   
 $q_2 = 6\text{кН/м},$   
 $P = 15\text{кН}.$   
 $\Delta x_C - ?$

**Задача 21.29.**

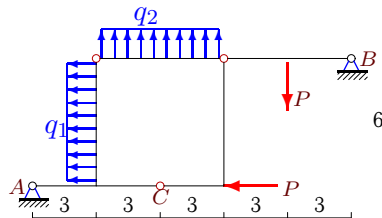
2



$q_1 = 6\text{кН/м},$   
 $q_2 = 3\text{кН/м},$   
 $P = 45\text{кН}.$   
 $\Delta y_C - ?$

**Задача 21.30.**

2



$q_1 = 6\text{кН/м},$   
 $q_2 = 5\text{кН/м},$   
 $P = 5\text{кН}.$   
 $\Delta y_C - ?$

**Статически определимая рама**

№	$X_A$	$X_B$	$Y_A$	$Y_B$	$x_A$	$x_B$	$y_A$	$y_B$	$EJ\Delta \cdot 10^{-3}$
1	-77.107	2.107	-36.089	8.089	-0.286	0.286	-0.571	-0.429	0.425
2	-6.038	-7.962	0.692	5.308	-0.231	0.231	-0.846	-0.154	0.028
3	-28.281	-131.719	-130.375	105.375	0.312	-0.312	-1.250	0.250	3.851
4	-21.556	4.556	-42.267	-2.733	-0.278	0.278	-0.833	-0.167	0.849
5	-30.853	0.853	-71.294	-1.706	-0.235	0.235	-0.529	-0.471	0.627
6	-26.917	55.917	-87.500	2.500	-0.417	0.417	-1.000	0.000	2.743
7	491.500	-462.500	-441.000	467.000	-10.000	10.000	9.000	-10.000	-900.115
8	-339.000	294.000	501.000	-588.000	-2.000	2.000	3.000	-4.000	81.998
9	-9.000	18.000	35.800	-10.800	0.357	-0.357	-1.214	0.214	-1.925
10	-78.167	78.167	-111.000	-51.000	-0.389	0.389	-1.000	0.000	19.335
11	-3.125	29.125	-3.417	19.417	0.375	-0.375	-0.750	-0.250	-2.375
12	29.944	-49.944	-60.500	-32.500	1.333	-1.333	-1.000	0.000	34.201
13	51.333	-51.333	-90.250	-6.750	0.389	-0.389	-1.000	0.000	13.712
14	-9.135	-5.865	-24.692	4.692	-0.192	0.192	-0.846	-0.154	0.273
15	-52.304	-4.696	-90.870	5.870	-0.348	0.348	-0.565	-0.435	6.156
16	9.750	-34.750	1.167	-23.167	-0.500	-0.500	0.333	-0.333	1.276
17	-47.400	32.400	-10.500	-22.500	-0.800	0.800	-1.000	0.000	0.307
18	20.192	-95.192	6.154	-76.154	1.154	-1.154	-0.077	-0.923	7.664
19	286.286	-319.286	-27.357	-157.643	1.714	-1.714	-0.143	-0.857	75.714
20	1249.500	-1257.500	-1328.500	1257.500	12.000	-12.000	-13.000	12.000	7128.341
21	-65.083	96.083	-126.056	64.056	-1.000	1.000	-1.667	0.667	30.996
22	158.800	-158.800	-142.500	-31.500	1.200	-1.200	-1.000	0.000	10.689
23	8.000	-66.000	-122.800	52.800	0.278	-0.278	-1.222	0.222	3.255
24	-13.950	-12.050	-25.038	9.038	-0.650	-0.350	-0.262	0.263	1.189
25	-57.563	-2.438	33.000	33.000	0.438	-0.438	-1.000	0.000	-7.546
26	-40.300	50.300	-124.500	-17.500	-0.400	0.400	-1.000	0.000	1.834
27	-548.000	476.000	-447.429	275.429	-3.500	3.500	-3.000	2.000	466.699
28	-25.667	67.667	-72.875	-23.125	-0.667	-0.333	-0.125	0.125	1.739
29	-16.588	-19.412	7.412	-19.412	0.706	-0.706	-0.294	-0.706	0.253
30	-3.250	44.250	-27.500	2.500	-1.000	1.000	-1.000	0.000	1.476

№	1	2	3	4	5	6	7	8
1	0.000	-0.009	-0.014	0.443	-0.063	0.034	-0.025	0.055
2	0.000	-0.059	-0.039	-0.364	-0.088	0.141	-0.059	0.339
3	0.000	1.098	0.878	-0.000	2.342	-0.000	1.042	-1.508
4	0.000	0.019	0.011	-0.090	-0.186	0.773	-0.155	0.431
5	0.000	0.002	0.004	0.590	-0.039	0.017	-0.015	0.101
6	0.000	0.000	0.000	0.255	0.000	1.771	0.000	0.808
7	0.000	-42.030	-42.030	0.000	-362.160	0.000	-0.207	-453.789
8	0.000	6.272	12.544	-0.000	31.033	-0.000	0.189	32.064
9	0.000	-0.096	-0.058	0.000	-0.362	0.000	-1.042	-0.367
10	0.000	0.000	0.000	0.257	0.000	11.891	0.000	7.387
11	0.000	-0.350	-0.233	0.000	-0.568	0.000	-1.152	-0.200
12	0.000	0.000	0.000	0.000	21.456	0.000	0.597	10.325
13	0.000	0.000	0.000	0.000	0.514	0.000	8.346	4.851
14	0.000	-0.030	-0.024	-0.066	-0.054	0.518	-0.030	0.427
15	0.000	-0.054	-0.068	5.148	-0.109	0.191	-0.054	1.096
16	0.000	0.556	0.371	0.000	2.217	0.000	0.000	-1.185
17	0.000	0.000	0.000	0.360	0.000	0.044	0.000	0.028
18	0.000	2.929	2.343	0.000	1.091	0.000	1.458	-0.158
19	0.000	23.061	11.530	0.000	22.170	0.000	13.653	5.336
20	0.000	321.920	321.920	0.000	3535.488	0.000	1.515	2947.499
21	0.000	3.075	2.050	1.013	3.587	12.007	3.075	7.441
22	0.000	0.000	0.000	0.000	7.420	0.000	0.229	3.040
23	0.000	0.489	0.391	0.000	0.585	0.000	1.250	0.540
24	0.000	0.051	0.038	0.241	0.089	0.095	0.051	1.037
25	0.000	0.000	0.000	0.000	1.554	0.000	-4.802	-4.298
26	0.000	0.000	0.000	0.042	0.000	1.141	0.000	0.672
27	0.000	62.981	35.989	0.000	63.933	134.260	89.507	79.917
28	0.000	-0.493	-0.185	-0.270	0.398	0.531	0.531	1.232
29	0.000	0.292	0.292	0.000	-0.215	0.000	0.256	-0.372
30	0.000	0.000	0.000	1.440	0.000	0.113	0.000	0.248