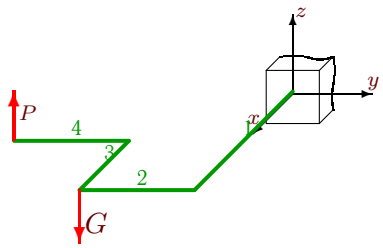
Деформации изогнутого стержня

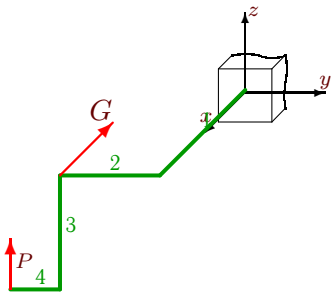
Участки изогнутого стержня параллельны осям координат. К стержню приложены силы G и P. Построить эпюры изгибающих и крутящих моментов. Определить перемещения конца стержня (в см) по направлению действия силы P, пренебрегая весом стержня и влиянием нормальных и перерезывающих сил. Найти угол поворота концевого сечения относительно оси участка 4. Принять жесткость на изгиб $EJ_x = EJ_y = 9.8 \cdot 10^5$ Нм^2, на кручение $EJ_0 = 7.6 \cdot 10^5$ Нм^2.

Задача М26.1.



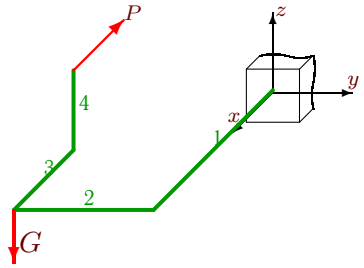
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 3$ кН.

Задача М26.2.



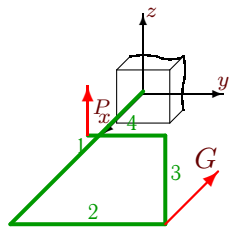
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 1$ кН.

Задача М26.3.



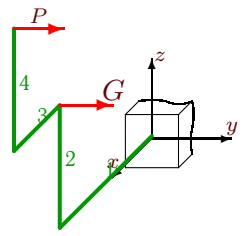
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.4.



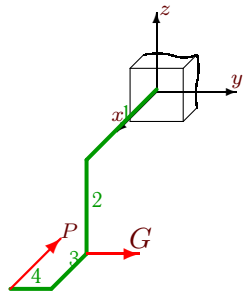
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.5.



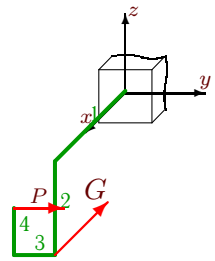
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.6.



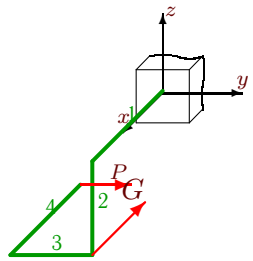
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 2$ кН.

Задача М26.7.



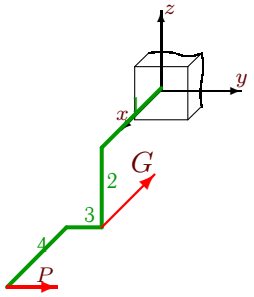
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.8.



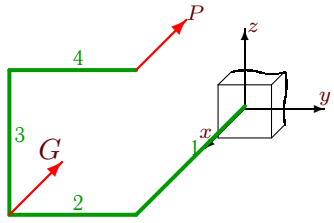
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 5$ кН.

Задача М26.9.



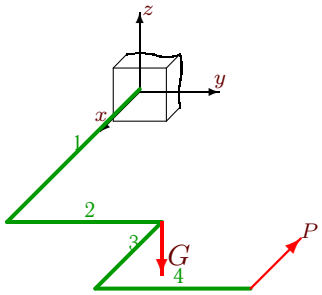
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.10.



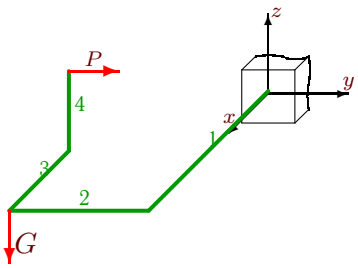
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 3$ кН.

Задача М26.11.



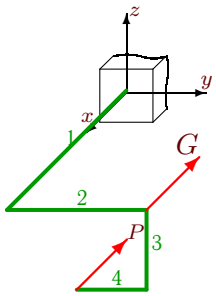
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 2$ кН.

Задача М26.12.



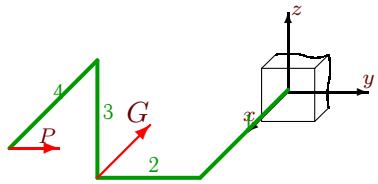
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.13.



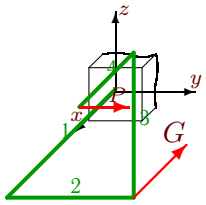
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.14.



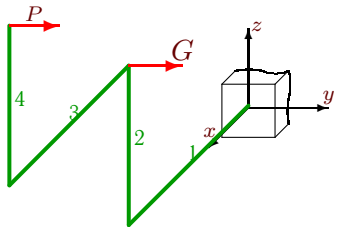
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.15.



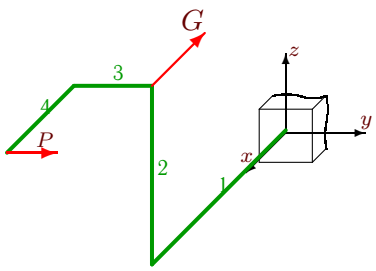
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 2$ кН.

Задача М26.16.



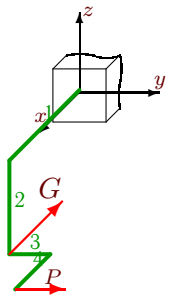
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 3$ кН.

Задача М26.17.



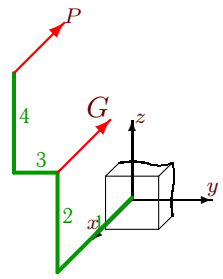
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.18.



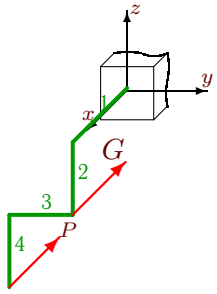
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 2$ кН.

Задача М26.19.



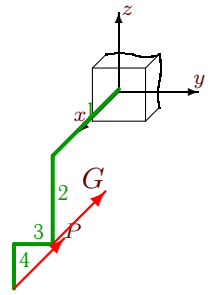
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 3$ кН.

Задача М26.20.



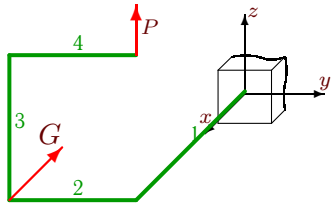
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.21.



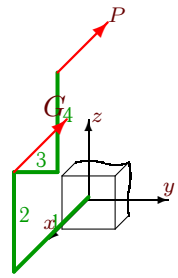
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 5$ кН.

Задача М26.22.



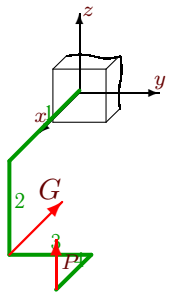
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.23.



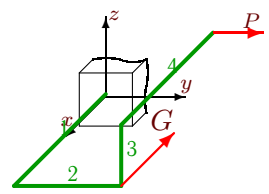
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 2$ кН.

Задача М26.24.



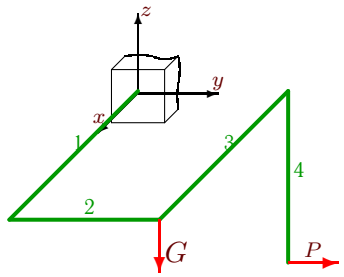
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 2$ кН.

Задача М26.25.



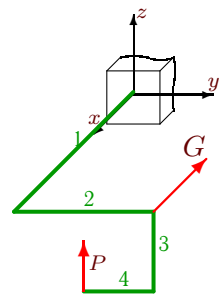
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 1$ кН.

Задача М26.26.



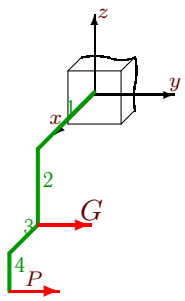
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 5$ кН.

Задача М26.27.



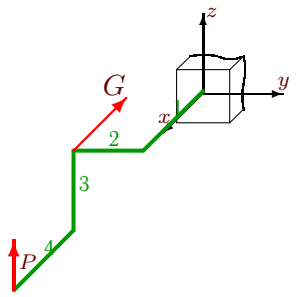
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 2$ кН.

Задача М26.28.



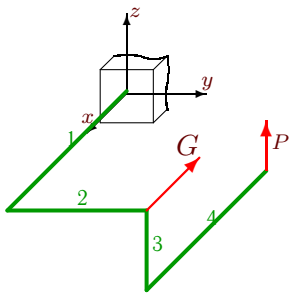
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 2$ кН.

Задача М26.29.



$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 2$ кН.

Задача М26.30.



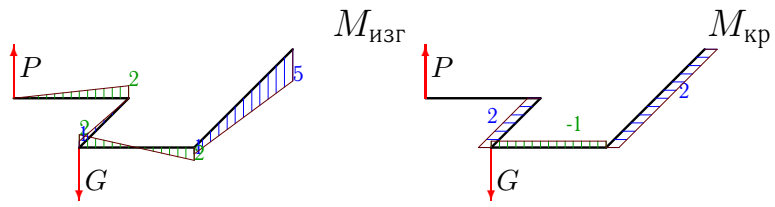
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 3$ кН.

М26 Ответы.

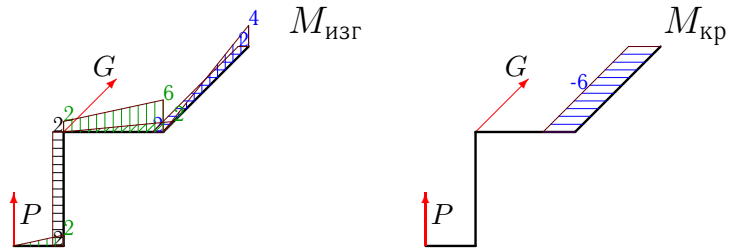
Деформации изогнутого стержня

10.04.2013

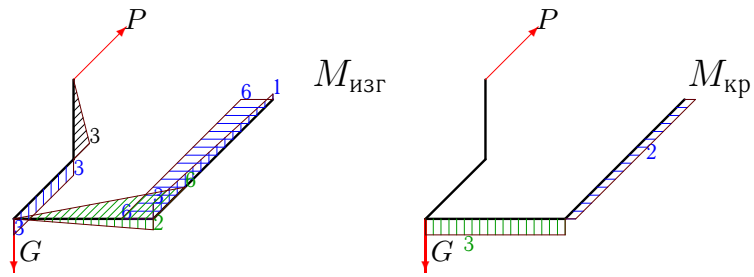
1.



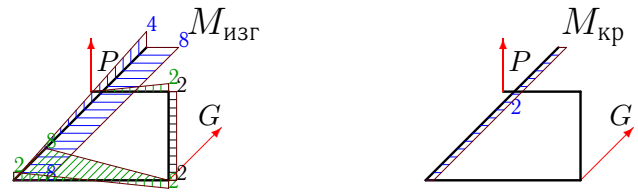
2.



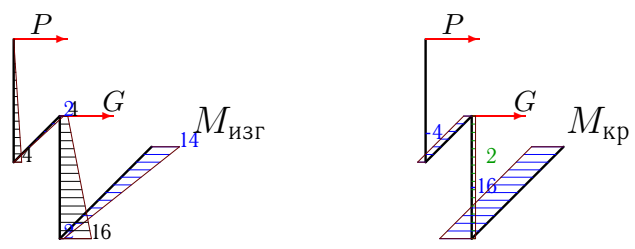
3.



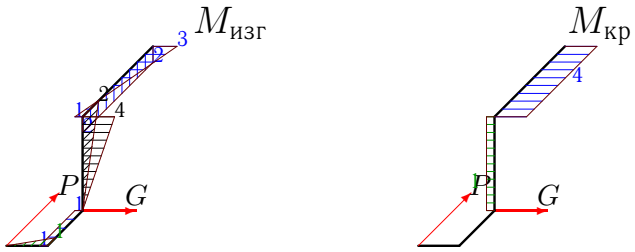
4.



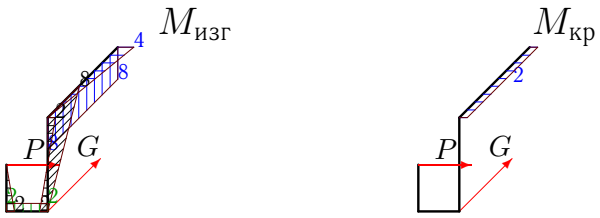
5.



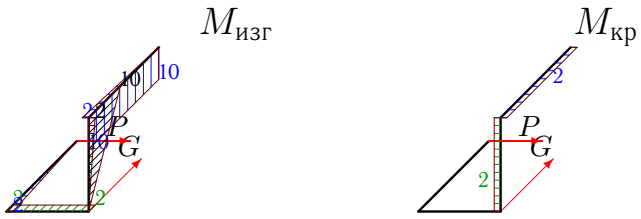
6.


$M_{изг}$
$M_{кр}$
P
G
P
G

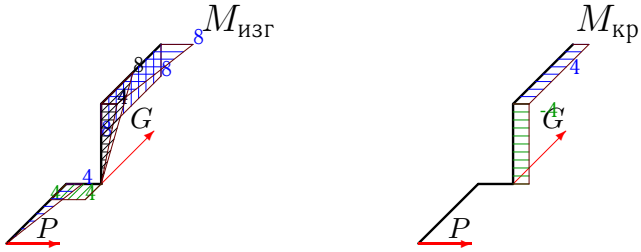
7.


$M_{изг}$
$M_{кр}$
P
G
P
G

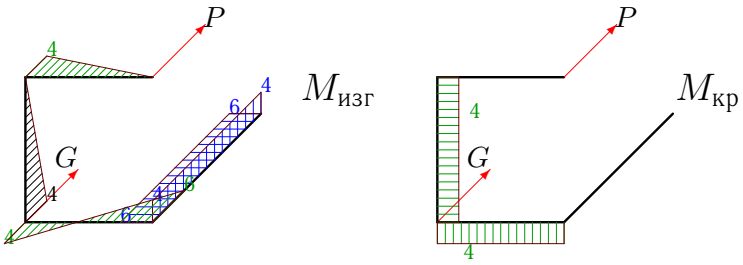
8.


$M_{изг}$
$M_{кр}$
P
G
P
G

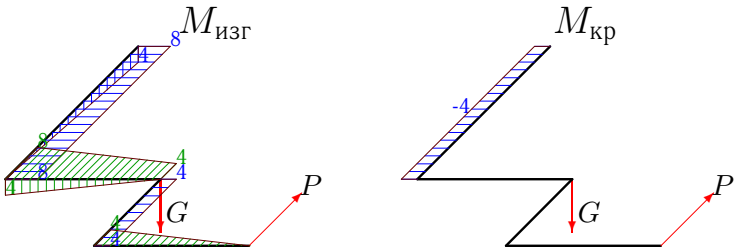
9.


$M_{изг}$
$M_{кр}$
G
P
G
P

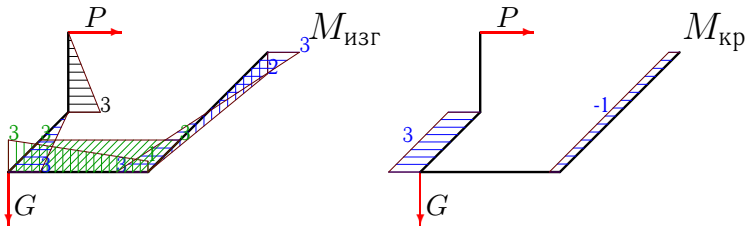
10.


P
$M_{изг}$
G
P
$M_{кр}$
G

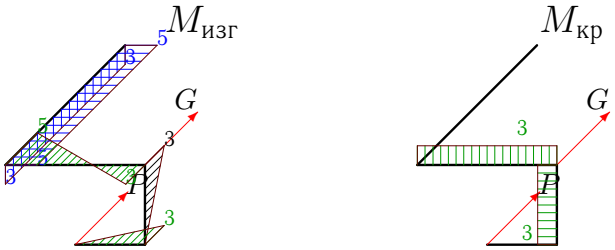
11.


$M_{изг}$
$M_{кр}$
P
G
P
G

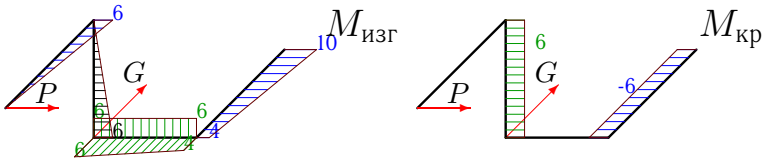
12.


P
$M_{изг}$
G
P
$M_{кр}$
G

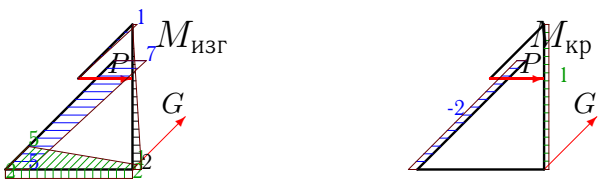
13.


$M_{изг}$
G
P
$M_{кр}$
G
P

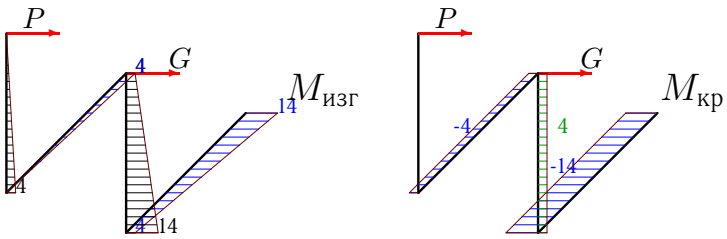
14.


$M_{изг}$
P
G
$M_{кр}$
P
G

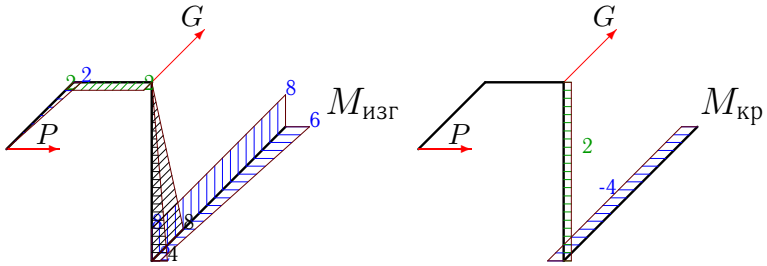
15.


$M_{изг}$
P
G
$M_{кр}$
P
G

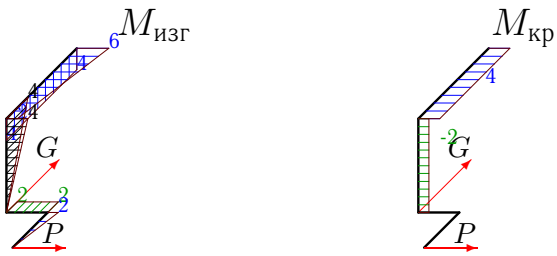
16.


P
G
4
14
$M_{изг}$
P
G
-4
4
-14
$M_{кр}$

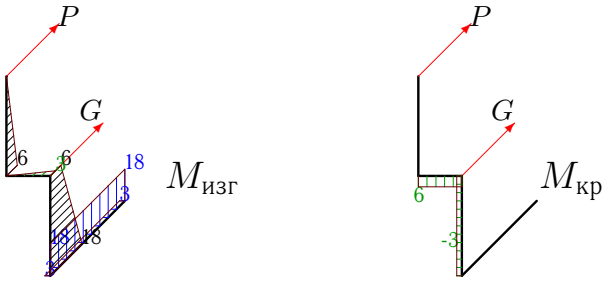
17.


G
P
8
6
$M_{изг}$
G
P
2
-4
$M_{кр}$

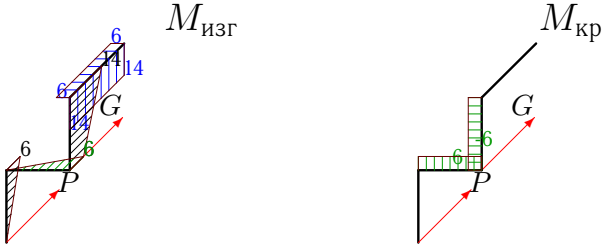
18.


$M_{изг}$
6
G
P
$M_{кр}$
4
-2
G
P

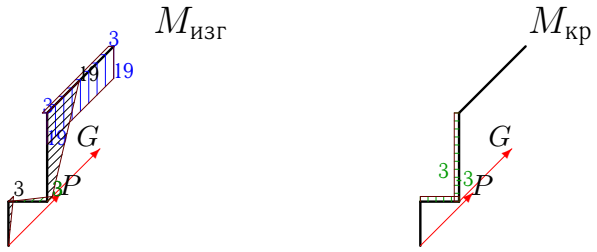
19.


P
G
6
18
$M_{изг}$
P
G
6
-3
$M_{кр}$

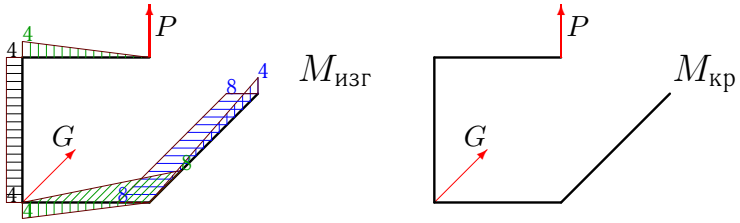
20.


$M_{изг}$
6
14
G
6
P
$M_{кр}$
G
6
P

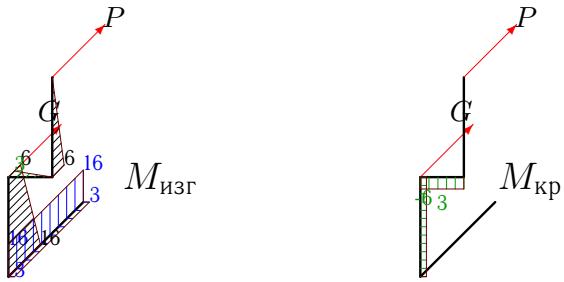
21.


$M_{изг}$
$M_{кр}$
G
P
G
P

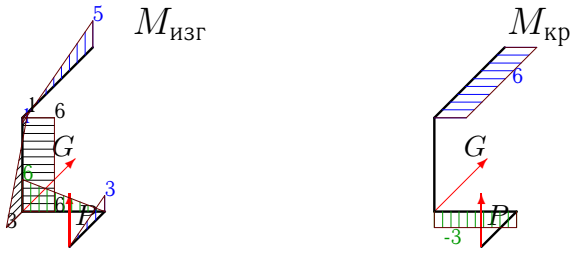
22.


P
$M_{изг}$
G
P
$M_{кр}$
G

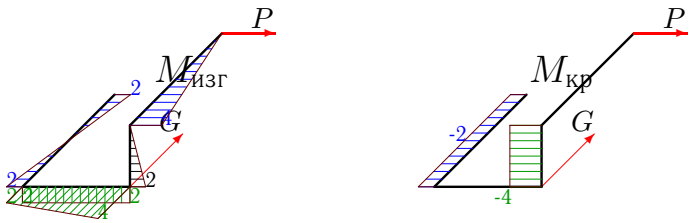
23.


P
G
$M_{изг}$
P
G
$M_{кр}$

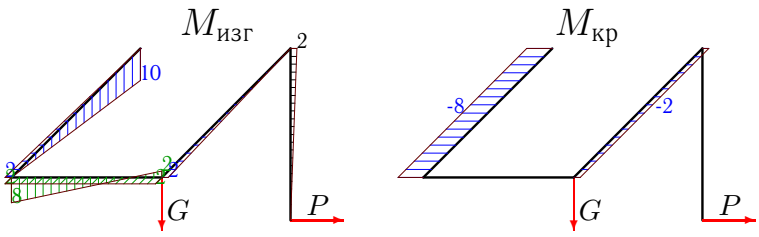
24.


$M_{изг}$
G
P
$M_{кр}$
G
P

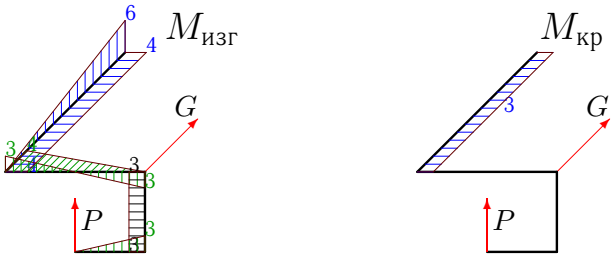
25.


P
$M_{изг}$
G
P
$M_{кр}$
G

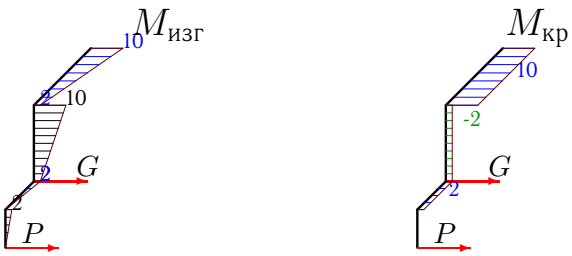
26.



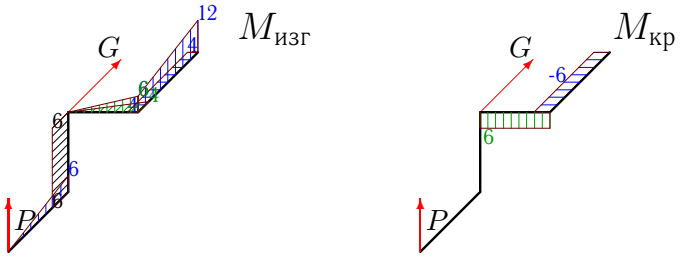
27.



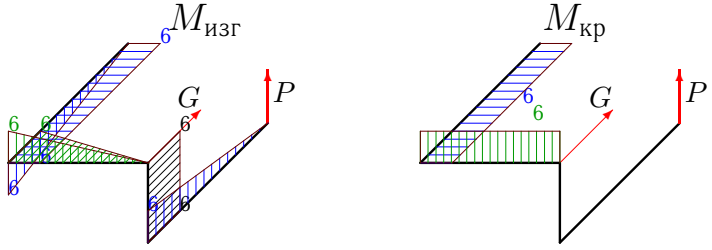
28.



29.



30.



M26 файл o26m1A

№	Δ_{1-2}	Δ_{2-3}	Δ_{3-4}	Δ_{4-5}	$\sum\Delta$	$\Delta\varphi\cdot 10^2$
1	-2.241	0.127	0.560	0.272	-1.282	0.926
2	5.281	1.769	0.408	0.068	7.526	-0.408
3	2.857	1.606	0.306	0.102	4.871	-1.837
4	1.071	0.136	0.204	0.068	1.479	-0.408
5	20.516	7.057	1.121	0.544	29.237	2.261
6	0.612	0.535	0.102	0.034	1.284	0.612
7	1.071	0.136	0.204	0.068	1.479	0.408
8	1.325	1.325	0.816	0.272	3.738	0.730
9	5.915	2.649	0.816	0.544	9.925	1.461
10	1.633	2.241	2.649	0.544	7.068	-2.277
11	6.531	3.810	0.816	0.544	11.701	0.408
12	0.467	1.020	0.497	0.102	2.086	-0.765
13	1.633	1.062	0.497	0.102	3.293	1.555
14	7.648	4.490	3.974	0.816	16.928	-3.416
15	3.570	1.429	0.535	0.034	5.567	-1.139
16	20.587	7.956	2.649	0.544	31.736	3.298
17	3.874	1.071	0.204	0.068	5.217	-1.461
18	3.874	1.071	0.204	0.068	5.217	1.461
19	15.306	8.545	1.681	0.816	26.348	-1.555
20	13.878	9.552	3.974	0.816	28.221	-3.416
21	12.245	5.823	0.497	0.102	18.667	-1.555
22	0.544	0.544	1.633	0.544	3.265	-0.408
23	13.673	7.864	1.681	0.816	24.035	1.555
24	4.178	2.653	1.606	0.102	8.539	3.416
25	0.662	1.633	1.121	0.544	3.960	-1.037
26	-3.938	-0.408	1.325	0.272	-2.750	-0.816
27	1.606	0.204	0.306	0.102	2.218	-0.612
28	10.616	3.247	0.331	0.068	14.262	1.853
29	8.872	3.974	2.449	0.816	16.112	-2.191
30	3.974	3.974	1.224	0.816	9.989	2.191