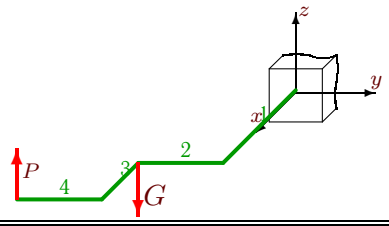
Деформации изогнутого стержня

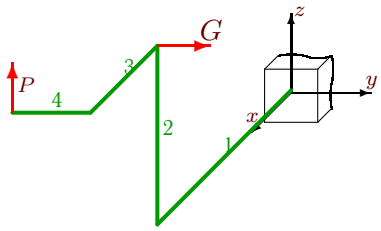
Участки изогнутого стержня параллельны осям координат. К стержню приложены силы G и P. Построить эпюры изгибающих и крутящих моментов. Определить перемещения конца стержня (в см) по направлению действия силы P, пренебрегая весом стержня и влиянием нормальных и перерезывающих сил. Найти угол поворота 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. *3*



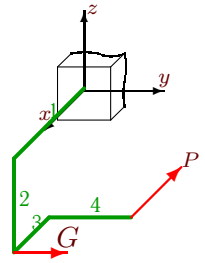
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 3$ кН.

Задача М26.2. *3*



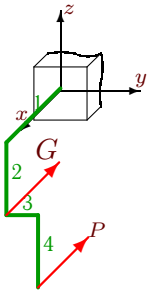
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 5$ кН.

Задача М26.3. *3*



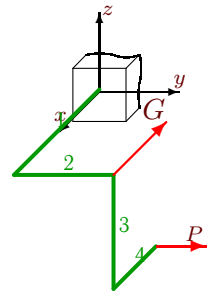
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 3$ кН.

Задача М26.4. *3*



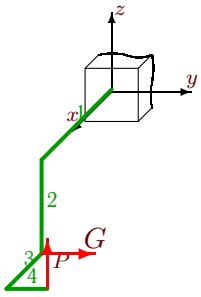
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 5$ кН.

Задача М26.5. *3*



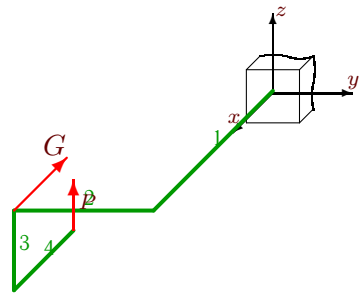
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 3$ кН.

Задача М26.6. *3*



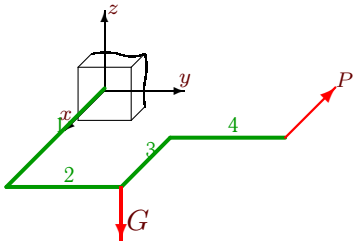
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.7. *3*



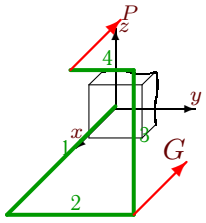
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 1$ кН.

Задача М26.8. *3*



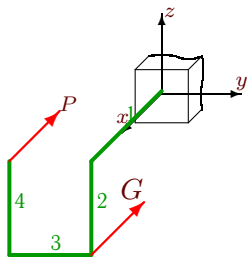
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 4$ кН.

Задача М26.9. *3*



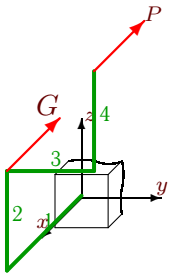
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 3$ кН.

Задача М26.10. *3*



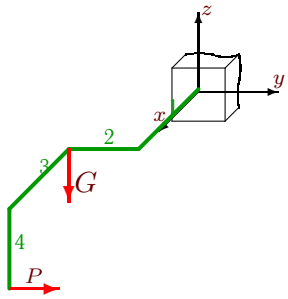
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.11. *3*



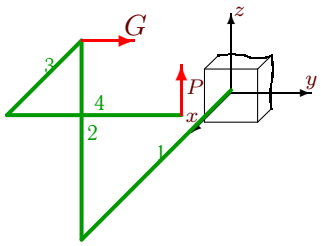
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 5$ кН.

Задача М26.12. *3*



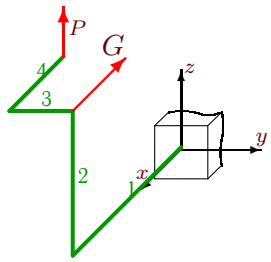
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.13. *3*



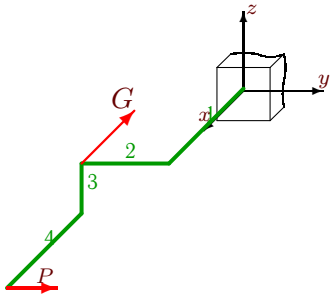
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 5$ кН.

Задача М26.14. *3*



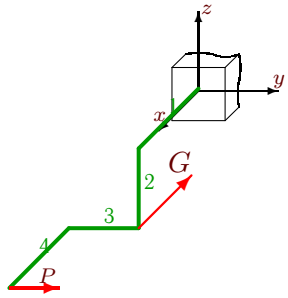
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 3$ кН.

Задача М26.15. *3*



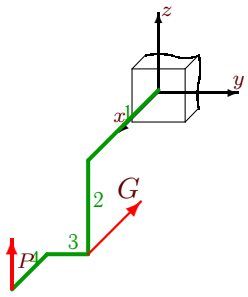
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 1$ кН,
$G = 5$ кН.

Задача М26.16. *3*



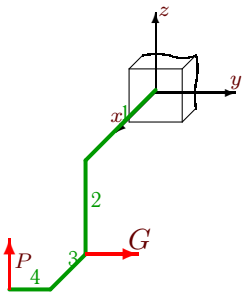
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 5$ кН.

Задача М26.17. *3*



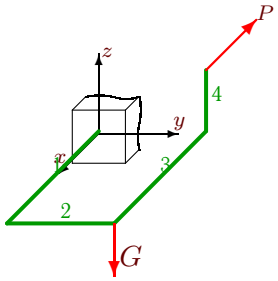
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 3$ кН.

Задача М26.18. *3*



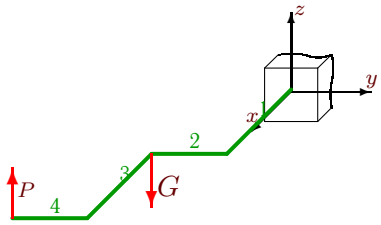
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 1$ кН.

Задача М26.19. 3



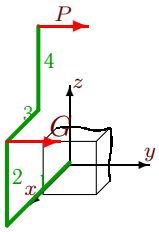
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 4$ кН.

Задача М26.20. 3



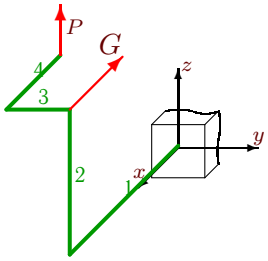
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 2$ кН.

Задача М26.21. 3



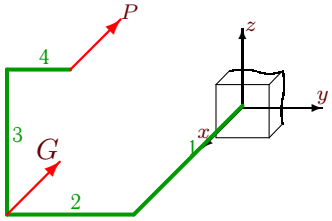
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 2$ м,
$P = 3$ кН,
$G = 3$ кН.

Задача М26.22. 3



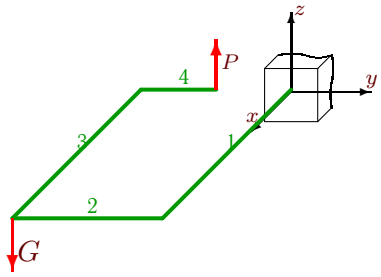
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 2$ кН.

Задача М26.23. 3



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

Задача М26.24. 3



$L_1 = 2$ м,
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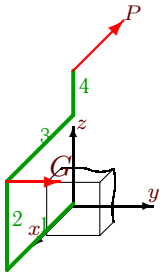
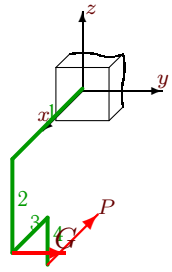
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 3$ кН,
$G = 4$ кН.

Задача М26.25. 3



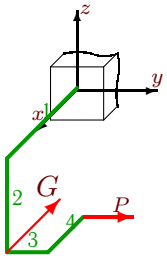
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 2$ кН.

Задача М26.26. 3



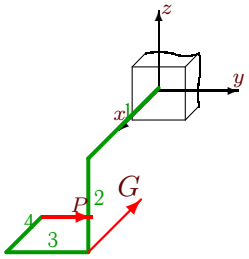
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 4$ кН.

Задача М26.27. 3



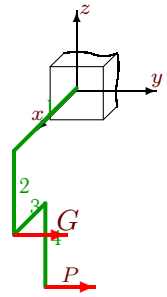
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 1$ м,
$L_4 = 1$ м,
$P = 1$ кН,
$G = 4$ кН.

Задача М26.28. 3



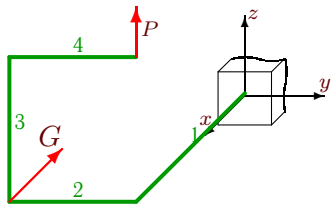
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 1$ м,
$P = 2$ кН,
$G = 4$ кН.

Задача М26.29.



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

Задача М26.30.



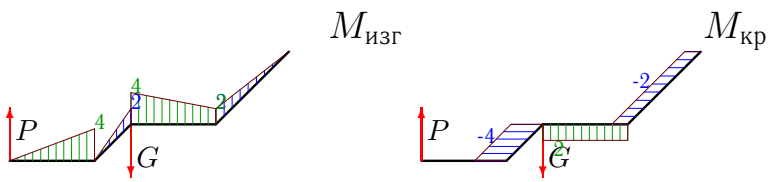
$L_1 = 2$ м,
$L_2 = 2$ м,
$L_3 = 2$ м,
$L_4 = 2$ м,
$P = 2$ кН,
$G = 5$ кН.

М26 Ответы.

Деформации изогнутого стержня

10.04.2013

1.



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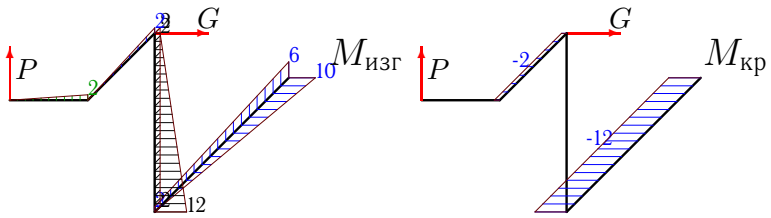

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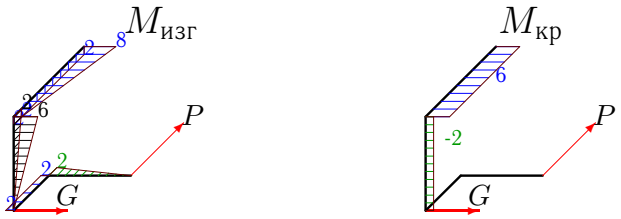

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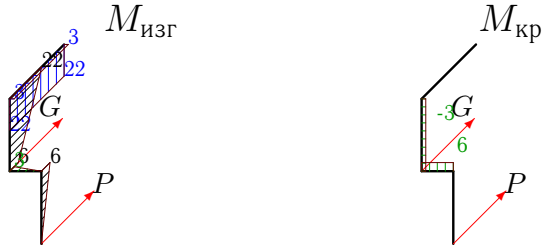
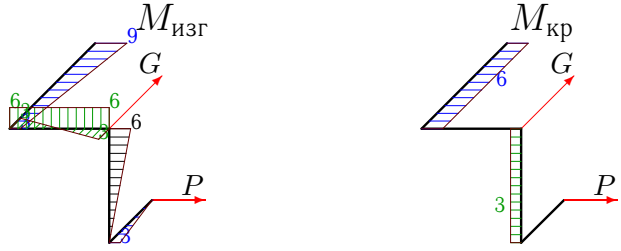


5.



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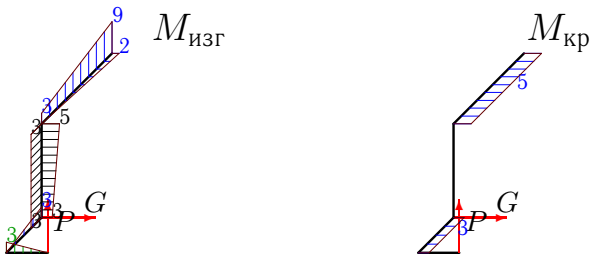
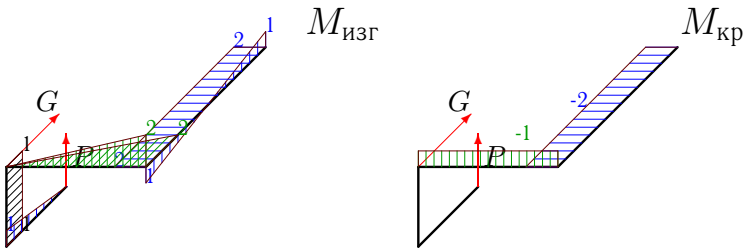
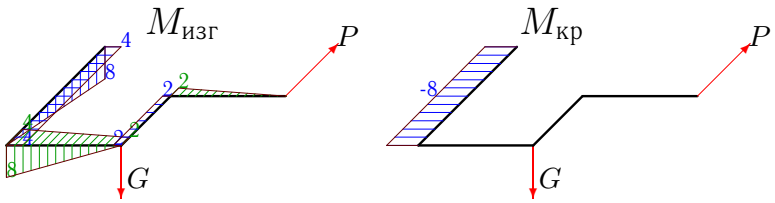

$M_{изг}$
$M_{кр}$
G
P
G
P

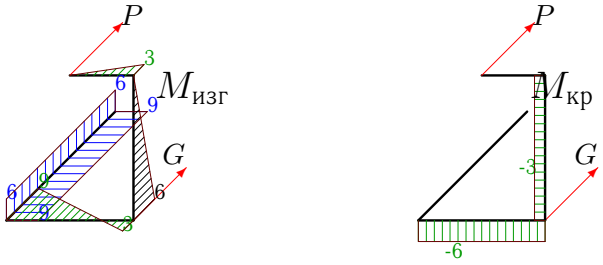
7.


$M_{изг}$
$M_{кр}$
G
P
G
P

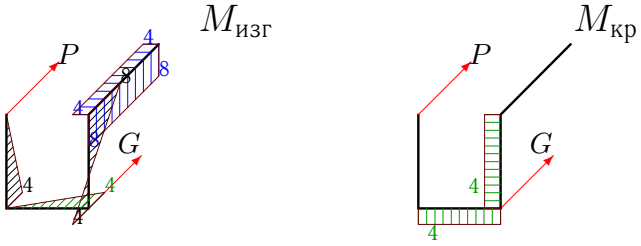
8.


$M_{изг}$
$M_{кр}$
P
G
P
G

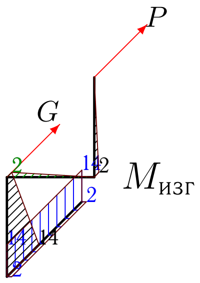
9.


P
$M_{изг}$
G
P
$M_{кр}$
G

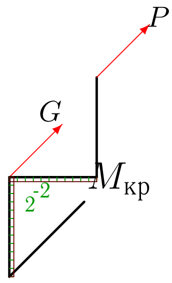
10.


$M_{изг}$
$M_{кр}$
P
G
P
G

11.

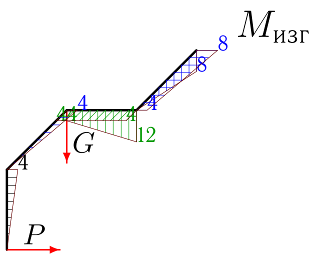


P
G
Mизг

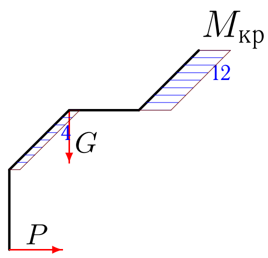


P
G
Mкр

12.

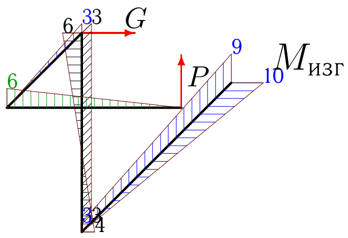


Mизг
G
P

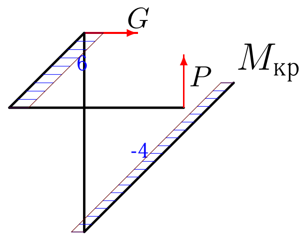


Mкр
12
G
P

13.

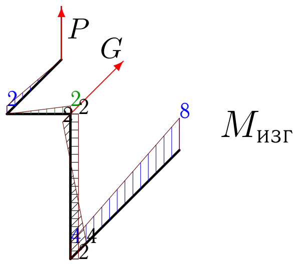


G
P
Mизг

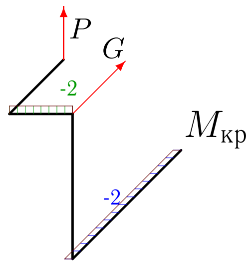


G
P
Mкр
-4

14.

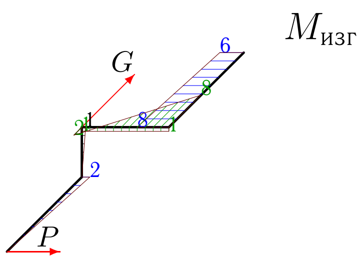


P
G
Mизг
8

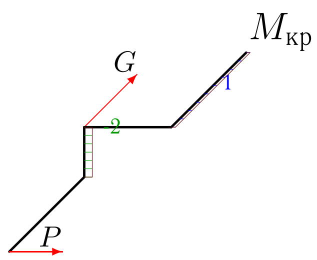


P
G
-2
Mкр
-2

15.

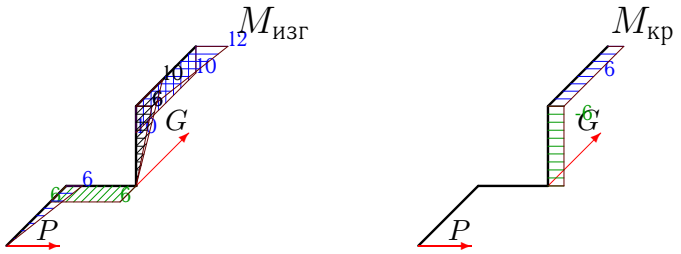


Mизг
G
6
P

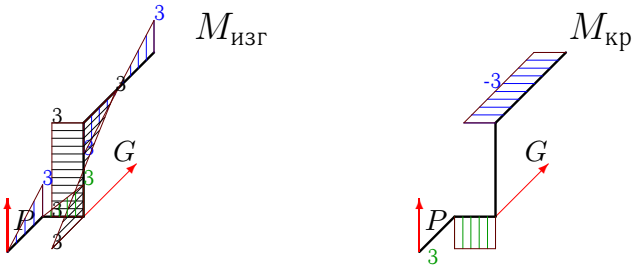


Mкр
G
P

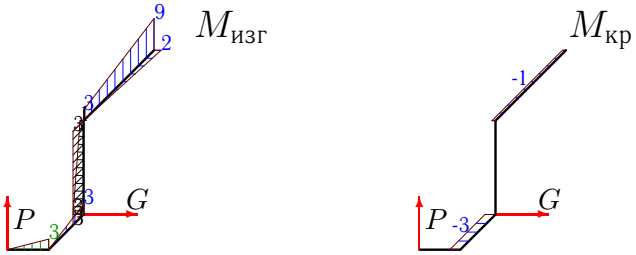
16.


$M_{изг}$
12
10
10
G
6
6
6
P
$M_{кр}$
6
6
G
P

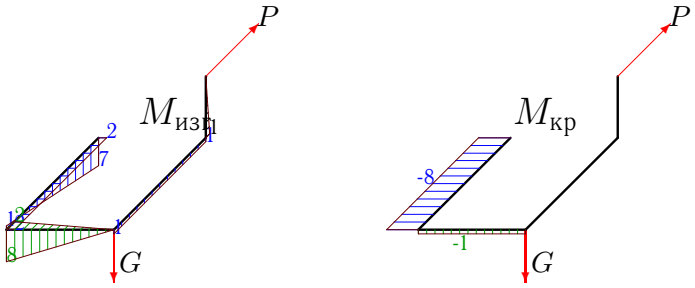
17.


$M_{изг}$
3
3
3
3
3
G
P
$M_{кр}$
-3
G
P
3

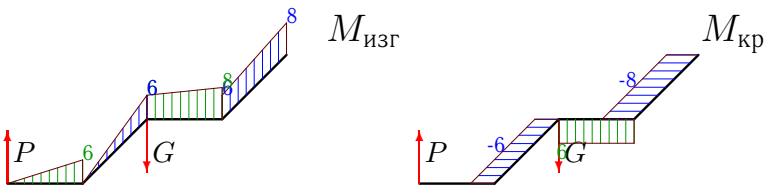
18.


$M_{изг}$
9
2
3
3
3
G
P
3
$M_{кр}$
-1
G
P
-3

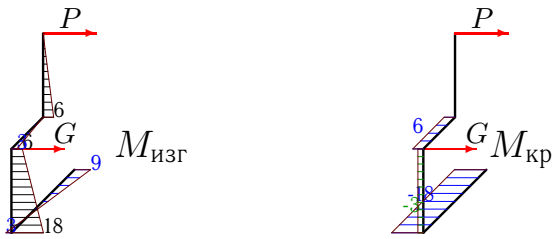
19.


P
$M_{изг}$
2
7
12
8
G
P
$M_{кр}$
-8
-1
G

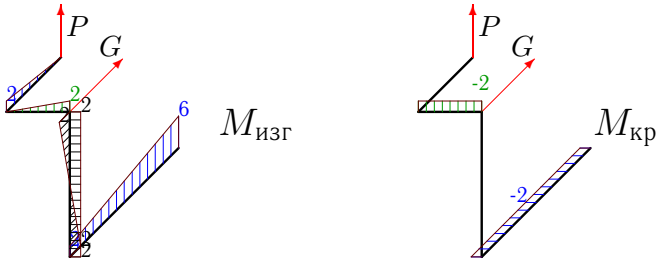
20.


$M_{изг}$
8
6
8
P
6
G
$M_{кр}$
-8
P
-6
G

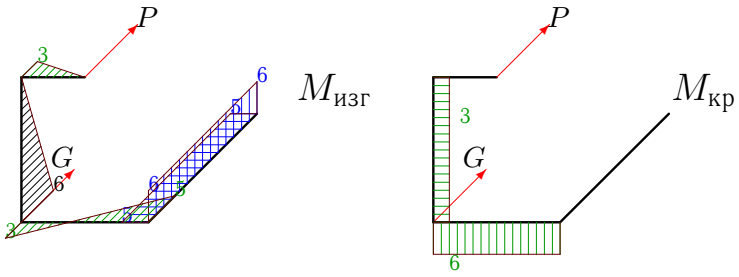
21.


P
6
G
9
18
$M_{изг}$
P
6
G
$M_{кр}$

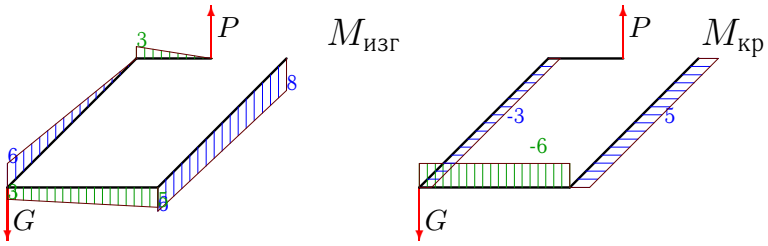
22.


P
G
2
2
2
6
$M_{изг}$
P
G
-2
-2
$M_{кр}$

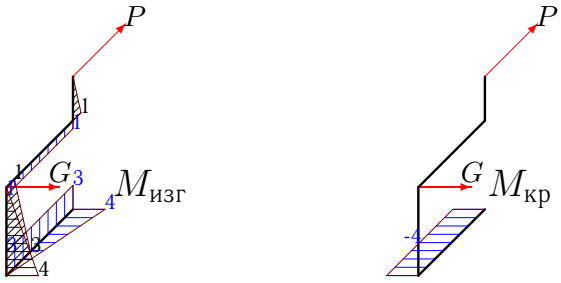
23.


P
3
6
G
6
$M_{изг}$
P
3
G
6
$M_{кр}$

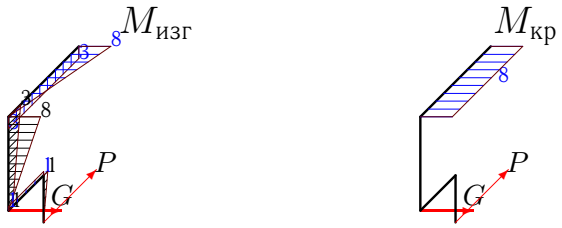
24.


P
3
8
6
G
$M_{изг}$
P
-3
-6
5
G
$M_{кр}$

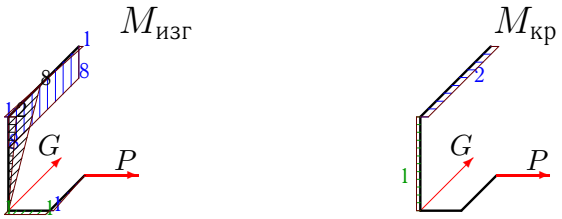
25.


P
1
1
G
3
4
4
$M_{изг}$
P
G
-4
$M_{кр}$

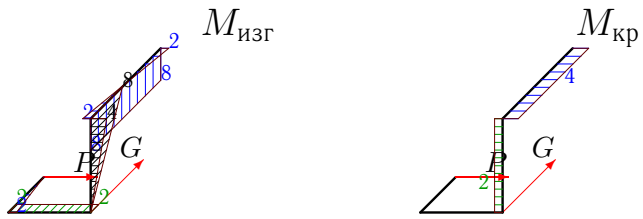
26.



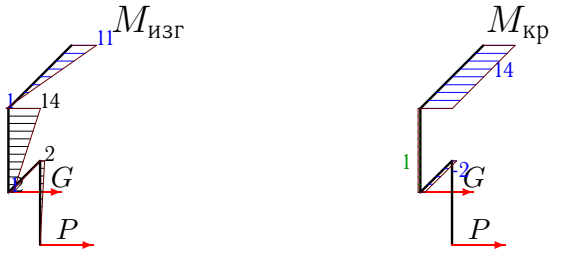
27.



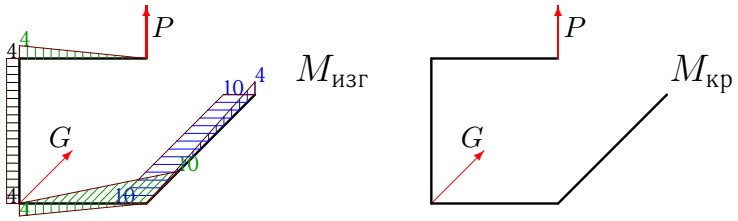
28.



29.



30.



M26 файл o26m3A

№	Δ_{1-2}	Δ_{2-3}	Δ_{3-4}	Δ_{4-5}	$\sum\Delta$	$\Delta\varphi\cdot 10^2$
1	2.445	2.295	1.121	0.544	6.405	-0.832
2	4.927	1.837	0.331	0.068	7.163	-1.327
3	2.857	1.325	0.408	0.272	4.862	0.612
4	18.571	9.905	1.681	0.816	30.974	1.555
5	3.362	2.449	1.606	0.102	7.519	3.416
6	3.969	1.429	0.497	0.102	5.996	-1.990
7	1.121	0.535	0.102	0.034	1.792	-0.730
8	3.265	1.905	0.408	0.272	5.850	0.816
9	4.286	3.566	1.606	0.102	9.560	-3.416
10	1.633	2.105	2.649	0.544	6.932	-2.277
11	12.245	6.359	1.325	0.272	20.201	1.139
12	10.125	4.898	2.649	0.544	18.217	2.449
13	0.548	1.020	1.681	0.816	4.066	-1.990
14	0.662	0.204	0.331	0.068	1.266	-1.037
15	-3.955	-1.020	0.560	0.272	-4.142	0.518
16	8.872	3.974	2.449	0.816	16.112	2.191
17	0.994	0.612	0.497	0.102	2.205	-1.555
18	2.916	1.020	0.497	0.102	4.535	-1.990
19	0.204	0.535	0.204	0.034	0.977	0.612
20	12.775	7.512	3.974	0.816	25.077	-3.620
21	19.356	8.545	1.681	0.816	30.397	-0.330
22	0.662	0.408	0.331	0.068	1.470	-1.037
23	3.469	3.430	1.606	0.102	8.607	-3.416
24	0.045	3.090	1.606	0.102	4.842	3.620
25	1.837	0.884	0.204	0.034	2.959	0.408
26	1.837	0.884	0.102	0.034	2.857	0.816
27	1.121	0.535	0.102	0.034	1.792	0.730
28	2.241	1.071	0.408	0.068	3.788	1.461
29	15.145	5.569	0.560	0.272	21.547	0.706
30	0.544	0.544	1.633	0.544	3.265	-0.408