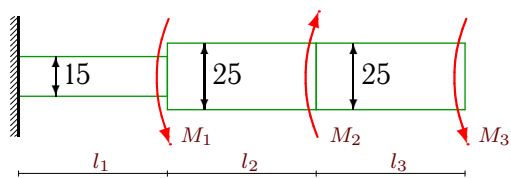


Кручение стержней кругового сечения

К стальному стержню кусочно-постоянного круглого сечения приложены моменты M_1, M_2, M_3 . Построить эпюры углов закручивания и касательных напряжений на поверхности вала. Модуль сдвига материала $G = 80 \text{ ГПа}$. Диаметры даны в сантиметрах.

Задача M28.1.

4

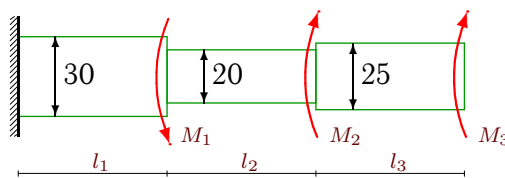


$$M_1 = 12 \text{ кНм}, M_2 = 40 \text{ кНм}, M_3 = 7 \text{ кНм},$$

$$l_1 = 3.4 \text{ м}, l_2 = 2.2 \text{ м}, l_3 = 3 \text{ м}.$$

Задача M28.2.

4

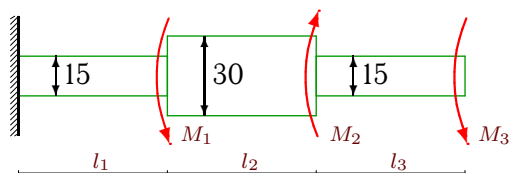


$$M_1 = 45 \text{ кНм}, M_2 = 8 \text{ кНм}, M_3 = 20 \text{ кНм},$$

$$l_1 = 4 \text{ м}, l_2 = 2.8 \text{ м}, l_3 = 2.6 \text{ м}.$$

Задача M28.3.

4

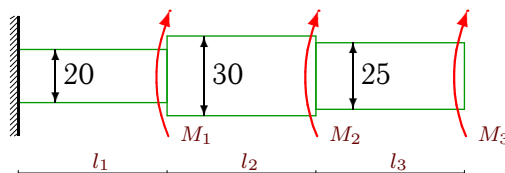


$$M_1 = 21 \text{ кНм}, M_2 = 45 \text{ кНм}, M_3 = 45 \text{ кНм},$$

$$l_1 = 3.6 \text{ м}, l_2 = 2.4 \text{ м}, l_3 = 4 \text{ м}.$$

Задача M28.4.

4

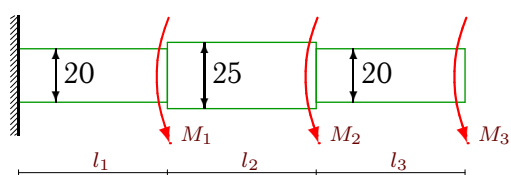


$$M_1 = 16 \text{ кНм}, M_2 = 14 \text{ кНм}, M_3 = 30 \text{ кНм},$$

$$l_1 = 2.6 \text{ м}, l_2 = 2.6 \text{ м}, l_3 = 2.4 \text{ м}.$$

Задача M28.5.

4

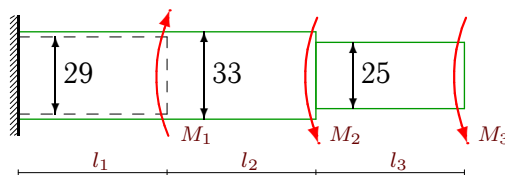


$$M_1 = 26 \text{ кНм}, M_2 = 33 \text{ кНм}, M_3 = 6 \text{ кНм},$$

$$l_1 = 3.4 \text{ м}, l_2 = 3.6 \text{ м}, l_3 = 3.2 \text{ м}.$$

Задача M28.6.

4

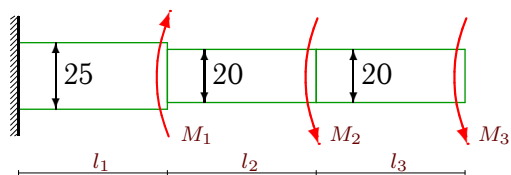


$$M_1 = 48 \text{ кНм}, M_2 = 24 \text{ кНм}, M_3 = 22 \text{ кНм},$$

$$l_1 = 2.2 \text{ м}, l_2 = 3.4 \text{ м}, l_3 = 3.4 \text{ м}.$$

Задача M28.7.

4

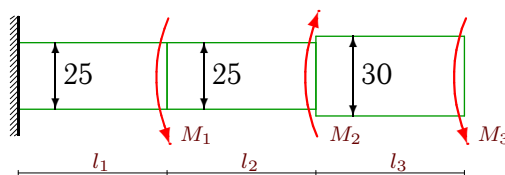


$$M_1 = 20 \text{ кНм}, M_2 = 7 \text{ кНм}, M_3 = 7 \text{ кНм},$$

$$l_1 = 2.6 \text{ м}, l_2 = 3 \text{ м}, l_3 = 3.2 \text{ м}.$$

Задача M28.8.

4

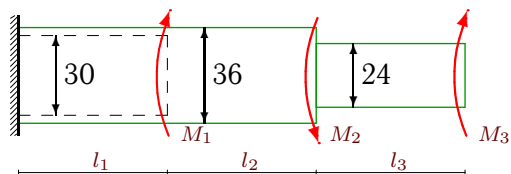


$$M_1 = 36 \text{ кНм}, M_2 = 11 \text{ кНм}, M_3 = 9 \text{ кНм},$$

$$l_1 = 3.8 \text{ м}, l_2 = 2.8 \text{ м}, l_3 = 3.2 \text{ м}.$$

Задача M28.9.

4

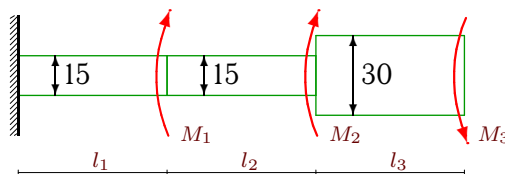


$$M_1 = 44 \text{ кНм}, M_2 = 7 \text{ кНм}, M_3 = 24 \text{ кНм},$$

$$l_1 = 2.2 \text{ м}, l_2 = 3.2 \text{ м}, l_3 = 2.4 \text{ м}.$$

Задача M28.10.

4

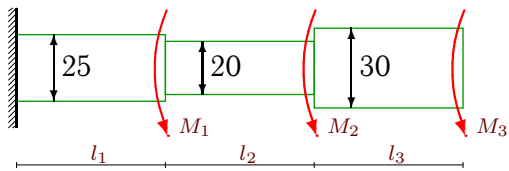


$$M_1 = 7 \text{ кНм}, M_2 = 42 \text{ кНм}, M_3 = 52 \text{ кНм},$$

$$l_1 = 2.8 \text{ м}, l_2 = 2.4 \text{ м}, l_3 = 3.8 \text{ м}.$$

Задача M28.11.

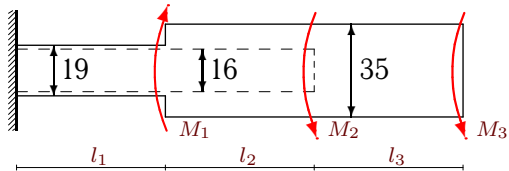
4



$M_1=56\text{кНм}$, $M_2=60\text{кНм}$, $M_3=50\text{кНм}$,
 $l_1=3.8\text{м}$, $l_2=3.8\text{м}$, $l_3=4\text{м}$.

Задача M28.13.

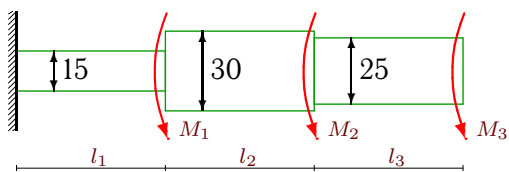
4



$M_1=45\text{кНм}$, $M_2=70\text{кНм}$, $M_3=28\text{кНм}$,
 $l_1=2.4\text{м}$, $l_2=4\text{м}$, $l_3=3.8\text{м}$.

Задача M28.15.

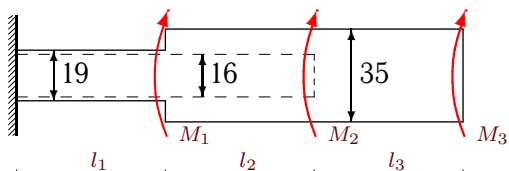
4



$M_1=52\text{кНм}$, $M_2=45\text{кНм}$, $M_3=65\text{кНм}$,
 $l_1=3.8\text{м}$, $l_2=3.6\text{м}$, $l_3=4\text{м}$.

Задача M28.17.

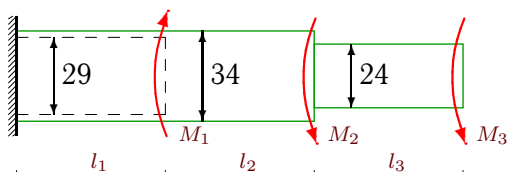
4



$M_1=27\text{кНм}$, $M_2=6\text{кНм}$, $M_3=28\text{кНм}$,
 $l_1=2.4\text{м}$, $l_2=2.8\text{м}$, $l_3=2.2\text{м}$.

Задача M28.19.

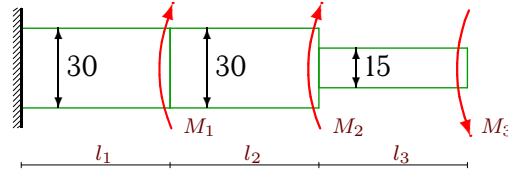
4



$M_1=40\text{кНм}$, $M_2=7\text{кНм}$, $M_3=24\text{кНм}$,
 $l_1=2.2\text{м}$, $l_2=3\text{м}$, $l_3=3.6\text{м}$.

Задача M28.12.

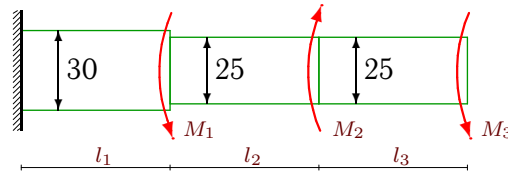
4



$M_1=8\text{кНм}$, $M_2=30\text{кНм}$, $M_3=35\text{кНм}$,
 $l_1=2.8\text{м}$, $l_2=2.6\text{м}$, $l_3=4\text{м}$.

Задача M28.14.

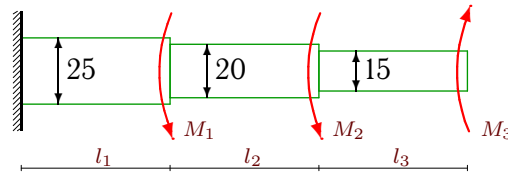
4



$M_1=30\text{кНм}$, $M_2=60\text{кНм}$, $M_3=40\text{кНм}$,
 $l_1=4\text{м}$, $l_2=2.2\text{м}$, $l_3=4\text{м}$.

Задача M28.16.

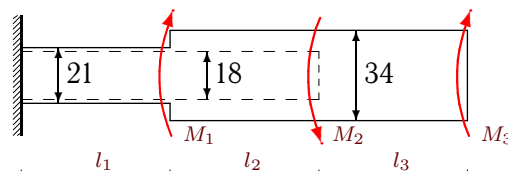
4



$M_1=10\text{кНм}$, $M_2=7\text{кНм}$, $M_3=52\text{кНм}$,
 $l_1=3.2\text{м}$, $l_2=3\text{м}$, $l_3=2.2\text{м}$.

Задача M28.18.

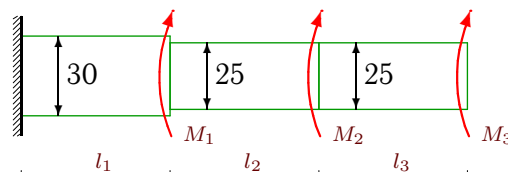
4



$M_1=45\text{кНм}$, $M_2=40\text{кНм}$, $M_3=20\text{кНм}$,
 $l_1=2.4\text{м}$, $l_2=4\text{м}$, $l_3=2.6\text{м}$.

Задача M28.20.

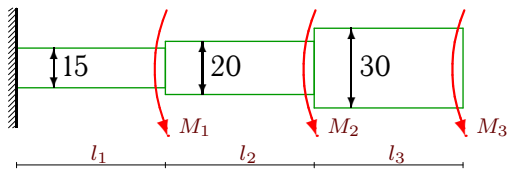
4



$M_1=18\text{кНм}$, $M_2=9\text{кНм}$, $M_3=11\text{кНм}$,
 $l_1=2.6\text{м}$, $l_2=2.8\text{м}$, $l_3=2.8\text{м}$.

Задача M28.21.

4

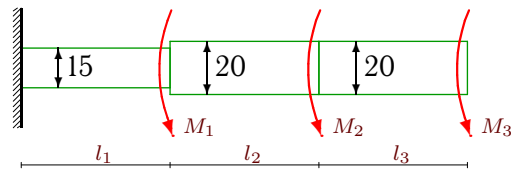


$$M_1=14\text{кНм}, M_2=44\text{кНм}, M_3=8\text{кНм},$$

$$l_1=3.2\text{м}, l_2=3.8\text{м}, l_3=3.2\text{м}.$$

Задача M28.22.

4

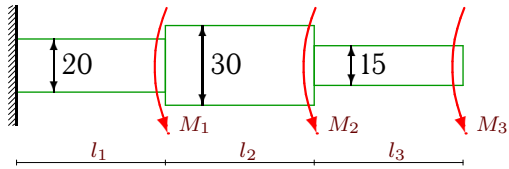


$$M_1=15\text{кНм}, M_2=60\text{кНм}, M_3=30\text{кНм},$$

$$l_1=3.2\text{м}, l_2=4\text{м}, l_3=3.4\text{м}.$$

Задача M28.23.

4

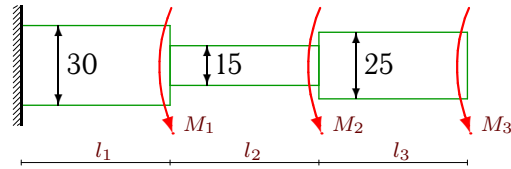


$$M_1=45\text{кНм}, M_2=60\text{кНм}, M_3=12\text{кНм},$$

$$l_1=3.6\text{м}, l_2=4\text{м}, l_3=3.4\text{м}.$$

Задача M28.24.

4

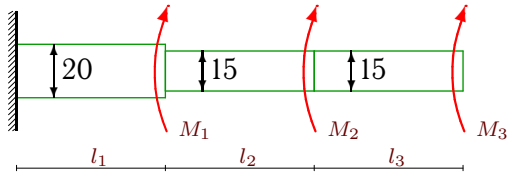


$$M_1=70\text{кНм}, M_2=48\text{кНм}, M_3=20\text{кНм},$$

$$l_1=4\text{м}, l_2=3.8\text{м}, l_3=3.4\text{м}.$$

Задача M28.25.

4

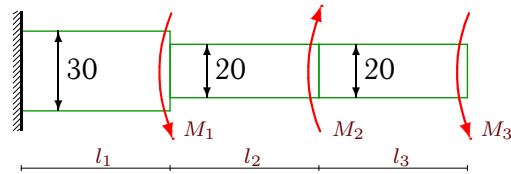


$$M_1=14\text{кНм}, M_2=24\text{кНм}, M_3=30\text{кНм},$$

$$l_1=2.6\text{м}, l_2=2.4\text{м}, l_3=2.6\text{м}.$$

Задача M28.26.

4

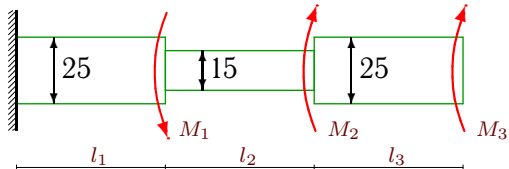


$$M_1=32\text{кНм}, M_2=30\text{кНм}, M_3=70\text{кНм},$$

$$l_1=3.8\text{м}, l_2=2.6\text{м}, l_3=4\text{м}.$$

Задача M28.27.

4

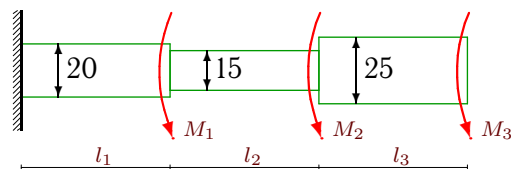


$$M_1=8\text{кНм}, M_2=16\text{кНм}, M_3=16\text{кНм},$$

$$l_1=3.2\text{м}, l_2=2.6\text{м}, l_3=2.6\text{м}.$$

Задача M28.28.

4

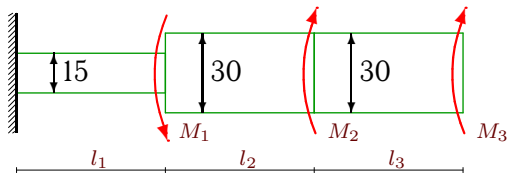


$$M_1=65\text{кНм}, M_2=36\text{кНм}, M_3=12\text{кНм},$$

$$l_1=4\text{м}, l_2=3.6\text{м}, l_3=3.4\text{м}.$$

Задача M28.29.

4

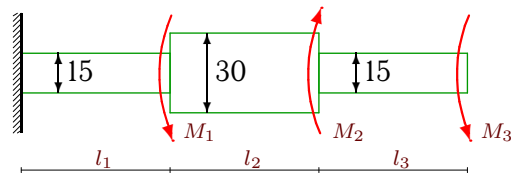


$$M_1=14\text{кНм}, M_2=24\text{кНм}, M_3=24\text{кНм},$$

$$l_1=3.4\text{м}, l_2=2.4\text{м}, l_3=2.6\text{м}.$$

Задача M28.30.

4



$$M_1=12\text{кНм}, M_2=48\text{кНм}, M_3=28\text{кНм},$$

$$l_1=3.4\text{м}, l_2=2.2\text{м}, l_3=3.4\text{м}.$$

M28 Ответы.**Кручение стержней кругового сечения**

17.02.2012

№	φ_1	φ_2	φ_3	τ_1	τ_2	τ_3
	рад·100			МПа		
1	-1.796	-2.032	-1.964	-31.690	-10.756	2.282
2	0.107	-0.517	-0.686	3.207	-17.825	-6.519
3	1.901	1.901	6.428	31.690	0.000	67.906
4	-1.241	-1.421	-1.656	-38.197	-8.300	-9.778
5	1.759	2.216	2.369	41.380	12.712	3.820
6	-0.012	0.156	0.400	-0.702	5.729	7.171
7	-0.051	0.283	0.462	-1.956	8.913	4.456
8	0.421	0.403	0.448	11.082	-0.652	1.698
9	-0.196	-0.238	-0.459	-12.861	-1.546	-8.842
10	0.211	0.815	1.125	4.527	15.090	9.809
11	2.056	5.382	5.697	54.108	70.028	9.431
12	-0.013	0.007	3.528	-0.566	0.943	52.816
13	2.500	2.848	2.938	79.164	5.565	3.326
14	0.063	-0.081	0.441	1.886	-6.519	13.038
15	15.483	16.105	16.953	244.462	20.749	21.187
16	-0.365	-1.439	-4.317	-11.408	-28.648	-78.469
17	-2.877	-2.962	-3.014	-91.113	-1.931	-3.326
18	-0.854	-0.771	-0.820	-29.873	1.489	-2.592
19	-0.040	0.049	0.380	-2.477	3.426	8.842
20	-0.155	-0.338	-0.438	-7.168	-6.519	-3.585
21	5.312	6.884	6.924	99.596	33.104	1.509
22	8.451	11.315	12.127	158.448	57.296	19.099
23	3.352	3.805	4.831	74.485	13.581	18.108
24	0.868	7.367	7.588	26.031	102.614	6.519
25	-1.407	-4.666	-6.628	-43.290	-81.487	-45.271
26	0.430	1.258	3.486	13.581	25.465	44.563
27	-0.250	-2.343	-2.478	-7.823	-48.289	-5.215
28	3.597	7.943	8.076	71.938	72.433	3.911
29	-2.907	-3.088	-3.187	-51.307	-9.054	-4.527
30	-0.684	-0.753	1.641	-12.072	-3.773	42.253

M28 файл o28m4A