

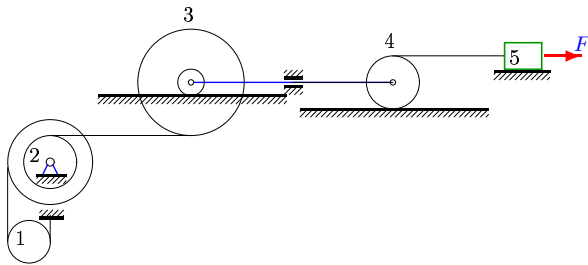
# Кинетическая энергия системы. Приведенные массы

Механическая система, состоящая из пяти тел 1, 2, 3, 4 и 5, движется под действием внешних сил. Заданы радиусы цилиндров и блоков. Радиусы инерции  $\rho$  даны для блоков, цилиндры считать однородными. Горизонтальный стержень, находящийся в зацеплении с блоками, считать невесомым. Массы даны в килограммах, радиусы — в сантиметрах. Вычислить приведенную массу системы  $\mu$  в формуле  $T = \mu v_1^2/2$ , где  $v_1$  — скорость груза 1 (или центра цилиндра 1).

Кирсанов М.Н. Задачи по теоретической механике с решениями в **Maple 11**. — М.: ФИЗМАТЛИТ, 2010. — 264 с. (с.111)

## Задача D-33.1.

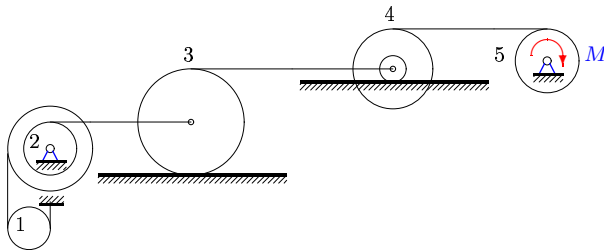
333



$$\begin{aligned} R_2 &= 4, r_2 = 2, \rho_2 = 3, \\ R_3 &= 4, r_3 = 1, \rho_3 = 3, \\ R_4 &= 2, \\ m_1 &= 10, m_2 = 4, \\ m_3 &= 72, m_4 = 42, \\ m_5 &= 54. \end{aligned}$$

## Задача D-33.2.

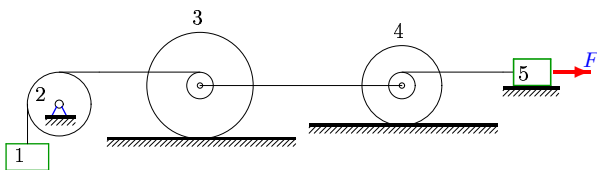
333



$$\begin{aligned} R_2 &= 4, r_2 = 2, \rho_2 = 2, \\ R_3 &= 4, \\ R_4 &= 3, r_4 = 1, \rho_4 = 2, \\ m_1 &= 2, m_2 = 20, \\ m_3 &= 8, m_4 = 3, \\ m_5 &= 4. \end{aligned}$$

## Задача D-33.3.

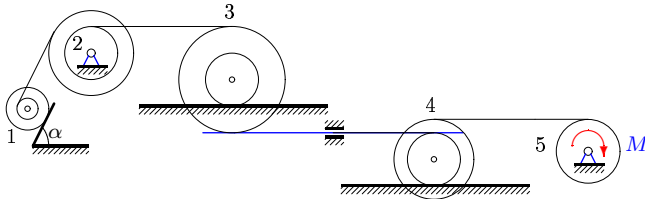
333



$$\begin{aligned} R_3 &= 4, r_3 = 1, \rho_3 = 3, \\ R_4 &= 3, r_4 = 1, \rho_4 = 2, \\ m_1 &= 9, m_2 = 10, \\ m_3 &= 4, m_4 = 225, \\ m_5 &= 225. \end{aligned}$$

## Задача D-33.4.

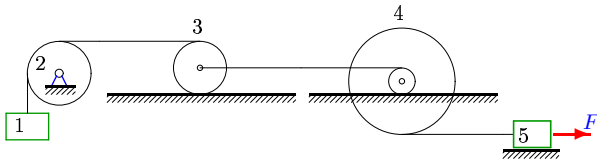
333



$$\begin{aligned} R_1 &= 2, r_1 = 1, \rho_1 = 1, \\ R_2 &= 3, r_2 = 2, \rho_2 = 2, \\ R_3 &= 4, r_3 = 2, \rho_3 = 3, \\ R_4 &= 3, r_4 = 2, \rho_4 = 2, \\ m_1 &= 4, m_2 = 4, \\ m_3 &= 144, m_4 = 54, \\ m_5 &= 288. \end{aligned}$$

Задача D-33.5.

333



$$R_3 = 2,$$

$$R_4 = 4, r_4 = 1, \rho_4 = 3,$$

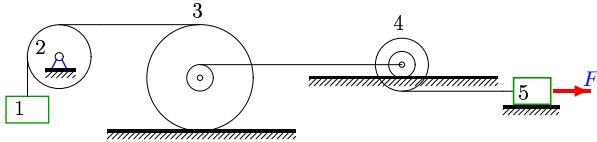
$$m_1 = 14, m_2 = 8,$$

$$m_3 = 32, m_4 = 24,$$

$$m_5 = 32.$$

Задача D-33.6.

333



$$R_3 = 4, r_3 = 1, \rho_3 = 3,$$

$$R_4 = 2, r_4 = 1, \rho_4 = 1,$$

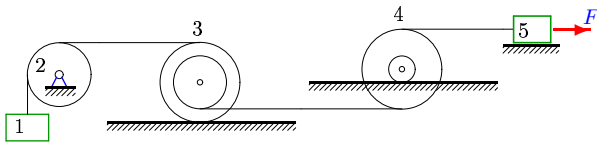
$$m_1 = 11, m_2 = 2,$$

$$m_3 = 256, m_4 = 96,$$

$$m_5 = 128.$$

Задача D-33.7.

333



$$R_3 = 3, r_3 = 2, \rho_3 = 2,$$

$$R_4 = 3, r_4 = 1, \rho_4 = 2,$$

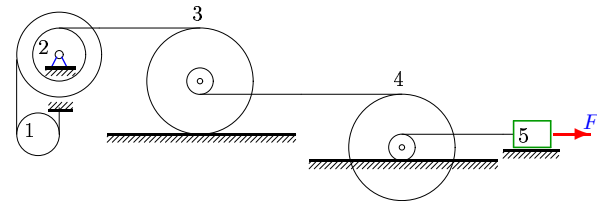
$$m_1 = 11, m_2 = 10,$$

$$m_3 = 144, m_4 = 144,$$

$$m_5 = 18.$$

Задача D-33.8.

333



$$R_2 = 4, r_2 = 2, \rho_2 = 2,$$

$$R_3 = 4, r_3 = 1, \rho_3 = 3,$$

$$R_4 = 4, r_4 = 1, \rho_4 = 3,$$

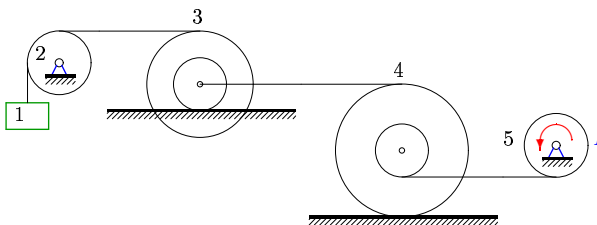
$$m_1 = 2, m_2 = 12,$$

$$m_3 = 256, m_4 = 160,$$

$$m_5 = 400.$$

Задача D-33.9.

333



$$R_3 = 4, r_3 = 2, \rho_3 = 3,$$

$$R_4 = 5, r_4 = 2, \rho_4 = 4,$$

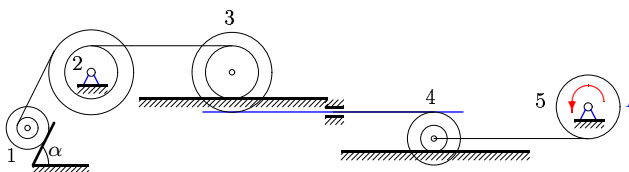
$$m_1 = 11, m_2 = 8,$$

$$m_3 = 180, m_4 = 900,$$

$$m_5 = 200.$$

Задача D-33.10.

333



$$R_1 = 2, r_1 = 1, \rho_1 = 2,$$

$$R_2 = 3, r_2 = 2, \rho_2 = 2,$$

$$R_3 = 3, r_3 = 2, \rho_3 = 2,$$

$$R_4 = 2, r_4 = 1, \rho_4 = 1,$$

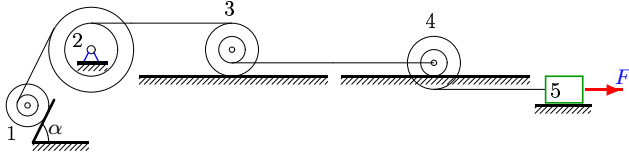
$$m_1 = 4, m_2 = 4,$$

$$m_3 = 8, m_4 = 216,$$

$$m_5 = 288.$$

Задача D-33.11.

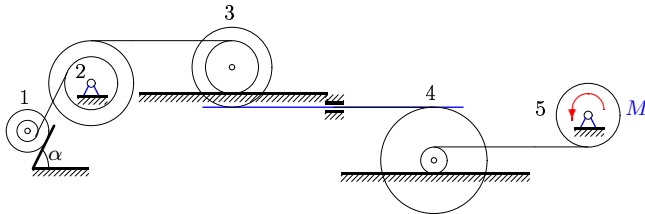
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 2, \\
 R_2 &= 3, r_2 = 2, \rho_2 = 2, \\
 R_3 &= 2, r_3 = 1, \rho_3 = 1, \\
 R_4 &= 2, r_4 = 1, \rho_4 = 1, \\
 m_1 &= 12, m_2 = 24, \\
 m_3 &= 96, m_4 = 40, \\
 m_5 &= 64.
 \end{aligned}$$

Задача D-33.12.

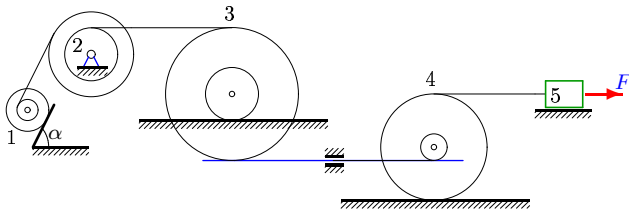
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 2, \\
 R_2 &= 4, r_2 = 2, \rho_2 = 2, \\
 R_3 &= 3, r_3 = 2, \rho_3 = 2, \\
 R_4 &= 4, r_4 = 1, \rho_4 = 3, \\
 m_1 &= 4, m_2 = 48, \\
 m_3 &= 8, m_4 = 120, \\
 m_5 &= 200.
 \end{aligned}$$

Задача D-33.13.

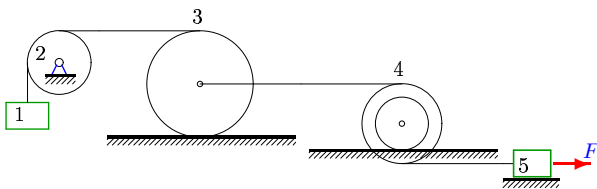
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 1, \\
 R_2 &= 3, r_2 = 2, \rho_2 = 3, \\
 R_3 &= 5, r_3 = 2, \rho_3 = 4, \\
 R_4 &= 4, r_4 = 1, \rho_4 = 3, \\
 m_1 &= 4, m_2 = 16, \\
 m_3 &= 196, m_4 = 147, \\
 m_5 &= 98.
 \end{aligned}$$

Задача D-33.14.

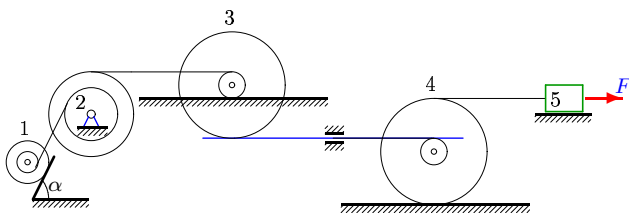
333



$$\begin{aligned}
 R_3 &= 4, \\
 R_4 &= 3, r_4 = 2, \rho_4 = 2, \\
 m_1 &= 12, m_2 = 2, \\
 m_3 &= 32, m_4 = 75, \\
 m_5 &= 100.
 \end{aligned}$$

Задача D-33.15.

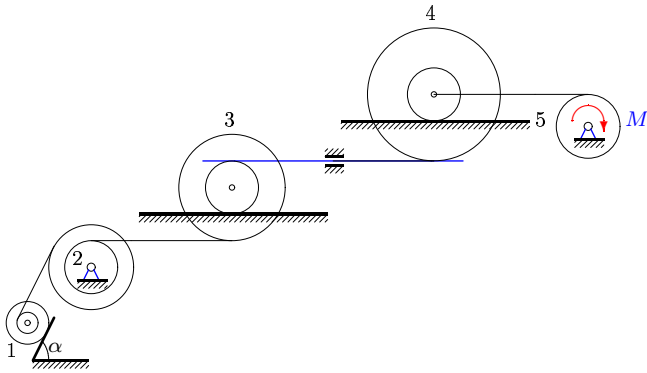
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 1, \\
 R_2 &= 4, r_2 = 2, \rho_2 = 3, \\
 R_3 &= 4, r_3 = 1, \rho_3 = 3, \\
 R_4 &= 4, r_4 = 1, \rho_4 = 3, \\
 m_1 &= 12, m_2 = 64, \\
 m_3 &= 12, m_4 = 20, \\
 m_5 &= 25.
 \end{aligned}$$

Задача D-33.16.

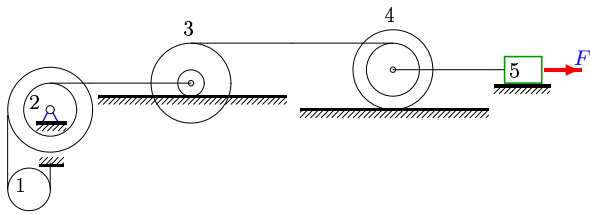
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 1, \\
 R_2 &= 3, r_2 = 2, \rho_2 = 2, \\
 R_3 &= 4, r_3 = 2, \rho_3 = 3, \\
 R_4 &= 5, r_4 = 2, \rho_4 = 4, \\
 m_1 &= 4, m_2 = 12, \\
 m_3 &= 16, m_4 = 27, \\
 m_5 &= 36.
 \end{aligned}$$

Задача D-33.17.

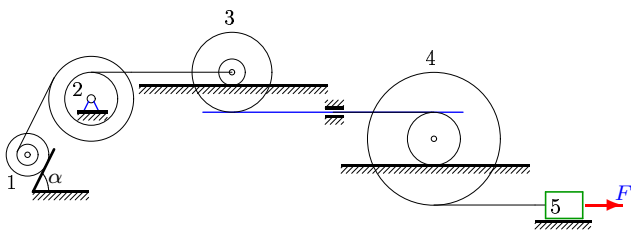
333



$$\begin{aligned}
 R_2 &= 4, r_2 = 2, \rho_2 = 3, \\
 R_3 &= 3, r_3 = 1, \rho_3 = 2, \\
 R_4 &= 3, r_4 = 2, \rho_4 = 2, \\
 m_1 &= 6, m_2 = 24, \\
 m_3 &= 6, m_4 = 25, \\
 m_5 &= 25.
 \end{aligned}$$

Задача D-33.18.

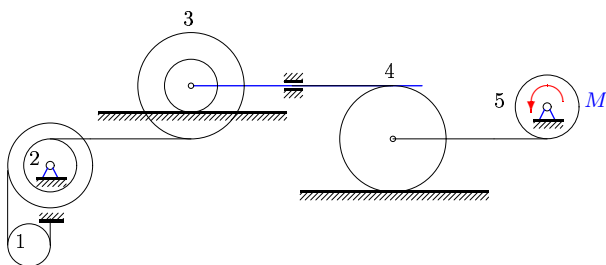
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 1, \\
 R_2 &= 3, r_2 = 2, \rho_2 = 2, \\
 R_3 &= 3, r_3 = 1, \rho_3 = 2, \\
 R_4 &= 5, r_4 = 2, \rho_4 = 4, \\
 m_1 &= 20, m_2 = 12, \\
 m_3 &= 8, m_4 = 7, \\
 m_5 &= 24.
 \end{aligned}$$

Задача D-33.19.

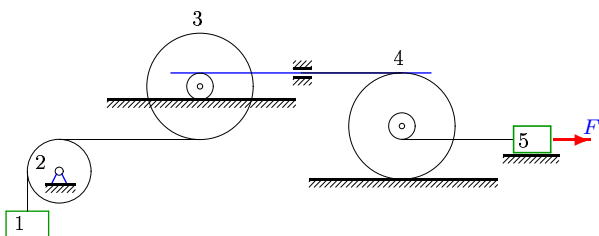
333



$$\begin{aligned}
 R_2 &= 4, r_2 = 2, \rho_2 = 3, \\
 R_3 &= 4, r_3 = 2, \rho_3 = 3, \\
 R_4 &= 4, \\
 m_1 &= 2, m_2 = 4, \\
 m_3 &= 16, m_4 = 24, \\
 m_5 &= 16.
 \end{aligned}$$

Задача D-33.20.

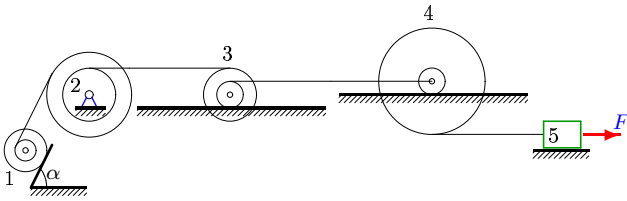
333



$$\begin{aligned}
 R_3 &= 4, r_3 = 1, \rho_3 = 3, \\
 R_4 &= 4, r_4 = 1, \rho_4 = 3, \\
 m_1 &= 17, m_2 = 6, \\
 m_3 &= 72, m_4 = 144, \\
 m_5 &= 96.
 \end{aligned}$$

Задача D-33.21.

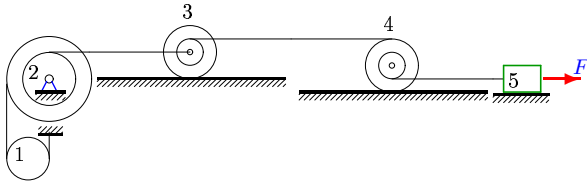
333



$$\begin{aligned} R_1 &= 2, r_1 = 1, \rho_1 = 2, \\ R_2 &= 3, r_2 = 2, \rho_2 = 2, \\ R_3 &= 2, r_3 = 1, \rho_3 = 1, \\ R_4 &= 4, r_4 = 1, \rho_4 = 3, \\ m_1 &= 4, m_2 = 12, \\ m_3 &= 36, m_4 = 27, \\ m_5 &= 2. \end{aligned}$$

Задача D-33.22.

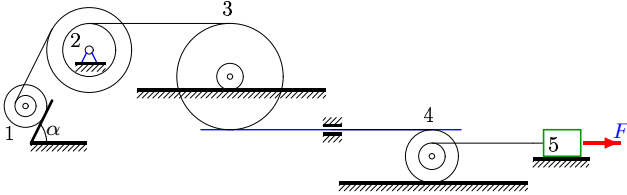
333



$$\begin{aligned} R_2 &= 4, r_2 = 2, \rho_2 = 3, \\ R_3 &= 2, r_3 = 1, \rho_3 = 1, \\ R_4 &= 2, r_4 = 1, \rho_4 = 1, \\ m_1 &= 2, m_2 = 24, \\ m_3 &= 16, m_4 = 192, \\ m_5 &= 128. \end{aligned}$$

Задача D-33.23.

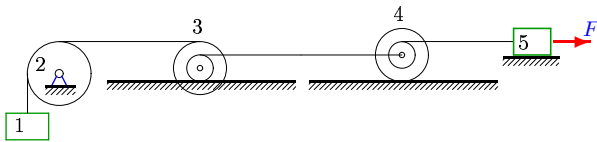
333



$$\begin{aligned} R_1 &= 2, r_1 = 1, \rho_1 = 1, \\ R_2 &= 3, r_2 = 2, \rho_2 = 3, \\ R_3 &= 4, r_3 = 1, \rho_3 = 3, \\ R_4 &= 2, r_4 = 1, \rho_4 = 1, \\ m_1 &= 4, m_2 = 4, \\ m_3 &= 20, m_4 = 240, \\ m_5 &= 400. \end{aligned}$$

Задача D-33.24.

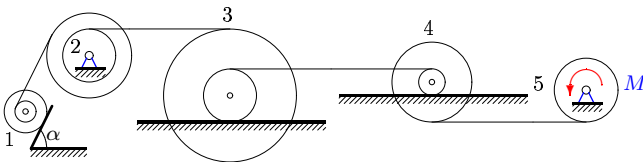
333



$$\begin{aligned} R_3 &= 2, r_3 = 1, \rho_3 = 1, \\ R_4 &= 2, r_4 = 1, \rho_4 = 1, \\ m_1 &= 11, m_2 = 12, \\ m_3 &= 36, m_4 = 27, \\ m_5 &= 2. \end{aligned}$$

Задача D-33.25.

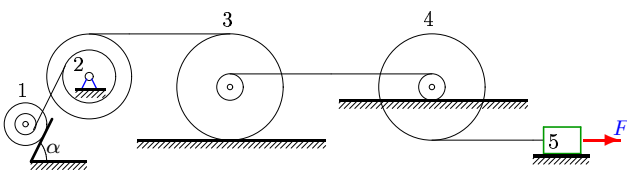
333



$$\begin{aligned} R_1 &= 2, r_1 = 1, \rho_1 = 1, \\ R_2 &= 3, r_2 = 2, \rho_2 = 2, \\ R_3 &= 5, r_3 = 2, \rho_3 = 4, \\ R_4 &= 3, r_4 = 1, \rho_4 = 2, \\ m_1 &= 4, m_2 = 20, \\ m_3 &= 196, m_4 = 147, \\ m_5 &= 196. \end{aligned}$$

Задача D-33.26.

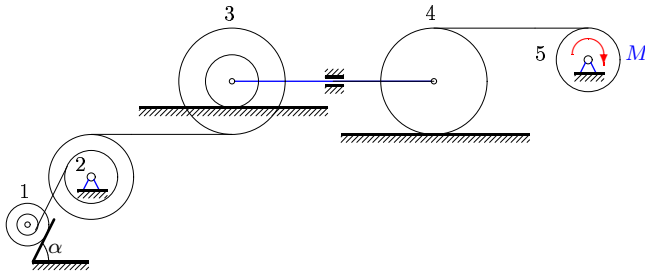
333



$$\begin{aligned} R_1 &= 2, r_1 = 1, \rho_1 = 1, \\ R_2 &= 4, r_2 = 2, \rho_2 = 2, \\ R_3 &= 4, r_3 = 1, \rho_3 = 3, \\ R_4 &= 4, r_4 = 1, \rho_4 = 3, \\ m_1 &= 4, m_2 = 64, \\ m_3 &= 256, m_4 = 128, \\ m_5 &= 256. \end{aligned}$$

Задача D-33.27.

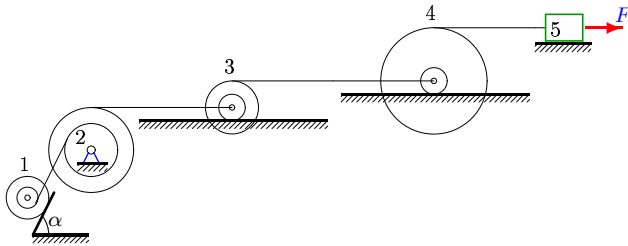
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 1, \\
 R_2 &= 4, r_2 = 2, \rho_2 = 3, \\
 R_3 &= 4, r_3 = 2, \rho_3 = 3, \\
 R_4 &= 4, \\
 m_1 &= 4, m_2 = 96, \\
 m_3 &= 16, m_4 = 6, \\
 m_5 &= 4.
 \end{aligned}$$

Задача D-33.28.

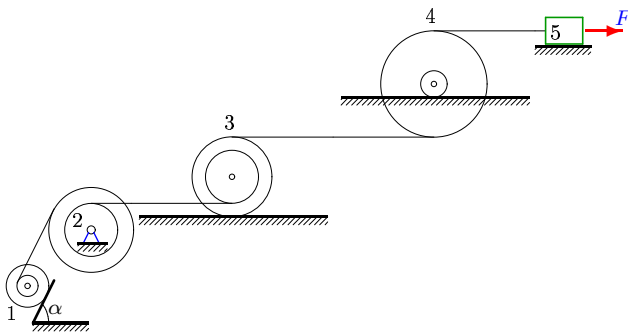
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 2, \\
 R_2 &= 4, r_2 = 2, \rho_2 = 2, \\
 R_3 &= 2, r_3 = 1, \rho_3 = 1, \\
 R_4 &= 4, r_4 = 1, \rho_4 = 3, \\
 m_1 &= 4, m_2 = 48, \\
 m_3 &= 4, m_4 = 3, \\
 m_5 &= 1.
 \end{aligned}$$

Задача D-33.29.

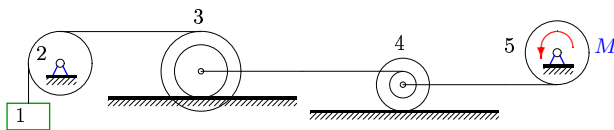
333



$$\begin{aligned}
 R_1 &= 2, r_1 = 1, \rho_1 = 2, \\
 R_2 &= 3, r_2 = 2, \rho_2 = 2, \\
 R_3 &= 3, r_3 = 2, \rho_3 = 2, \\
 R_4 &= 4, r_4 = 1, \rho_4 = 3, \\
 m_1 &= 4, m_2 = 12, \\
 m_3 &= 4, m_4 = 3, \\
 m_5 &= 2.
 \end{aligned}$$

Задача D-33.30.

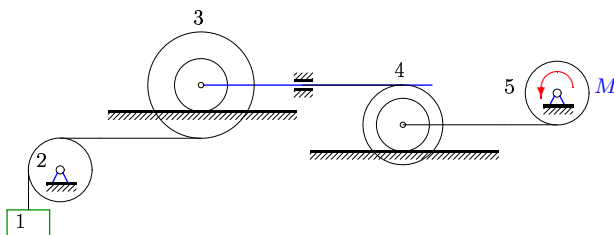
333



$$\begin{aligned}
 R_3 &= 3, r_3 = 2, \rho_3 = 2, \\
 R_4 &= 2, r_4 = 1, \rho_4 = 1, \\
 m_1 &= 13, m_2 = 2, \\
 m_3 &= 125, m_4 = 180, \\
 m_5 &= 450.
 \end{aligned}$$

Задача D-33.31.

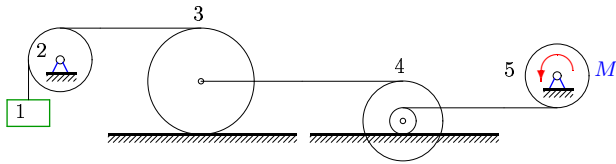
333



$$\begin{aligned}
 R_3 &= 4, r_3 = 2, \rho_3 = 3, \\
 R_4 &= 3, r_4 = 2, \rho_4 = 2, \\
 m_1 &= 17, m_2 = 2, \\
 m_3 &= 16, m_4 = 75, \\
 m_5 &= 100.
 \end{aligned}$$

Задача D-33.32.

333



$$R_3 = 4,$$

$$R_4 = 3, r_4 = 1, \rho_4 = 2,$$

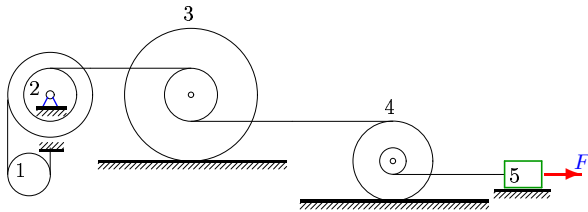
$$m_1 = 10, m_2 = 10,$$

$$m_3 = 32, m_4 = 192,$$

$$m_5 = 64.$$

Задача D-33.33.

333



$$R_2 = 4, r_2 = 2, \rho_2 = 3,$$

$$R_3 = 5, r_3 = 2, \rho_3 = 4,$$

$$R_4 = 3, r_4 = 1, \rho_4 = 2,$$

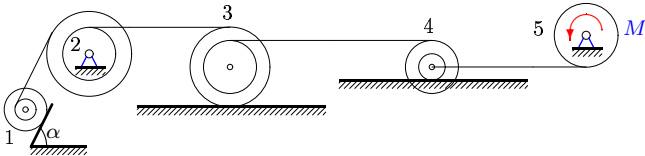
$$m_1 = 2, m_2 = 20,$$

$$m_3 = 196, m_4 = 196,$$

$$m_5 = 98.$$

Задача D-33.34.

333



$$R_1 = 2, r_1 = 1, \rho_1 = 2,$$

$$R_2 = 3, r_2 = 2, \rho_2 = 2,$$

$$R_3 = 3, r_3 = 2, \rho_3 = 2,$$

$$R_4 = 2, r_4 = 1, \rho_4 = 1,$$

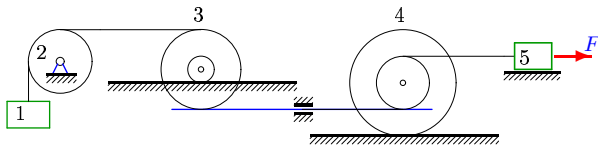
$$m_1 = 8, m_2 = 24,$$

$$m_3 = 180, m_4 = 162,$$

$$m_5 = 648.$$

Задача D-33.35.

333



$$R_3 = 3, r_3 = 1, \rho_3 = 2,$$

$$R_4 = 4, r_4 = 2, \rho_4 = 3,$$

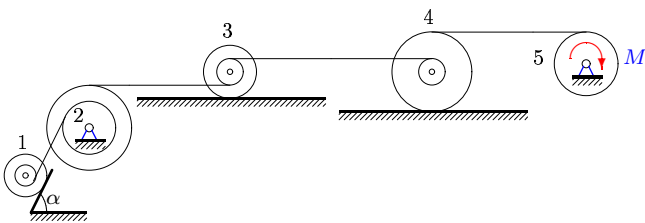
$$m_1 = 14, m_2 = 4,$$

$$m_3 = 64, m_4 = 48,$$

$$m_5 = 8.$$

Задача D-33.36.

333



$$R_1 = 2, r_1 = 1, \rho_1 = 2,$$

$$R_2 = 4, r_2 = 2, \rho_2 = 3,$$

$$R_3 = 2, r_3 = 1, \rho_3 = 1,$$

$$R_4 = 3, r_4 = 1, \rho_4 = 2,$$

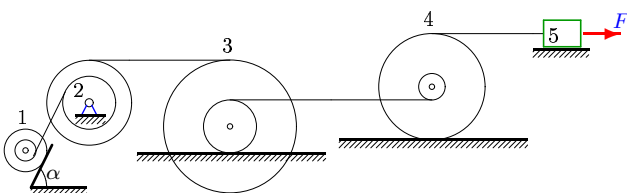
$$m_1 = 4, m_2 = 32,$$

$$m_3 = 4, m_4 = 48,$$

$$m_5 = 16.$$

Задача D-33.37.

333



$$R_1 = 2, r_1 = 1, \rho_1 = 1,$$

$$R_2 = 4, r_2 = 2, \rho_2 = 3,$$

$$R_3 = 5, r_3 = 2, \rho_3 = 4,$$

$$R_4 = 4, r_4 = 1, \rho_4 = 3,$$

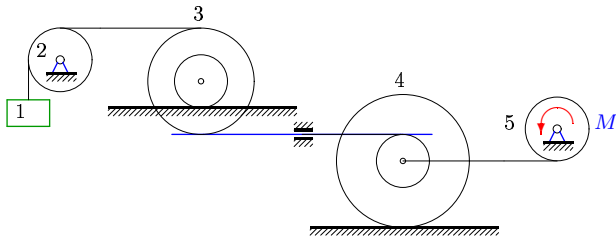
$$m_1 = 4, m_2 = 48,$$

$$m_3 = 196, m_4 = 441,$$

$$m_5 = 441.$$

Задача D-33.38.

333



$$R_3 = 4, r_3 = 2, \rho_3 = 3,$$

$$R_4 = 5, r_4 = 2, \rho_4 = 4,$$

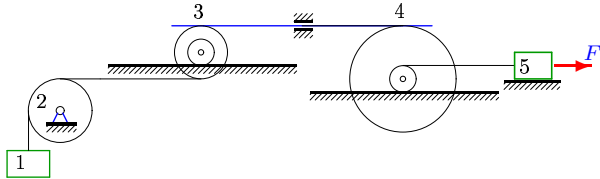
$$m_1 = 13, m_2 = 8,$$

$$m_3 = 144, m_4 = 441,$$

$$m_5 = 882.$$

Задача D-33.39.

333



$$R_3 = 2, r_3 = 1, \rho_3 = 1,$$

$$R_4 = 4, r_4 = 1, \rho_4 = 3,$$

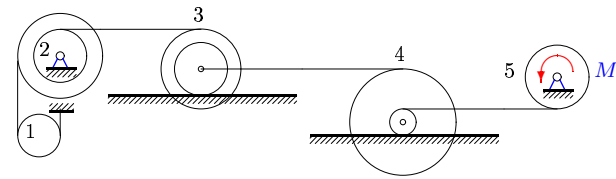
$$m_1 = 19, m_2 = 8,$$

$$m_3 = 8, m_4 = 35,$$

$$m_5 = 150.$$

Задача D-33.40.

333



$$R_2 = 4, r_2 = 2, \rho_2 = 2,$$

$$R_3 = 3, r_3 = 2, \rho_3 = 2,$$

$$R_4 = 4, r_4 = 1, \rho_4 = 3,$$

$$m_1 = 2, m_2 = 12,$$

$$m_3 = 100, m_4 = 125,$$

$$m_5 = 1250.$$

D-33

Ответы.

Кинетическая энергия системы. Приведенные массы 13-

Dec-17



№	$\mu_1$	$\mu_2$	$\mu_3$	$\mu_4$	$\mu_5$	$\sum \mu_k$
1	15	9	80	7	24	135
2	3	20	12	60	128	223
3	9	5	4	208	256	482
4	5	4	52	3	25	89
5	14	4	12	15	18	63
6	11	1	100	75	50	237
7	11	5	52	5	2	75
8	3	12	100	9	9	133
9	11	4	65	41	1	122
10	8	4	4	3	1	20
11	24	24	30	5	4	87
12	8	12	4	3	1	28
13	5	36	80	75	128	324
14	12	1	12	6	1	32
15	15	36	30	45	144	270
16	5	12	52	240	32	341
17	9	54	30	208	144	445
18	25	12	40	35	54	166
19	3	9	52	9	2	75
20	17	3	80	25	6	131
21	8	12	8	120	8	156
22	3	54	20	135	18	230
23	5	9	8	27	81	130
24	11	6	8	15	2	42
25	5	20	80	60	32	197
26	5	16	100	125	225	471
27	5	54	52	9	8	128
28	8	12	8	270	225	523
29	8	12	52	120	200	392
30	13	1	40	16	16	86
31	17	1	52	24	8	102
32	10	5	12	15	2	44
33	3	45	164	13	2	227
34	16	24	65	25	25	155
35	14	2	20	75	18	129
36	8	18	20	351	162	559
37	5	27	80	400	1024	1536
38	13	4	52	41	25	135
39	19	4	16	126	216	381
40	3	12	32	8	16	71