

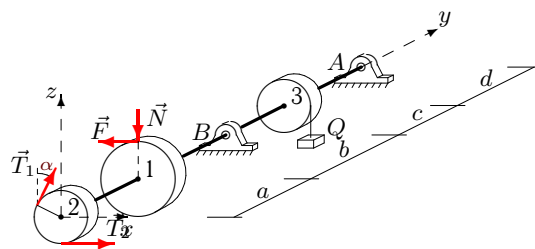
## Равновесие вала

Горизонтальный вал весом  $G$  может вращаться в цилиндрических шарнирах  $A$  и  $B$ . К шкиву 1 приложено нормальное давление  $N$  и касательная сила сопротивления  $F$ , пропорциональная  $N$ . На шкив 2 действуют силы натяжения ремней  $T_1$  и  $T_2$ . Груз  $Q$  висит на нити, навитой на шкив 3. Определить силу давления  $N$  и реакции шарниров в условии равновесия вала (в Н). Учесть веса шкивов  $P_1, P_2, P_3$ . Все нагрузки действуют в вертикальной плоскости. Силы даны в Н, размеры — в см.

Кирсанов М.Н. **Решебник. Теоретическая механика** с. 94.

### Вариант 1

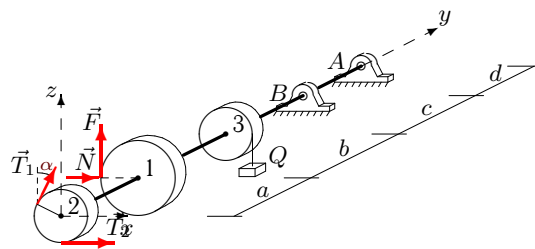
C19.



$$F = 0.4N, T_1 = 50, \\ T_2 = 29, P_1 = 34, \\ P_2 = 20, P_3 = 28, \\ Q = 10, G = 25, \\ \alpha = 45^\circ, R_1 = 24, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 25, \\ c = 27, d = 27.$$

### Вариант 2

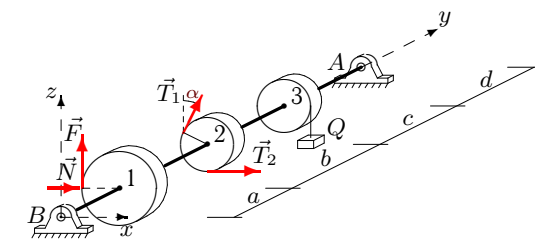
C19.



$$F = 0.4N, T_1 = 50, \\ T_2 = 96, P_1 = 44, \\ P_2 = 30, P_3 = 38, \\ Q = 22, G = 25, \\ \alpha = 60^\circ, R_1 = 26, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 28, \\ c = 31, d = 27.$$

### Вариант 3

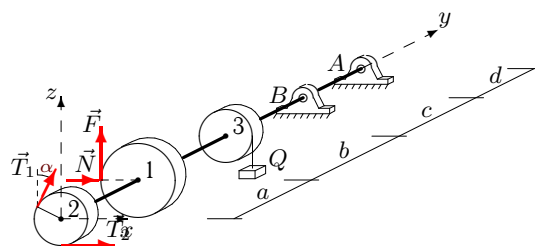
C19.



$$F = 0.3N, T_1 = 40, \\ T_2 = 78, P_1 = 46, \\ P_2 = 30, P_3 = 38, \\ Q = 14, G = 20, \\ \alpha = 60^\circ, R_1 = 30, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 26, \\ c = 29, d = 28.$$

### Вариант 4

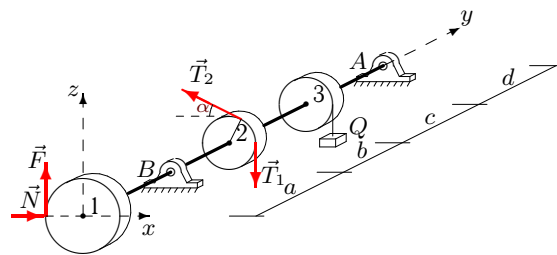
C19.



$$F = 0.3N, T_1 = 50, \\ T_2 = 96, P_1 = 46, \\ P_2 = 30, P_3 = 38, \\ Q = 22, G = 25, \\ \alpha = 60^\circ, R_1 = 30, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 28, \\ c = 31, d = 28.$$

**Вариант 5**

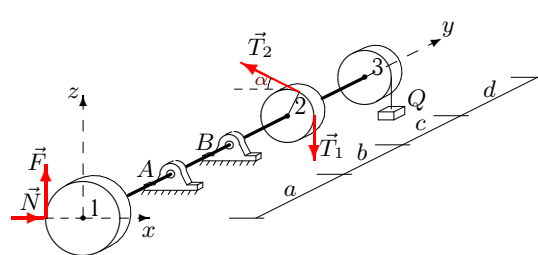
C19.



$F = 0.4N$ ,  $T_1 = 60$ ,  
 $T_2 = 117$ ,  $P_1 = 32$ ,  
 $P_2 = 20$ ,  $P_3 = 28$ ,  
 $Q = 18$ ,  $G = 30$ ,  
 $\alpha = 45^\circ$ ,  $R_1 = 20$ ,  
 $R_2 = 10$ ,  $R_3 = 12$ ,  
 $a = 24$ ,  $b = 27$ ,  
 $c = 29$ ,  $d = 26$ .

**Вариант 6**

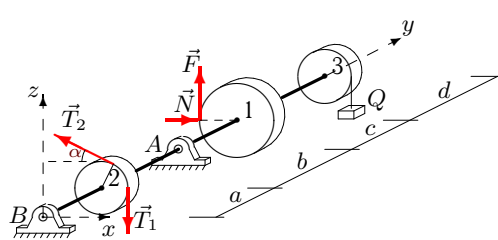
C19.



$F = 0.4N$ ,  $T_1 = 60$ ,  
 $T_2 = 118$ ,  $P_1 = 30$ ,  
 $P_2 = 20$ ,  $P_3 = 28$ ,  
 $Q = 14$ ,  $G = 30$ ,  
 $\alpha = 45^\circ$ ,  $R_1 = 16$ ,  
 $R_2 = 10$ ,  $R_3 = 12$ ,  
 $a = 24$ ,  $b = 26$ ,  
 $c = 28$ ,  $d = 25$ .

**Вариант 7**

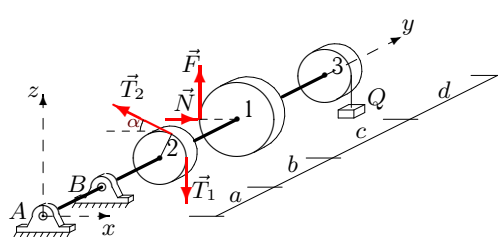
C19.



$F = 0.3N$ ,  $T_1 = 40$ ,  
 $T_2 = 77$ ,  $P_1 = 22$ ,  
 $P_2 = 10$ ,  $P_3 = 18$ ,  
 $Q = 18$ ,  $G = 20$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 18$ ,  
 $R_2 = 8$ ,  $R_3 = 10$ ,  
 $a = 24$ ,  $b = 27$ ,  
 $c = 28$ ,  $d = 26$ .

**Вариант 8**

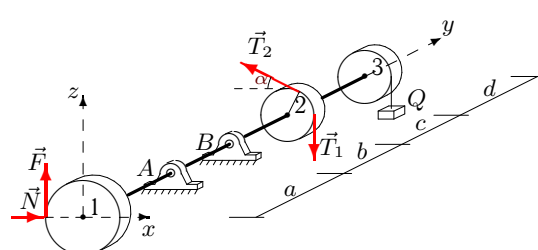
C19.



$F = 0.1N$ ,  $T_1 = 30$ ,  
 $T_2 = 58$ ,  $P_1 = 18$ ,  
 $P_2 = 10$ ,  $P_3 = 14$ ,  
 $Q = 14$ ,  $G = 15$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 18$ ,  
 $R_2 = 8$ ,  $R_3 = 9$ ,  
 $a = 22$ ,  $b = 24$ ,  
 $c = 25$ ,  $d = 24$ .

**Вариант 9**

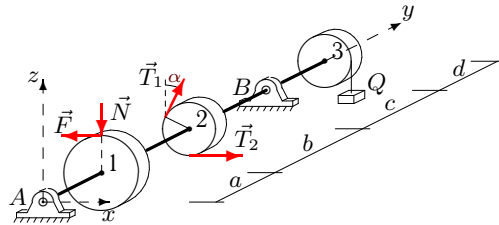
C19.



$F = 0.2N$ ,  $T_1 = 60$ ,  
 $T_2 = 117$ ,  $P_1 = 16$ ,  
 $P_2 = 10$ ,  $P_3 = 14$ ,  
 $Q = 18$ ,  $G = 30$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 14$ ,  
 $R_2 = 8$ ,  $R_3 = 9$ ,  
 $a = 22$ ,  $b = 25$ ,  
 $c = 26$ ,  $d = 23$ .

**Вариант 10**

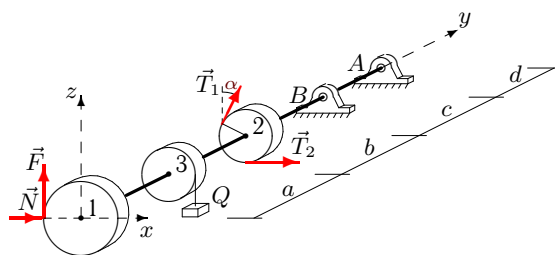
C19.



$$F = 0.4N, T_1 = 30, \\ T_2 = 19, P_1 = 46, \\ P_2 = 30, P_3 = 38, \\ Q = 10, G = 15, \\ \alpha = 60^\circ, R_1 = 30, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 25, \\ c = 28, d = 28.$$

**Вариант 11**

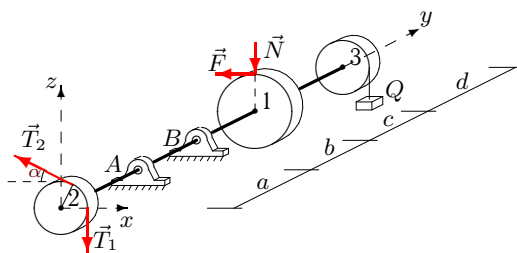
C19.



$$F = 0.4N, T_1 = 60, \\ T_2 = 116, P_1 = 46, \\ P_2 = 30, P_3 = 38, \\ Q = 22, G = 30, \\ \alpha = 60^\circ, R_1 = 30, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 28, \\ c = 31, d = 28.$$

**Вариант 12**

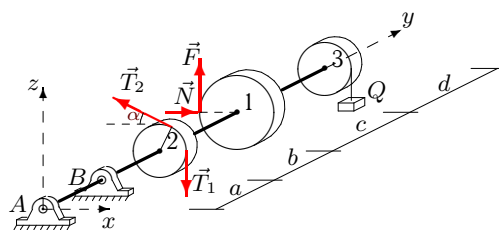
C19.



$$F = 0.1N, T_1 = 50, \\ T_2 = 26, P_1 = 16, \\ P_2 = 10, P_3 = 14, \\ Q = 10, G = 25, \\ \alpha = 30^\circ, R_1 = 14, \\ R_2 = 8, R_3 = 9, \\ a = 22, b = 23, \\ c = 24, d = 23.$$

**Вариант 13**

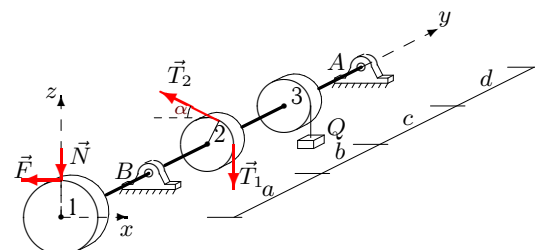
C19.



$$F = 0.2N, T_1 = 30, \\ T_2 = 58, P_1 = 26, \\ P_2 = 20, P_3 = 24, \\ Q = 14, G = 15, \\ \alpha = 45^\circ, R_1 = 16, \\ R_2 = 10, R_3 = 11, \\ a = 22, b = 24, \\ c = 26, d = 23.$$

**Вариант 14**

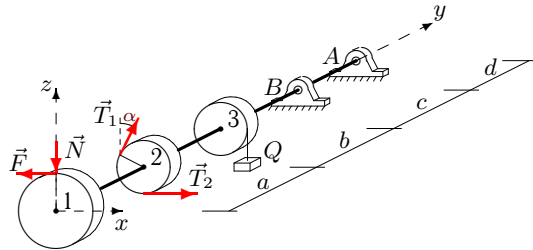
C19.



$$F = 0.3N, T_1 = 60, \\ T_2 = 33, P_1 = 42, \\ P_2 = 30, P_3 = 38, \\ Q = 26, G = 30, \\ \alpha = 60^\circ, R_1 = 22, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 29, \\ c = 32, d = 26.$$

**Вариант 15**

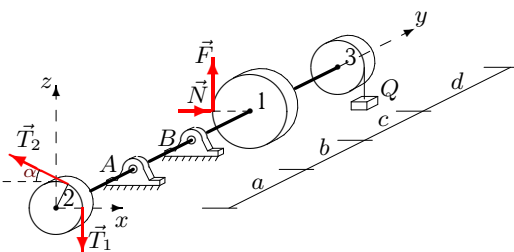
C19.



$$F = 0.3N, T_1 = 60, \\ T_2 = 33, P_1 = 44, \\ P_2 = 30, P_3 = 38, \\ Q = 10, G = 30, \\ \alpha = 60^\circ, R_1 = 26, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 25, \\ c = 28, d = 27.$$

**Вариант 16**

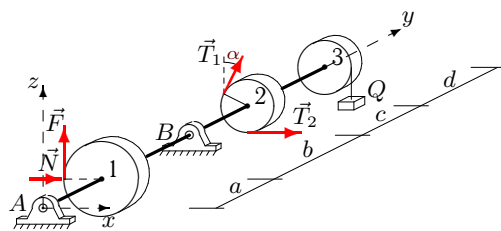
C19.



$$F = 0.3N, T_1 = 50, \\ T_2 = 96, P_1 = 30, \\ P_2 = 20, P_3 = 28, \\ Q = 22, G = 25, \\ \alpha = 45^\circ, R_1 = 16, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 28, \\ c = 30, d = 25.$$

**Вариант 17**

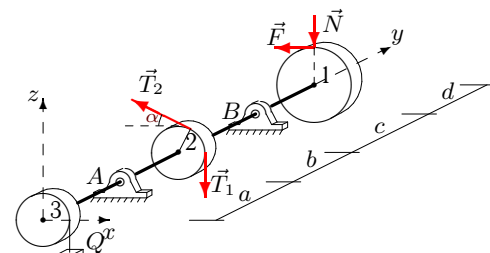
C19.



$$F = 0.3N, T_1 = 30, \\ T_2 = 57, P_1 = 26, \\ P_2 = 10, P_3 = 18, \\ Q = 18, G = 15, \\ \alpha = 30^\circ, R_1 = 26, \\ R_2 = 8, R_3 = 10, \\ a = 24, b = 27, \\ c = 28, d = 28.$$

**Вариант 18**

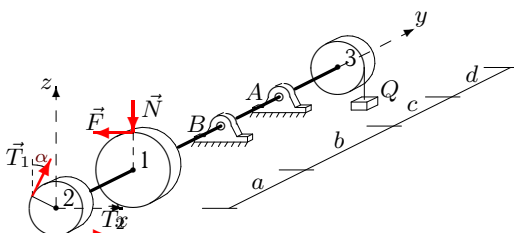
C19.



$$F = 0.1N, T_1 = 70, \\ T_2 = 36, P_1 = 36, \\ P_2 = 30, P_3 = 34, \\ Q = 10, G = 35, \\ \alpha = 60^\circ, R_1 = 18, \\ R_2 = 12, R_3 = 13, \\ a = 22, b = 23, \\ c = 26, d = 23.$$

**Вариант 19**

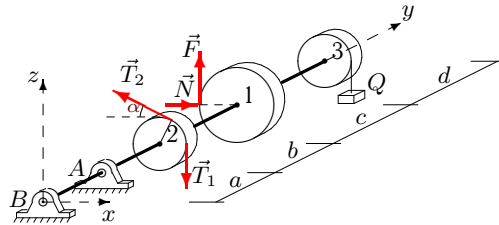
C19.



$$F = 0.2N, T_1 = 50, \\ T_2 = 27, P_1 = 32, \\ P_2 = 20, P_3 = 24, \\ Q = 26, G = 25, \\ \alpha = 45^\circ, R_1 = 28, \\ R_2 = 10, R_3 = 11, \\ a = 22, b = 27, \\ c = 29, d = 26.$$

**Вариант 20**

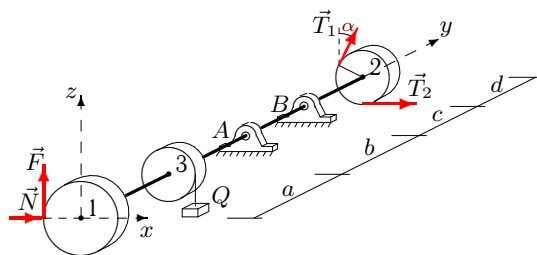
C19.



$F = 0.1N, T_1 = 40,$   
 $T_2 = 77, P_1 = 26,$   
 $P_2 = 20, P_3 = 24,$   
 $Q = 18, G = 20,$   
 $\alpha = 45^\circ, R_1 = 16,$   
 $R_2 = 10, R_3 = 11,$   
 $a = 22, b = 25,$   
 $c = 27, d = 23.$

**Вариант 21**

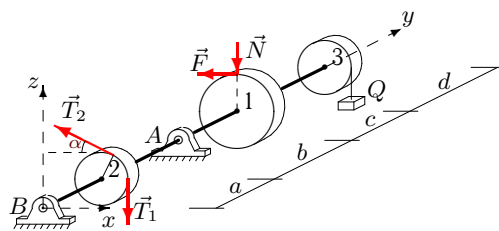
C19.



$F = 0.3N, T_1 = 60,$   
 $T_2 = 117, P_1 = 26,$   
 $P_2 = 10, P_3 = 18,$   
 $Q = 18, G = 30,$   
 $\alpha = 30^\circ, R_1 = 26,$   
 $R_2 = 8, R_3 = 10,$   
 $a = 24, b = 27,$   
 $c = 28, d = 28.$

**Вариант 22**

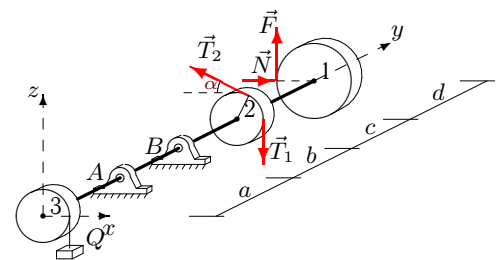
C19.



$F = 0.1N, T_1 = 40,$   
 $T_2 = 21, P_1 = 18,$   
 $P_2 = 10, P_3 = 14,$   
 $Q = 26, G = 20,$   
 $\alpha = 30^\circ, R_1 = 18,$   
 $R_2 = 8, R_3 = 9,$   
 $a = 22, b = 27,$   
 $c = 28, d = 24.$

**Вариант 23**

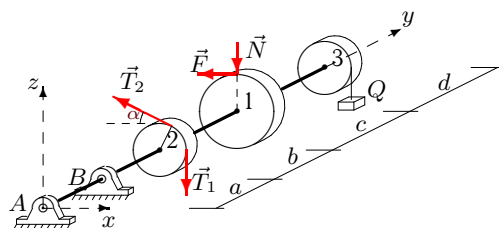
C19.



$F = 0.1N, T_1 = 70,$   
 $T_2 = 137, P_1 = 16,$   
 $P_2 = 10, P_3 = 14,$   
 $Q = 18, G = 35,$   
 $\alpha = 30^\circ, R_1 = 14,$   
 $R_2 = 8, R_3 = 9,$   
 $a = 22, b = 25,$   
 $c = 26, d = 23.$

**Вариант 24**

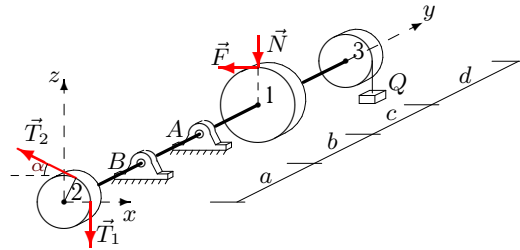
C19.



$F = 0.4N, T_1 = 30,$   
 $T_2 = 19, P_1 = 32,$   
 $P_2 = 20, P_3 = 28,$   
 $Q = 26, G = 15,$   
 $\alpha = 45^\circ, R_1 = 20,$   
 $R_2 = 10, R_3 = 12,$   
 $a = 24, b = 29,$   
 $c = 31, d = 26.$

**Вариант 25**

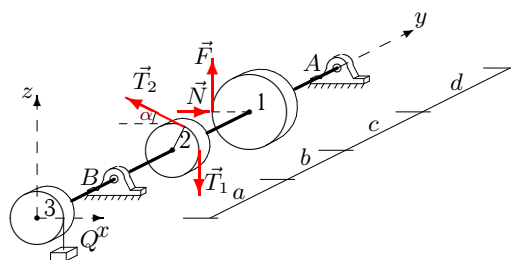
C19.



$F = 0.3N$ ,  $T_1 = 50$ ,  
 $T_2 = 28$ ,  $P_1 = 22$ ,  
 $P_2 = 10$ ,  $P_3 = 18$ ,  
 $Q = 26$ ,  $G = 25$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 18$ ,  
 $R_2 = 8$ ,  $R_3 = 10$ ,  
 $a = 24$ ,  $b = 29$ ,  
 $c = 30$ ,  $d = 26$ .

**Вариант 26**

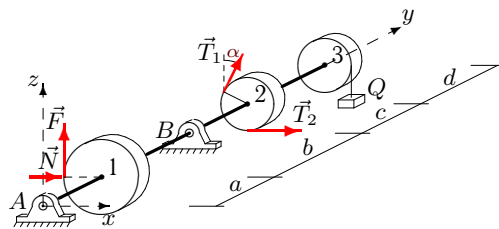
C19.



$F = 0.3N$ ,  $T_1 = 70$ ,  
 $T_2 = 137$ ,  $P_1 = 42$ ,  
 $P_2 = 30$ ,  $P_3 = 38$ ,  
 $Q = 18$ ,  $G = 35$ ,  
 $\alpha = 60^\circ$ ,  $R_1 = 22$ ,  
 $R_2 = 12$ ,  $R_3 = 14$ ,  
 $a = 24$ ,  $b = 27$ ,  
 $c = 30$ ,  $d = 26$ .

**Вариант 27**

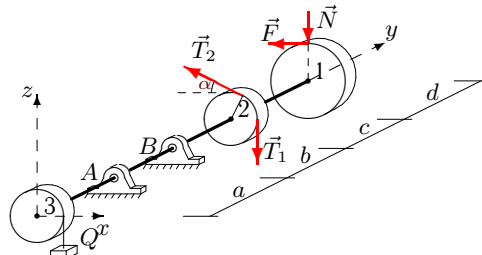
C19.



$F = 0.2N$ ,  $T_1 = 30$ ,  
 $T_2 = 56$ ,  $P_1 = 22$ ,  
 $P_2 = 10$ ,  $P_3 = 14$ ,  
 $Q = 22$ ,  $G = 15$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 26$ ,  
 $R_2 = 8$ ,  $R_3 = 9$ ,  
 $a = 22$ ,  $b = 26$ ,  
 $c = 27$ ,  $d = 26$ .

**Вариант 28**

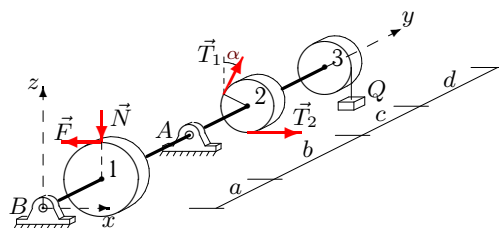
C19.



$F = 0.1N$ ,  $T_1 = 70$ ,  
 $T_2 = 36$ ,  $P_1 = 26$ ,  
 $P_2 = 20$ ,  $P_3 = 24$ ,  
 $Q = 26$ ,  $G = 35$ ,  
 $\alpha = 45^\circ$ ,  $R_1 = 16$ ,  
 $R_2 = 10$ ,  $R_3 = 11$ ,  
 $a = 22$ ,  $b = 27$ ,  
 $c = 29$ ,  $d = 23$ .

**Вариант 29**

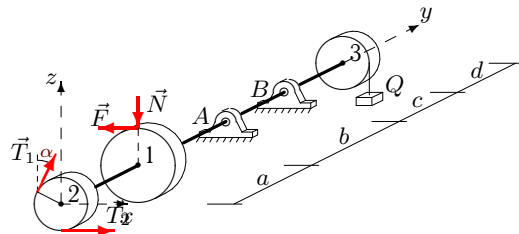
C19.



$F = 0.3N$ ,  $T_1 = 40$ ,  
 $T_2 = 23$ ,  $P_1 = 26$ ,  
 $P_2 = 10$ ,  $P_3 = 18$ ,  
 $Q = 26$ ,  $G = 20$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 26$ ,  
 $R_2 = 8$ ,  $R_3 = 10$ ,  
 $a = 24$ ,  $b = 29$ ,  
 $c = 30$ ,  $d = 28$ .

**Вариант 30**

**С19.**



$F = 0.2N$ ,  $T_1 = 50$ ,  
 $T_2 = 27$ ,  $P_1 = 20$ ,  
 $P_2 = 10$ ,  $P_3 = 14$ ,  
 $Q = 10$ ,  $G = 25$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 22$ ,  
 $R_2 = 8$ ,  $R_3 = 9$ ,  
 $a = 22$ ,  $b = 23$ ,  
 $c = 24$ ,  $d = 25$ .

Отвeты

	$N$	$X_A$	$Z_A$	$X_B$	$Z_B$
1	34.375	52.031	2.436	-102.636	113.584
2	23.462	479.490	-185.826	-642.253	310.442
3	28.889	-59.116	61.439	-82.414	57.894
4	27.111	470.056	-185.594	-636.468	313.461
5	44.250	40.192	36.940	-1.711	50.629
6	64.375	-213.655	-75.470	232.719	148.281
7	21.481	-1.895	124.214	47.097	-41.158
8	54.444	66.467	-150.260	-70.682	216.816
9	105.000	-302.778	-85.280	299.103	153.780
10	22.667	-10.116	40.037	-25.798	106.630
11	30.333	275.874	-256.283	-474.169	380.150
12	201.429	23.036	-185.056	19.624	498.484
13	39.375	44.748	-194.475	-43.111	274.588
14	104.242	-3.127	35.867	50.900	265.797
15	59.487	115.882	-372.686	-182.997	554.173
16	40.833	169.817	-114.638	-142.768	209.506
17	4.615	37.086	-18.459	-113.701	78.094
18	298.889	-4.478	-39.776	52.367	522.488
19	92.143	88.201	7.778	-132.128	176.010
20	107.500	-245.272	292.431	192.219	-209.628
21	35.385	47.165	183.404	-229.549	-143.981
22	214.444	41.864	486.066	-2.233	-154.121
23	267.143	400.209	67.800	-548.706	-0.014
24	52.750	-68.984	-468.933	103.519	659.248
25	80.741	29.212	326.214	19.259	-108.473
26	83.636	-35.154	1.794	20.018	87.470
27	1.923	38.896	-19.834	-111.819	76.468
28	391.250	-102.693	-784.122	167.274	1350.916
29	50.769	-60.443	109.269	32.673	6.859
30	62.273	-125.110	63.293	85.564	34.679