

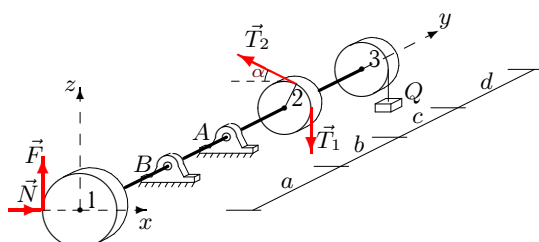
## Равновесие вала

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

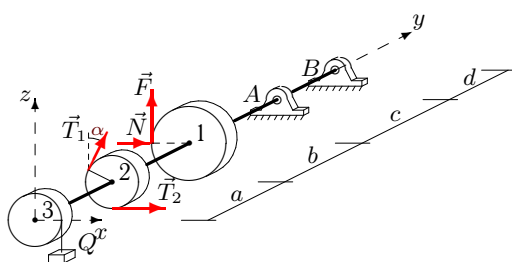
C19.



$$F = 0.3N, T_1 = 60, \\ T_2 = 117, P_1 = 22, \\ P_2 = 10, P_3 = 18, \\ Q = 18, G = 30, \\ \alpha = 30^\circ, R_1 = 18, \\ R_2 = 8, R_3 = 10, \\ a = 24, b = 27, \\ c = 28, d = 26.$$

### Вариант 2

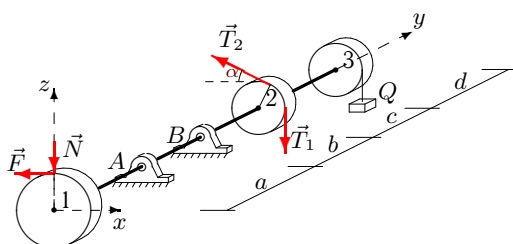
C19.



$$F = 0.2N, T_1 = 70, \\ T_2 = 137, P_1 = 40, \\ P_2 = 30, P_3 = 34, \\ Q = 18, G = 35, \\ \alpha = 60^\circ, R_1 = 26, \\ R_2 = 12, R_3 = 13, \\ a = 22, b = 25, \\ c = 28, d = 25.$$

### Вариант 3

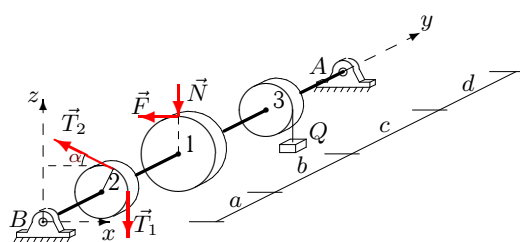
C19.



$$F = 0.2N, T_1 = 60, \\ T_2 = 32, P_1 = 16, \\ P_2 = 10, P_3 = 14, \\ Q = 26, G = 30, \\ \alpha = 30^\circ, R_1 = 14, \\ R_2 = 8, R_3 = 9, \\ a = 22, b = 27, \\ c = 28, d = 23.$$

### Вариант 4

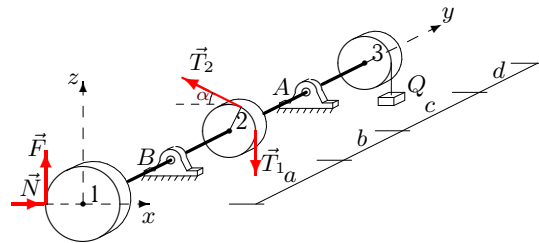
C19.



$$F = 0.4N, T_1 = 40, \\ T_2 = 24, P_1 = 42, \\ P_2 = 30, P_3 = 38, \\ Q = 10, G = 20, \\ \alpha = 60^\circ, R_1 = 22, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 25, \\ c = 28, d = 26.$$

**Вариант 5**

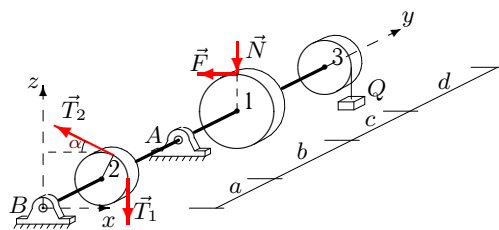
C19.



$$F = 0.2N, T_1 = 60, \\ T_2 = 116, P_1 = 38, \\ P_2 = 30, P_3 = 34, \\ Q = 22, G = 30, \\ \alpha = 60^\circ, R_1 = 22, \\ R_2 = 12, R_3 = 13, \\ a = 22, b = 26, \\ c = 29, d = 24.$$

**Вариант 6**

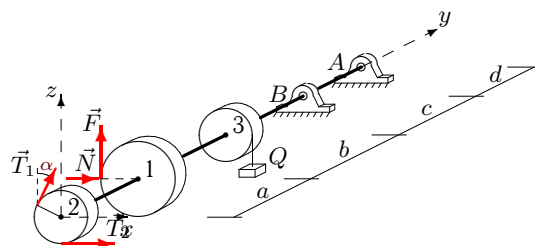
C19.



$$F = 0.4N, T_1 = 40, \\ T_2 = 24, P_1 = 22, \\ P_2 = 10, P_3 = 18, \\ Q = 10, G = 20, \\ \alpha = 30^\circ, R_1 = 18, \\ R_2 = 8, R_3 = 10, \\ a = 24, b = 25, \\ c = 26, d = 26.$$

**Вариант 7**

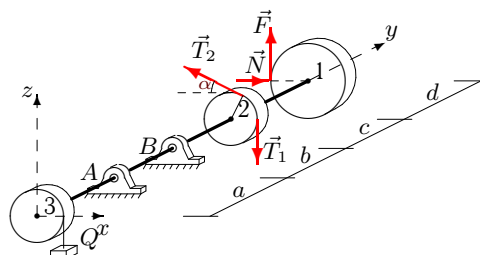
C19.



$$F = 0.3N, T_1 = 50, \\ T_2 = 98, P_1 = 44, \\ P_2 = 30, P_3 = 38, \\ Q = 14, G = 25, \\ \alpha = 60^\circ, R_1 = 26, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 26, \\ c = 29, d = 27.$$

**Вариант 8**

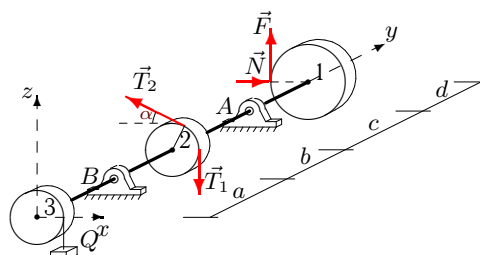
C19.



$$F = 0.3N, T_1 = 70, \\ T_2 = 136, P_1 = 30, \\ P_2 = 20, P_3 = 28, \\ Q = 22, G = 35, \\ \alpha = 45^\circ, R_1 = 16, \\ R_2 = 10, R_3 = 12, \\ a = 24, b = 28, \\ c = 30, d = 25.$$

**Вариант 9**

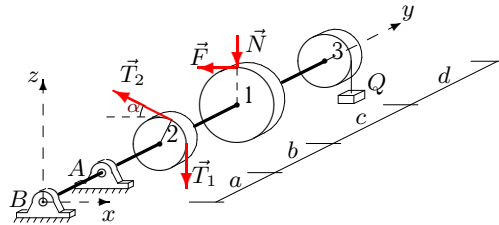
C19.



$$F = 0.2N, T_1 = 70, \\ T_2 = 137, P_1 = 38, \\ P_2 = 30, P_3 = 34, \\ Q = 18, G = 35, \\ \alpha = 60^\circ, R_1 = 22, \\ R_2 = 12, R_3 = 13, \\ a = 22, b = 25, \\ c = 28, d = 24.$$

**Вариант 10**

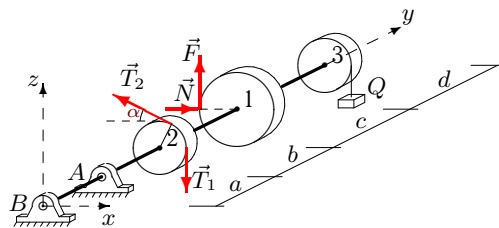
C19.



$F = 0.4N$ ,  $T_1 = 40$ ,  
 $T_2 = 24$ ,  $P_1 = 20$ ,  
 $P_2 = 10$ ,  $P_3 = 18$ ,  
 $Q = 26$ ,  $G = 20$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 14$ ,  
 $R_2 = 8$ ,  $R_3 = 10$ ,  
 $a = 24$ ,  $b = 29$ ,  
 $c = 30$ ,  $d = 25$ .

**Вариант 11**

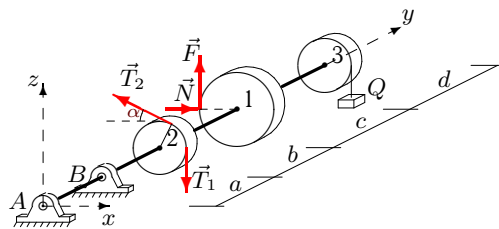
C19.



$F = 0.1N$ ,  $T_1 = 40$ ,  
 $T_2 = 78$ ,  $P_1 = 36$ ,  
 $P_2 = 30$ ,  $P_3 = 34$ ,  
 $Q = 14$ ,  $G = 20$ ,  
 $\alpha = 60^\circ$ ,  $R_1 = 18$ ,  
 $R_2 = 12$ ,  $R_3 = 13$ ,  
 $a = 22$ ,  $b = 24$ ,  
 $c = 27$ ,  $d = 23$ .

**Вариант 12**

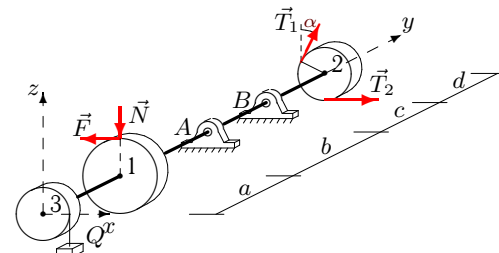
C19.



$F = 0.1N$ ,  $T_1 = 30$ ,  
 $T_2 = 57$ ,  $P_1 = 36$ ,  
 $P_2 = 30$ ,  $P_3 = 34$ ,  
 $Q = 18$ ,  $G = 15$ ,  
 $\alpha = 60^\circ$ ,  $R_1 = 18$ ,  
 $R_2 = 12$ ,  $R_3 = 13$ ,  
 $a = 22$ ,  $b = 25$ ,  
 $c = 28$ ,  $d = 23$ .

**Вариант 13**

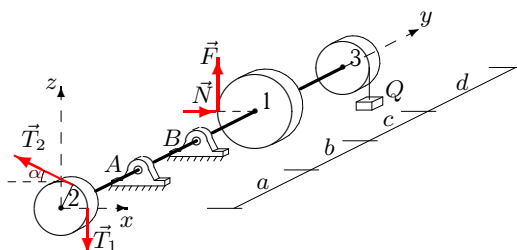
C19.



$F = 0.3N$ ,  $T_1 = 70$ ,  
 $T_2 = 38$ ,  $P_1 = 26$ ,  
 $P_2 = 10$ ,  $P_3 = 18$ ,  
 $Q = 10$ ,  $G = 35$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 26$ ,  
 $R_2 = 8$ ,  $R_3 = 10$ ,  
 $a = 24$ ,  $b = 25$ ,  
 $c = 26$ ,  $d = 28$ .

**Вариант 14**

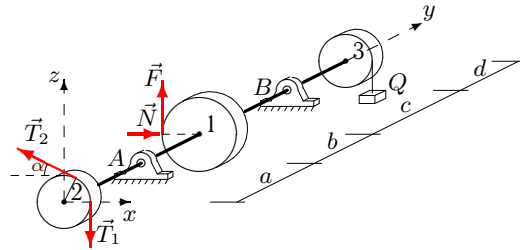
C19.



$F = 0.3N$ ,  $T_1 = 50$ ,  
 $T_2 = 98$ ,  $P_1 = 20$ ,  
 $P_2 = 10$ ,  $P_3 = 18$ ,  
 $Q = 14$ ,  $G = 25$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 14$ ,  
 $R_2 = 8$ ,  $R_3 = 10$ ,  
 $a = 24$ ,  $b = 26$ ,  
 $c = 27$ ,  $d = 25$ .

**Вариант 15**

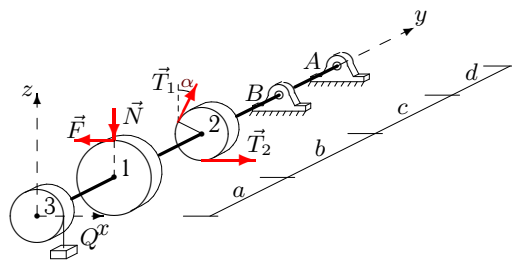
C19.



$$F = 0.4N, T_1 = 50, \\ T_2 = 98, P_1 = 40, \\ P_2 = 30, P_3 = 38, \\ Q = 14, G = 25, \\ \alpha = 60^\circ, R_1 = 18, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 26, \\ c = 29, d = 25.$$

**Вариант 16**

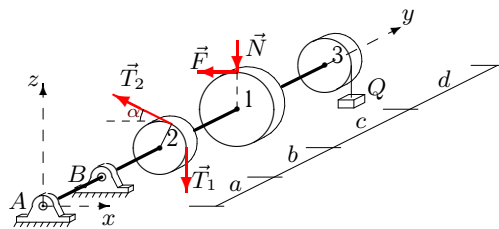
C19.



$$F = 0.4N, T_1 = 70, \\ T_2 = 39, P_1 = 46, \\ P_2 = 30, P_3 = 38, \\ Q = 26, G = 35, \\ \alpha = 60^\circ, R_1 = 30, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 29, \\ c = 32, d = 28.$$

**Вариант 17**

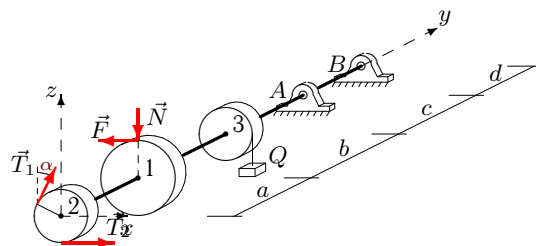
C19.



$$F = 0.4N, T_1 = 30, \\ T_2 = 19, P_1 = 42, \\ P_2 = 30, P_3 = 38, \\ Q = 10, G = 15, \\ \alpha = 60^\circ, R_1 = 22, \\ R_2 = 12, R_3 = 14, \\ a = 24, b = 25, \\ c = 28, d = 26.$$

**Вариант 18**

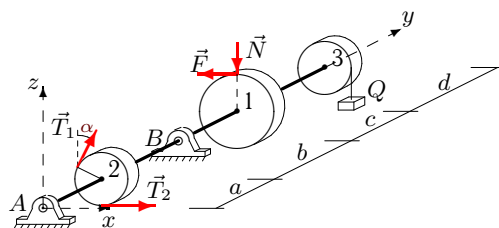
C19.



$$F = 0.2N, T_1 = 50, \\ T_2 = 27, P_1 = 42, \\ P_2 = 30, P_3 = 34, \\ Q = 26, G = 25, \\ \alpha = 60^\circ, R_1 = 30, \\ R_2 = 12, R_3 = 13, \\ a = 22, b = 27, \\ c = 30, d = 26.$$

**Вариант 19**

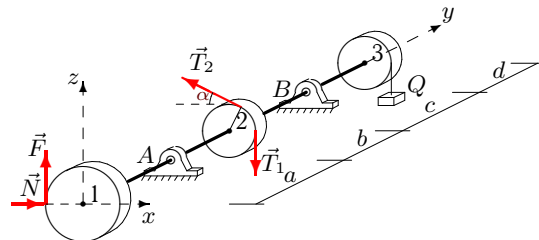
C19.



$$F = 0.1N, T_1 = 30, \\ T_2 = 16, P_1 = 20, \\ P_2 = 10, P_3 = 14, \\ Q = 10, G = 15, \\ \alpha = 30^\circ, R_1 = 22, \\ R_2 = 8, R_3 = 9, \\ a = 22, b = 23, \\ c = 24, d = 25.$$

**Вариант 20**

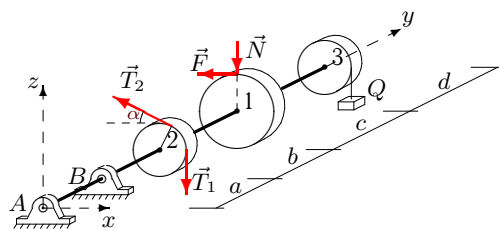
C19.



$F = 0.1N, T_1 = 60,$   
 $T_2 = 118, P_1 = 36,$   
 $P_2 = 30, P_3 = 34,$   
 $Q = 14, G = 30,$   
 $\alpha = 60^\circ, R_1 = 18,$   
 $R_2 = 12, R_3 = 13,$   
 $a = 22, b = 24,$   
 $c = 27, d = 23.$

**Вариант 21**

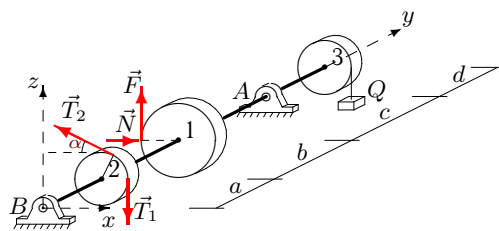
C19.



$F = 0.1N, T_1 = 30,$   
 $T_2 = 16, P_1 = 26,$   
 $P_2 = 20, P_3 = 24,$   
 $Q = 26, G = 15,$   
 $\alpha = 45^\circ, R_1 = 16,$   
 $R_2 = 10, R_3 = 11,$   
 $a = 22, b = 27,$   
 $c = 29, d = 23.$

**Вариант 22**

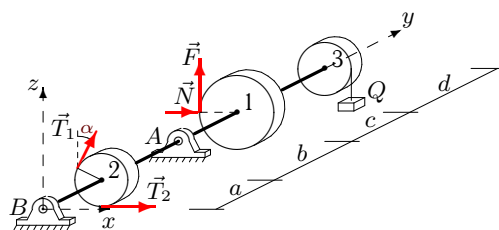
C19.



$F = 0.1N, T_1 = 40,$   
 $T_2 = 76, P_1 = 28,$   
 $P_2 = 20, P_3 = 24,$   
 $Q = 22, G = 20,$   
 $\alpha = 45^\circ, R_1 = 20,$   
 $R_2 = 10, R_3 = 11,$   
 $a = 22, b = 26,$   
 $c = 28, d = 24.$

**Вариант 23**

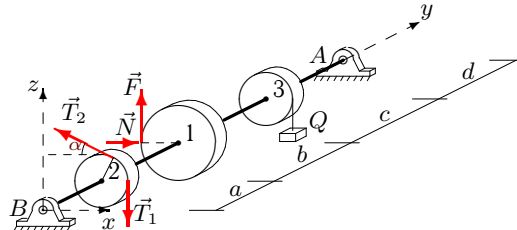
C19.



$F = 0.1N, T_1 = 40,$   
 $T_2 = 76, P_1 = 20,$   
 $P_2 = 10, P_3 = 14,$   
 $Q = 22, G = 20,$   
 $\alpha = 30^\circ, R_1 = 22,$   
 $R_2 = 8, R_3 = 9,$   
 $a = 22, b = 26,$   
 $c = 27, d = 25.$

**Вариант 24**

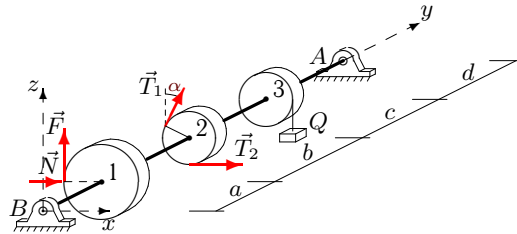
C19.



$F = 0.3N, T_1 = 40,$   
 $T_2 = 78, P_1 = 42,$   
 $P_2 = 30, P_3 = 38,$   
 $Q = 14, G = 20,$   
 $\alpha = 60^\circ, R_1 = 22,$   
 $R_2 = 12, R_3 = 14,$   
 $a = 24, b = 26,$   
 $c = 29, d = 26.$

**Вариант 25**

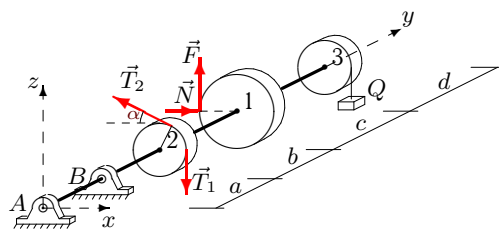
C19.



$F = 0.4N, T_1 = 40,$   
 $T_2 = 78, P_1 = 46,$   
 $P_2 = 30, P_3 = 38,$   
 $Q = 14, G = 20,$   
 $\alpha = 60^\circ, R_1 = 30,$   
 $R_2 = 12, R_3 = 14,$   
 $a = 24, b = 26,$   
 $c = 29, d = 28.$

**Вариант 26**

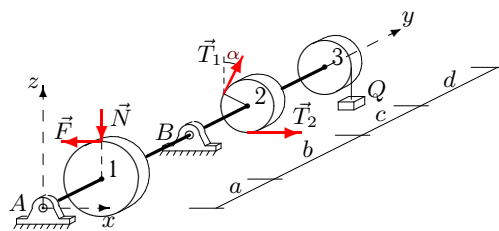
C19.



$F = 0.3N, T_1 = 30,$   
 $T_2 = 58, P_1 = 20,$   
 $P_2 = 10, P_3 = 18,$   
 $Q = 22, G = 15,$   
 $\alpha = 30^\circ, R_1 = 14,$   
 $R_2 = 8, R_3 = 10,$   
 $a = 24, b = 28,$   
 $c = 29, d = 25.$

**Вариант 27**

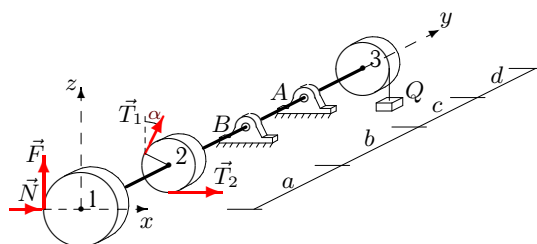
C19.



$F = 0.2N, T_1 = 30,$   
 $T_2 = 17, P_1 = 32,$   
 $P_2 = 20, P_3 = 24,$   
 $Q = 26, G = 15,$   
 $\alpha = 45^\circ, R_1 = 28,$   
 $R_2 = 10, R_3 = 11,$   
 $a = 22, b = 27,$   
 $c = 29, d = 26.$

**Вариант 28**

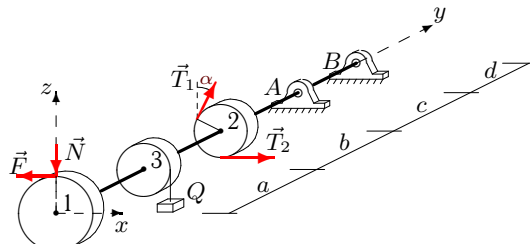
C19.



$F = 0.2N, T_1 = 60,$   
 $T_2 = 117, P_1 = 30,$   
 $P_2 = 20, P_3 = 24,$   
 $Q = 18, G = 30,$   
 $\alpha = 45^\circ, R_1 = 24,$   
 $R_2 = 10, R_3 = 11,$   
 $a = 22, b = 25,$   
 $c = 27, d = 25.$

**Вариант 29**

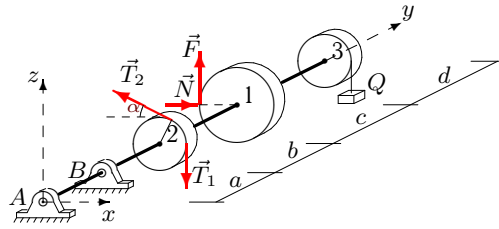
C19.



$F = 0.2N, T_1 = 60,$   
 $T_2 = 32, P_1 = 42,$   
 $P_2 = 30, P_3 = 34,$   
 $Q = 10, G = 30,$   
 $\alpha = 60^\circ, R_1 = 30,$   
 $R_2 = 12, R_3 = 13,$   
 $a = 22, b = 23,$   
 $c = 26, d = 26.$

**Вариант 30**

**C19.**



$F = 0.2N$ ,  $T_1 = 30$ ,  
 $T_2 = 56$ ,  $P_1 = 18$ ,  
 $P_2 = 10$ ,  $P_3 = 14$ ,  
 $Q = 22$ ,  $G = 15$ ,  
 $\alpha = 30^\circ$ ,  $R_1 = 18$ ,  
 $R_2 = 8$ ,  $R_3 = 9$ ,  
 $a = 22$ ,  $b = 26$ ,  
 $c = 27$ ,  $d = 24$ .

Отвѣты

	$N$	$X_A$	$Z_A$	$X_B$	$Z_B$
1	51.111	251.835	157.167	-201.621	-73.000
2	109.615	-848.965	300.723	541.727	-200.646
3	163.571	30.631	193.222	29.796	110.349
4	37.727	9.975	95.280	17.116	101.663
5	87.727	62.509	82.856	-92.236	13.140
6	31.667	29.568	179.082	3.883	-39.415
7	48.718	512.677	-154.413	-702.697	265.798
8	82.500	59.018	87.277	-45.351	-3.193
9	129.545	-155.896	5.346	94.851	75.099
10	69.286	141.745	635.696	-93.246	-444.411
11	152.222	-423.556	327.158	310.333	-235.930
12	50.000	88.068	-284.814	-109.568	393.451
13	45.641	105.473	307.446	-164.781	-223.427
14	58.095	223.542	-46.478	-196.767	117.049
15	52.778	42.554	-8.400	-46.331	99.418
16	61.333	60.406	-458.030	-135.494	659.363
17	30.909	-37.199	-381.555	59.063	561.010
18	102.333	-218.573	660.660	168.738	-426.327
19	91.818	-20.741	-94.604	-1.077	229.442
20	285.556	-377.501	-2.739	150.946	75.993
21	266.250	-81.658	-990.365	119.596	1386.301
22	59.000	-21.707	89.454	16.447	4.906
23	40.909	-107.920	109.397	-28.989	-62.129
24	39.394	-9.845	64.056	9.451	40.576
25	21.667	-57.496	61.439	-76.812	57.894
26	0.952	-54.318	-215.613	101.863	302.327
27	74.286	30.803	2.243	-54.159	167.830
28	77.500	282.524	79.191	-519.451	-15.118
29	77.667	-109.972	629.333	41.544	-435.667
30	2.778	-50.623	-200.957	96.343	281.402