

# Пространственная ферма

Найти усилия в стержнях 1–6 пространственной фермы, нагруженной в одном узле вертикальной силой  $\vec{G}$  и горизонтальной  $\vec{F}$ . Ответ выразить в кН.

Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.:ФИЗМАТЛИТ, 2002.– 384 с. (с.86.)

**Задача 11.1.** 4

$G = 12 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 2 \text{ м}.$

**Задача 11.2.** 4

$G = 11 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.3.** 4

$G = 8 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 3 \text{ м}.$

**Задача 11.4.** 4

$G = 13 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 7 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 4 \text{ м}.$

**Задача 11.5.** 4

$G = 12 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 1 \text{ м}.$

**Задача 11.6.** 4

$G = 10 \text{ кН},$   
 $F = 4 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.7.** 4

$G = 9 \text{ кН},$   
 $F = 4 \text{ кН}.$

$a = 7 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 3 \text{ м}.$

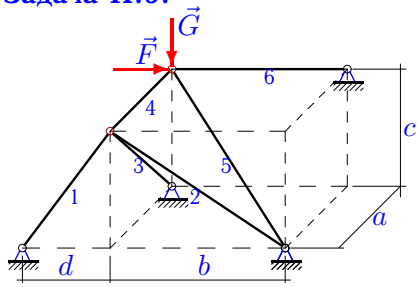
**Задача 11.8.** 4

$G = 8 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 1 \text{ м}.$

**Задача 11.9.**

4

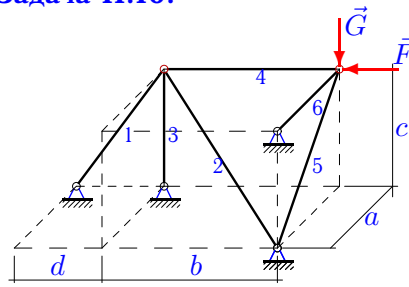


$G = 10 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 4 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 4 \text{ м}.$

**Задача 11.10.**

4

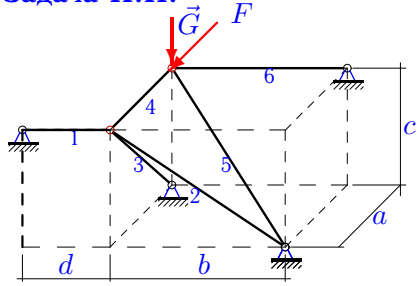


$G = 8 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 1 \text{ м}.$

**Задача 11.11.**

4

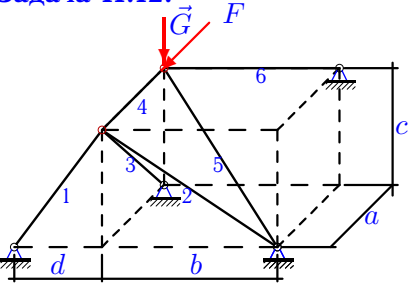


$G = 5 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 3 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 2 \text{ м}.$

**Задача 11.12.**

4

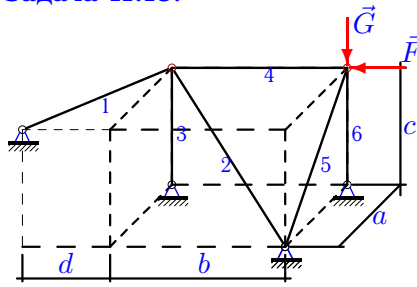


$G = 4 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 2 \text{ м}, b = 3 \text{ м}, c = 4 \text{ м}, d = 3 \text{ м}.$

**Задача 11.13.**

4

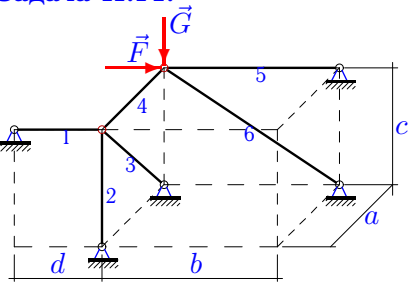


$G = 9 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 3 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 1 \text{ м}.$

**Задача 11.14.**

4

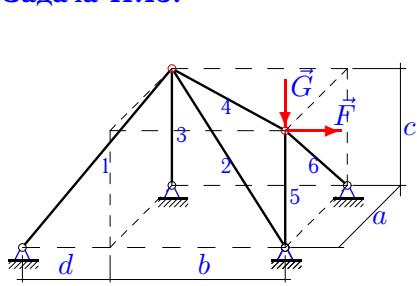


$G = 10 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 4 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 4 \text{ м}.$

**Задача 11.15.**

4

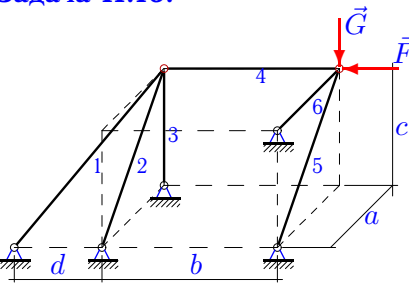


$G = 12 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 1 \text{ м}.$

**Задача 11.16.**

4

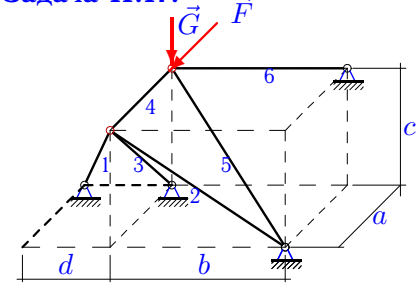


$G = 7 \text{ кН},$   
 $F = 4 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.17.**

4

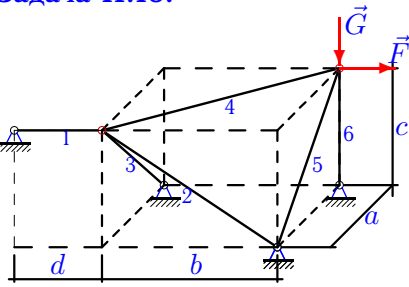


$G = 10 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 3 \text{ м}.$

**Задача 11.18.**

4

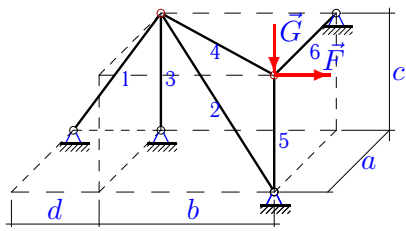


$G = 9 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 2 \text{ м}.$

**Задача 11.19.**

4

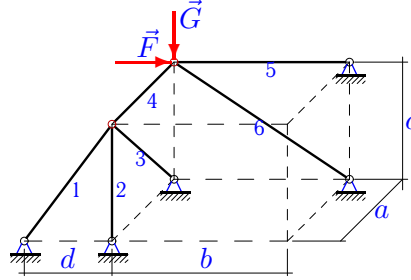


$G = 8 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 1 \text{ м}.$

**Задача 11.20.**

4

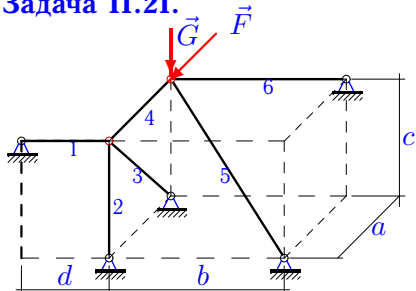


$G = 10 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 4 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 4 \text{ м}.$

**Задача 11.21.**

4

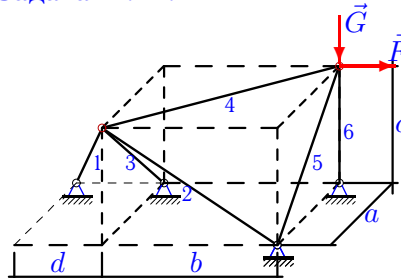


$G = 3 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 2 \text{ м}, b = 3 \text{ м}, c = 4 \text{ м}, d = 3 \text{ м}.$

**Задача 11.22.**

4

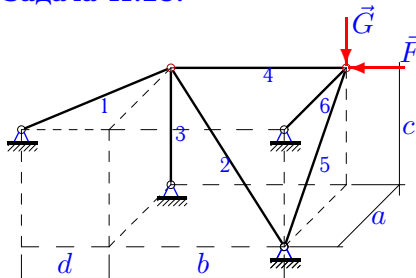


$G = 13 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 3 \text{ м}.$

**Задача 11.23.**

4

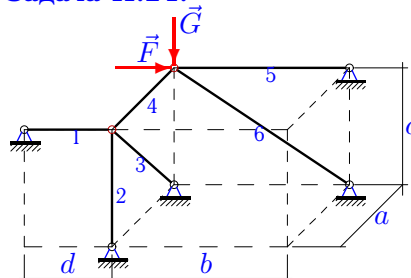


$G = 9 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.24.**

4

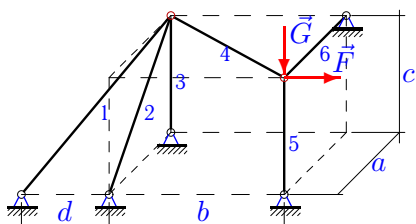


$G = 8 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 4 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 4 \text{ м}.$

**Задача 11.25.**

4

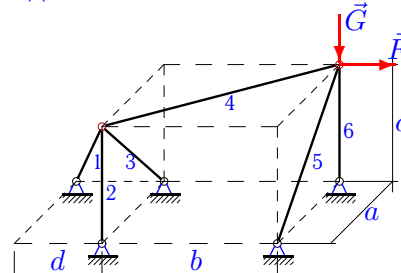


$G = 7 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.26.**

4

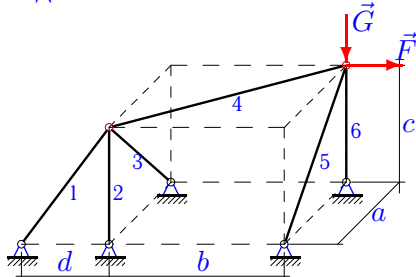


$G = 12 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 7 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 4 \text{ м}.$

**Задача 11.27.**

4

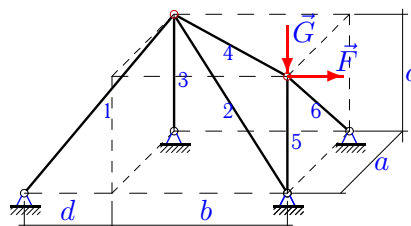


$G = 6 \text{ кН},$   
 $F = 1 \text{ кН}.$

$a = 2 \text{ м}, b = 3 \text{ м}, c = 4 \text{ м}, d = 3 \text{ м}.$

**Задача 11.28.**

4

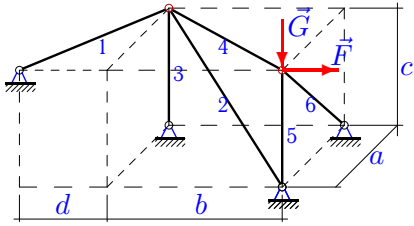


$G = 10 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.29.**

4

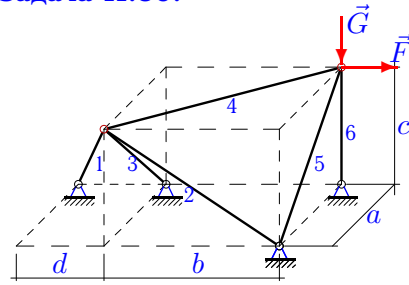


$G = 10 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.30.**

4

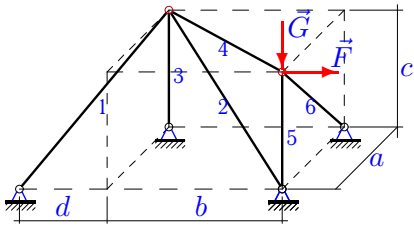


$G = 9 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 5 \text{ м}, b = 4 \text{ м}, c = 3 \text{ м}, d = 2 \text{ м}.$

**Задача 11.31.**

4

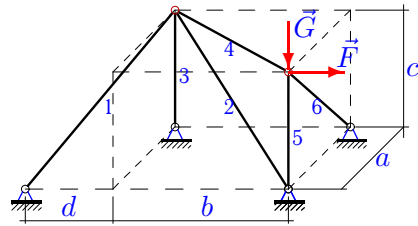


$G = 8 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 2 \text{ м}, b = 3 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.32.**

4

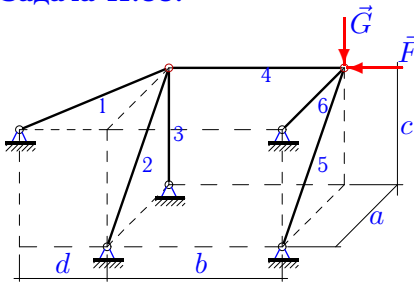


$G = 13 \text{ кН},$   
 $F = 2 \text{ кН}.$

$a = 7 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 3 \text{ м}.$

**Задача 11.33.**

4

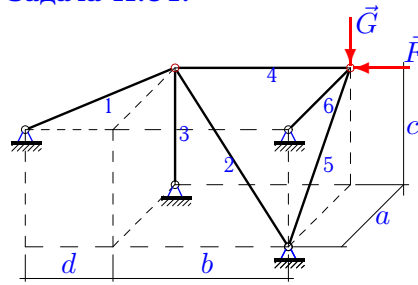


$G = 7 \text{ кН},$   
 $F = 4 \text{ кН}.$

$a = 6 \text{ м}, b = 5 \text{ м}, c = 4 \text{ м}, d = 2 \text{ м}.$

**Задача 11.34.**

4



$G = 7 \text{ кН},$   
 $F = 8 \text{ кН}.$

$a = 4 \text{ м}, b = 6 \text{ м}, c = 5 \text{ м}, d = 3 \text{ м}.$

**Пространственная ферма**

	$S_1$	$S_2$	$S_3$	$S_4$	$S_5$	$S_6$
1	16.000	20.000	-23.324	20.000	-28.284	14.000
2	-7.228	10.029	-4.571	-8.000	-0.000	-11.000
3	-0.000	8.000	-14.422	12.000	-17.550	9.000
4	2.561	-0.521	-2.867	3.073	-2.867	-11.333
5	-9.466	11.314	0.000	-8.000	-0.000	-12.000
6	-14.967	14.422	-0.000	-4.000	-0.000	-10.000
7	-12.147	11.470	-0.000	-4.000	-15.484	12.600
8	-9.466	11.314	0.000	-8.000	-15.549	13.333
9	7.684	6.248	-12.806	8.000	-17.550	10.000
10	-25.298	-0.000	24.000	-8.000	-15.549	13.333
11	4.000	5.000	-4.243	3.000	-9.718	6.667
12	-0.000	-0.000	-0.000	-0.000	-5.385	3.000
13	-5.060	9.330	-4.800	-8.000	-0.000	-9.000
14	-0.000	-0.000	-0.000	-0.000	11.000	-15.620
15	-0.000	-3.536	1.500	3.202	-10.500	-2.915
16	-14.967	14.422	-0.000	-4.000	-12.619	10.500
17	28.204	13.873	-41.664	13.000	-21.937	12.500
18	4.000	2.500	-2.915	3.202	-2.915	-7.500
19	-0.000	-3.536	1.500	3.202	-8.000	-2.500
20	-0.000	-0.000	-0.000	-0.000	11.000	-15.620
21	-0.000	1.000	-1.118	0.500	-4.039	2.250
22	10.414	2.561	-12.499	3.124	-2.884	-11.400
23	-7.228	10.029	-4.571	-8.000	-16.225	13.500
24	-0.000	-0.000	-0.000	-0.000	8.600	-12.496
25	3.742	-5.048	0.800	1.562	-7.000	-1.200
26	2.372	0.833	-3.584	1.537	-1.434	-11.167
27	1.667	-0.000	-1.491	1.202	-1.491	-4.667
28	-0.000	-3.510	1.600	3.124	-8.400	-2.884
29	0.000	-3.510	1.600	3.124	-8.400	-2.884
30	12.329	2.500	-14.577	3.202	-2.915	-7.500
31	0.000	-3.590	2.667	2.404	-5.333	-2.981
32	-0.000	-3.496	1.667	3.073	-11.333	-2.867
33	-12.649	14.422	-8.000	-4.000	-12.619	10.500
34	-4.444	7.800	-4.444	-8.000	-8.964	5.600