

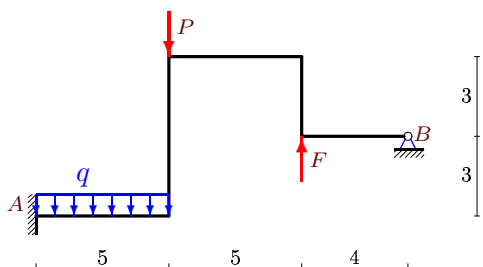
Статически неопределимая рама (метод сил)

Найти реакции опор статически неопределимой рамы.

Неизвестными в основной системе для вариантов с заделкой являются горизонтальная реакция (X_1) и момент заделки (X_2), в остальных вариантах в качестве неизвестных выбраны горизонтальная реакция опоры A (X_1) и реакция опоры D (X_2).

Задача М5.1.

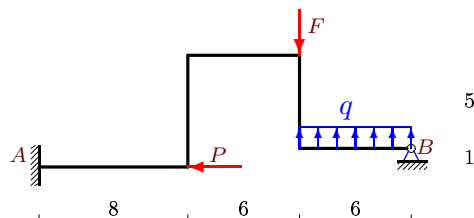
2



$$P=16 \text{ кН}, F=15 \text{ кН}, q=2 \text{ кН/м.}$$

Задача М5.2.

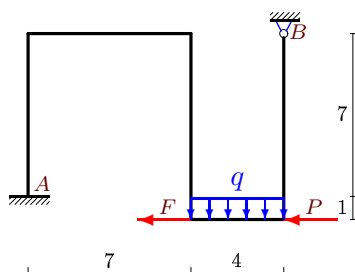
2



$$P=16 \text{ кН}, F=5 \text{ кН}, q=2 \text{ кН/м.}$$

Задача М5.3.

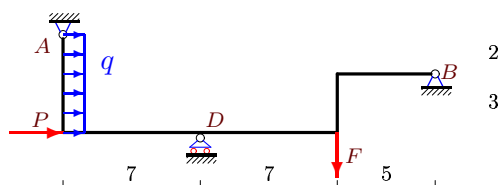
2



$$P=5 \text{ кН}, F=12 \text{ кН}, q=4 \text{ кН/м.}$$

Задача М5.4.

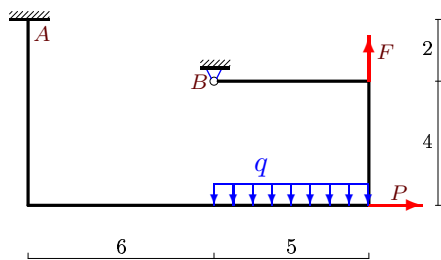
2



$$P=10 \text{ кН}, F=12 \text{ кН}, q=2 \text{ кН/м.}$$

Задача М5.5.

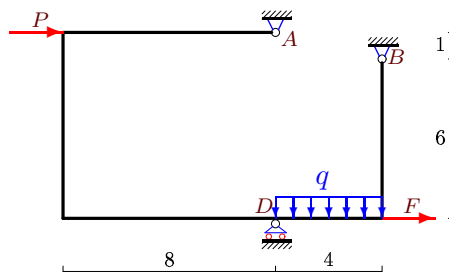
2



$$P=4 \text{ кН}, F=11 \text{ кН}, q=1 \text{ кН/м.}$$

Задача М5.6.

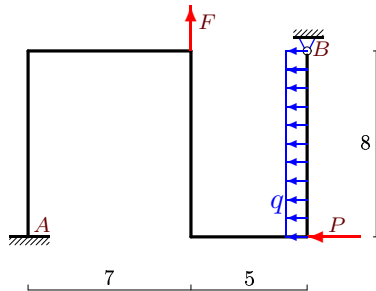
2



$$P=25 \text{ кН}, F=6 \text{ кН}, q=6 \text{ кН/м.}$$

Задача М5.7.

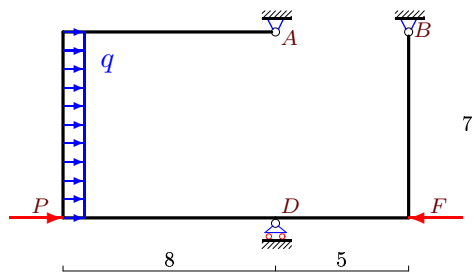
2



$$P=5 \text{ кН}, F=12 \text{ кН}, q=2 \text{ кН/м.}$$

Задача М5.8.

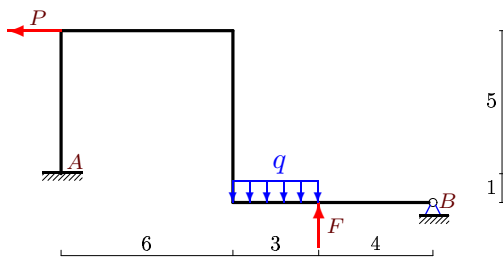
2



$$P=25 \text{ кН}, F=6 \text{ кН}, q=4 \text{ кН/м.}$$

Задача М5.9.

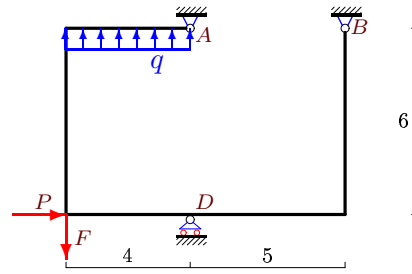
2



$P=24 \text{ кН}, F=11 \text{ кН}, q=1 \text{ кН/м}.$

Задача М5.10.

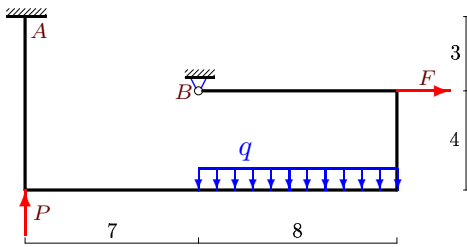
2



$P=24 \text{ кН}, F=10 \text{ кН}, q=3 \text{ кН/м}.$

Задача М5.11.

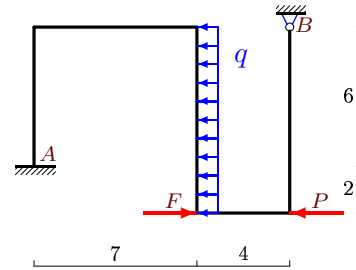
2



$P=5 \text{ кН}, F=10 \text{ кН}, q=2 \text{ кН/м}.$

Задача М5.12.

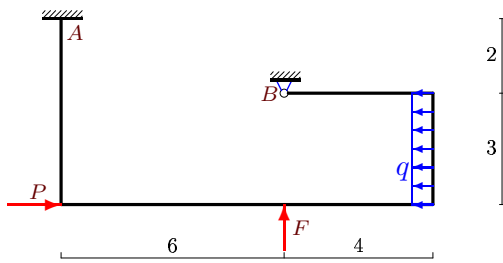
2



$P=10 \text{ кН}, F=12 \text{ кН}, q=2 \text{ кН/м}.$

Задача М5.13.

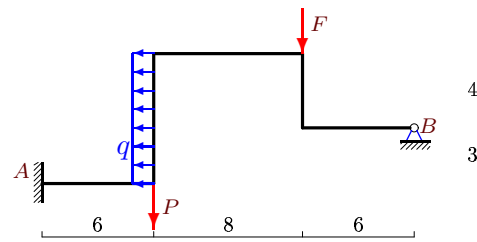
2



$P=4 \text{ кН}, F=5 \text{ кН}, q=2 \text{ кН/м}.$

Задача М5.14.

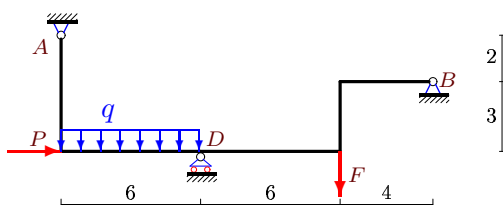
2



$P=25 \text{ кН}, F=12 \text{ кН}, q=2 \text{ кН/м}.$

Задача М5.15.

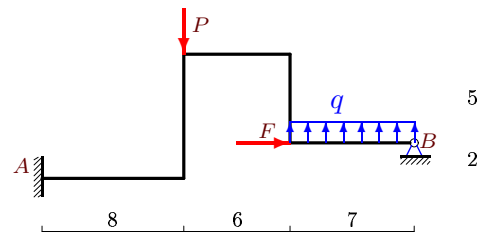
2



$P=16 \text{ кН}, F=5 \text{ кН}, q=3 \text{ кН/м}.$

Задача М5.16.

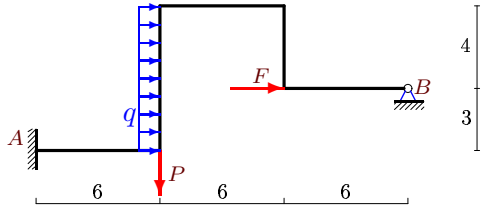
2



$P=30 \text{ кН}, F=6 \text{ кН}, q=2 \text{ кН/м}.$

Задача М5.17.

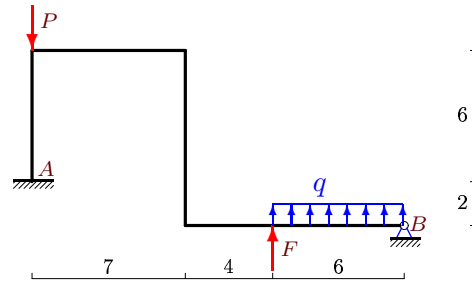
2



$P=30 \text{ кН}, F=12 \text{ кН}, q = 4 \text{ кН/м}.$

Задача М5.18.

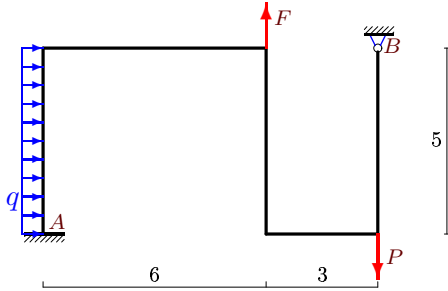
2



$P=40 \text{ кН}, F=18 \text{ кН}, q = 4 \text{ кН/м}.$

Задача М5.19.

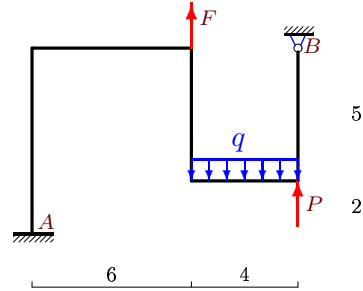
2



$P=4 \text{ кН}, F=10 \text{ кН}, q = 2 \text{ кН/м}.$

Задача М5.20.

2



$P=9 \text{ кН}, F=10 \text{ кН}, q = 2 \text{ кН/м}.$

М5

Ответы.**Статически неопределимая рама (метод сил)**

07.04.2015

| | X_A | Y_A | M_A | X_B | Y_B | Y_D |
|----|---------|---------|---------|---------|---------|--------|
| 1 | -0.382 | 17.234 | 43.415 | 0.382 | -6.234 | — |
| 2 | 15.537 | -0.463 | -2.789 | 0.463 | -6.537 | — |
| 3 | 11.928 | -8.575 | -73.829 | 5.072 | 24.575 | — |
| 4 | -4.760 | -4.191 | — | -15.240 | 0.845 | 15.347 |
| 5 | -14.094 | 2.635 | -70.876 | 10.094 | -8.635 | — |
| 6 | -27.091 | -1.113 | — | -3.909 | 2.477 | 22.635 |
| 7 | 11.518 | -13.716 | -92.735 | 9.482 | 1.716 | — |
| 8 | -26.305 | -7.706 | — | -20.695 | -46.200 | 53.906 |
| 9 | 16.514 | 2.139 | -72.176 | 7.486 | -10.139 | — |
| 10 | -9.516 | -14.312 | — | -14.484 | -32.000 | 44.312 |
| 11 | 18.908 | -1.321 | 146.481 | -28.908 | 12.321 | — |
| 12 | 12.229 | -3.108 | -59.563 | 1.771 | 3.108 | — |
| 13 | -3.096 | -1.217 | -16.492 | 5.096 | -3.783 | — |
| 14 | 20.922 | 29.897 | 106.172 | -6.922 | 7.103 | — |
| 15 | -2.014 | 7.790 | — | -13.986 | -2.929 | 18.138 |
| 16 | 7.978 | 21.940 | 103.795 | -13.978 | -5.940 | — |
| 17 | -8.597 | 23.249 | 98.266 | -31.403 | 6.751 | — |
| 18 | 4.219 | 24.515 | -74.801 | -4.219 | -26.515 | — |
| 19 | -8.099 | -4.354 | 6.311 | -1.901 | -1.646 | — |
| 20 | 0.454 | -2.805 | -7.224 | -0.454 | -8.195 | — |

M5 файл о5m2A

| | δ_{11} | δ_{12} | δ_{22} | Δ_1 | Δ_2 | | | | |
|----|---------------|---------------|---------------|------------|------------|---------|---------|---------|---------|
| 1 | 159.09 | 18.10 | 7.39 | -725.14 | -313.98 | -46.07 | -46.07 | 12.86 | 12.86 |
| | | | | | | -1.07 | 4.93 | 3.86 | 0.86 |
| | | | | | | 0.64 | 0.64 | 0.29 | 0.29 |
| 2 | 287.04 | 27.33 | 9.28 | -4383.45 | -398.69 | 8.80 | -87.20 | -80.60 | -0.60 |
| | | | | | | -0.40 | 5.60 | 5.30 | 0.30 |
| | | | | | | 0.60 | 0.60 | 0.30 | 0.30 |
| 3 | 698.80 | 40.12 | 11.72 | -5373.87 | 387.07 | 0.00 | 66.18 | 66.18 | 136.00 |
| | | | | | | 7.00 | 2.55 | -5.45 | -8.00 |
| | | | | | | 1.00 | 0.36 | 0.36 | 0.00 |
| 4 | 313.67 | -169.07 | 133.97 | 4087.79 | -2860.79 | -25.00 | -60.00 | -95.00 | -35.00 |
| | | | | | | -5.00 | -4.26 | -3.53 | -0.53 |
| | | | | | | 0.00 | 4.42 | 1.84 | 1.84 |
| 5 | 285.70 | -29.19 | 13.09 | 1958.29 | 516.60 | 0.00 | -58.50 | -94.75 | -78.75 |
| | | | | | | -6.00 | -4.00 | -2.33 | 1.67 |
| | | | | | | 1.00 | 0.00 | -0.83 | -0.83 |
| 6 | 1007.00 | 617.33 | 789.33 | 13307.00 | -1142.67 | 118.00 | -57.00 | -175.00 | -186.00 |
| | | | | | | -2.00 | -9.00 | -7.00 | -6.00 |
| | | | | | | -8.00 | -8.00 | 0.00 | 0.00 |
| 7 | 830.22 | 53.44 | 13.39 | -4606.22 | 626.06 | 0.00 | 95.67 | 95.67 | 104.00 |
| | | | | | | 8.00 | 3.33 | -4.67 | -8.00 |
| | | | | | | 1.00 | 0.42 | 0.42 | 0.00 |
| 8 | 865.67 | 420.00 | 789.33 | 130.67 | -31501.87 | 369.60 | 271.60 | -98.00 | -329.00 |
| | | | | | | 0.00 | -7.00 | -7.00 | -7.00 |
| | | | | | | -8.00 | -8.00 | 0.00 | 0.00 |
| 9 | 260.97 | 43.81 | 11.07 | -1147.41 | 75.72 | 0.00 | -53.77 | 90.23 | 67.85 |
| | | | | | | 5.00 | 5.46 | -0.54 | -0.31 |
| | | | | | | 1.00 | 0.54 | 0.54 | 0.31 |
| 10 | 468.00 | 120.00 | 138.67 | -864.00 | -5002.67 | 144.00 | 144.00 | 16.00 | -144.00 |
| | | | | | | 0.00 | -6.00 | -6.00 | -6.00 |
| | | | | | | -4.00 | -4.00 | 0.00 | 0.00 |
| 11 | 425.81 | -54.64 | 21.52 | -47.24 | -2119.62 | 0.00 | 64.00 | 201.14 | 201.14 |
| | | | | | | -7.00 | -4.00 | -0.57 | 3.43 |
| | | | | | | 1.00 | 0.00 | -1.14 | -1.14 |
| 12 | 629.96 | 28.89 | 10.72 | -5982.72 | 285.47 | 0.00 | 30.55 | 94.55 | 112.00 |
| | | | | | | 6.00 | 2.18 | -5.82 | -8.00 |
| | | | | | | 1.00 | 0.36 | 0.36 | 0.00 |
| 13 | 166.74 | -23.54 | 9.52 | 128.03 | 84.11 | 0.00 | -3.00 | -25.00 | -22.00 |
| | | | | | | -5.00 | -3.00 | -1.67 | 1.33 |
| | | | | | | 1.00 | 0.00 | -0.67 | -0.67 |
| 14 | 361.08 | 36.92 | 10.46 | -11474.44 | -1882.66 | -128.70 | -177.70 | -149.30 | -93.30 |
| | | | | | | -0.90 | 6.10 | 4.90 | 0.90 |
| | | | | | | 0.70 | 0.70 | 0.30 | 0.30 |
| 15 | 275.25 | -122.50 | 81.75 | 2776.25 | -1729.50 | 0.00 | -59.25 | -64.50 | -16.50 |
| | | | | | | -5.00 | -4.25 | -3.50 | -0.50 |
| | | | | | | 0.00 | 3.75 | 1.50 | 1.50 |
| 16 | 356.95 | 32.48 | 10.24 | -6218.48 | -1321.74 | -129.90 | -129.90 | -47.33 | -47.33 |
| | | | | | | -0.76 | 6.24 | 5.67 | 0.67 |
| | | | | | | 0.62 | 0.62 | 0.33 | 0.33 |
| 17 | 299.67 | 30.67 | 9.56 | -437.17 | -675.33 | -115.33 | -17.33 | 47.33 | -64.67 |
| | | | | | | -1.00 | 6.00 | 5.00 | 1.00 |
| | | | | | | 0.67 | 0.67 | 0.33 | 0.33 |
| 18 | 471.23 | 64.42 | 14.43 | 2831.13 | 807.97 | 0.00 | 74.12 | 74.12 | 116.47 |
| | | | | | | 6.00 | 6.82 | -1.18 | -0.71 |
| | | | | | | 1.00 | 0.59 | 0.59 | 0.35 |
| 19 | 222.22 | 23.61 | 8.56 | 1650.69 | 137.22 | 25.00 | 28.33 | -21.67 | -50.00 |
| | | | | | | 5.00 | 1.67 | -3.33 | -5.00 |
| | | | | | | 1.00 | 0.33 | 0.33 | 0.00 |
| 20 | 374.20 | 44.43 | 11.13 | 151.20 | 60.27 | 0.00 | 14.40 | 14.40 | 0.00 |
| | | | | | | 7.00 | 2.80 | -2.20 | -5.00 |
| | | | | | | 1.00 | 0.40 | 0.40 | 0.00 |