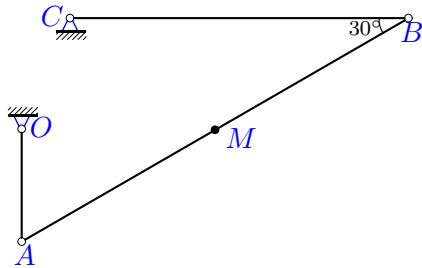


## Сложное движение точки, плоское переносное движение

Плоский шарнирно-стержневой механизм приводится в движение кривошипом  $OA$ , который вращается против часовой стрелки с постоянной угловой скоростью  $\omega$ . Вдоль стержня  $AB$  движется точка  $M$  по закону  $AM = \sigma(t)$  или  $BM = \sigma(t)$ . Положение механизма при  $t = t_1$  указано на рисунке. Все размеры даны в сантиметрах. Стержни, положение которых не задано углом, горизонтальны или вертикальны. Найти абсолютную скорость и абсолютное ускорение точки  $M$  в этот момент.

### Задача K12.1.

7



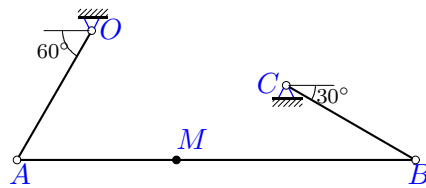
$$AM = 11t(2 + \cos(\pi t/3)); t = 6 \text{ с},$$

$$\omega_{OA} = 1.3 \frac{1}{\text{с}},$$

$$OA = 100, AB = 396, BC = 300$$

### Задача K12.2.

7



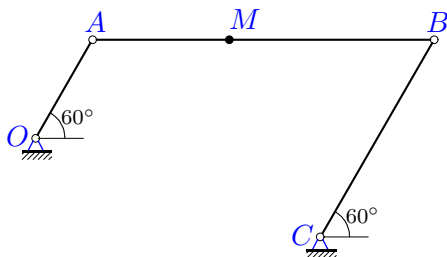
$$AM = 12t + 8 \sin^2(\pi t/4); t = 2 \text{ с},$$

$$\omega_{OA} = 1.4 \frac{1}{\text{с}},$$

$$OA = 30, AB = 80, BC = 30$$

### Задача K12.3.

7



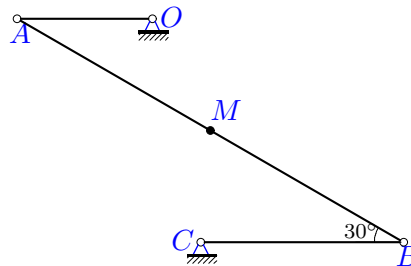
$$AM = 12(\sin(\pi t/6) + t^2); t = 3 \text{ с},$$

$$\omega_{OA} = 0.7 \frac{1}{\text{с}},$$

$$OA = 100, AB = 300, BC = 200$$

### Задача K12.4.

7



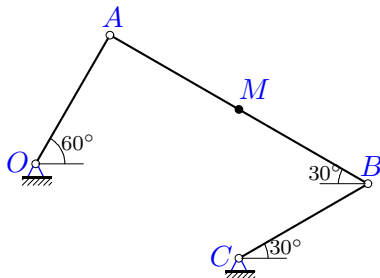
$$BM = 11t(2 + \cos(\pi t/3)); t = 2 \text{ с},$$

$$\omega_{OA} = 1.2 \frac{1}{\text{с}},$$

$$OA = 20, AB = 66, BC = 30$$

### Задача K12.5.

7



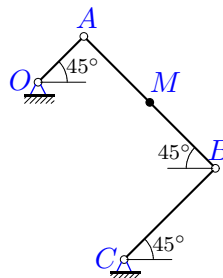
$$BM = 8t + 8 \sin^2(\pi t/6); t = 1 \text{ с},$$

$$\omega_{OA} = 2.2 \frac{1}{\text{с}},$$

$$OA = 10, AB = 20, BC = 10$$

### Задача K12.6.

7



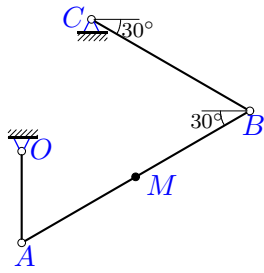
$$BM = 12t(8 - t); t = 2 \text{ с},$$

$$\omega_{OA} = 1.5 \frac{1}{\text{с}},$$

$$OA = 100, AB = 288, BC = 200$$

**Задача K12.7.**

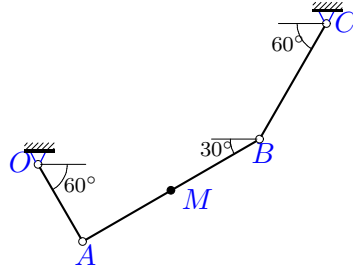
7



$AM = 12t(5 - t); t = 2 \text{ c},$   
 $\omega_{OA} = 1.2 \frac{1}{\text{c}},$   
 $OA = 50, AB = 144, BC = 100$

**Задача K12.8.**

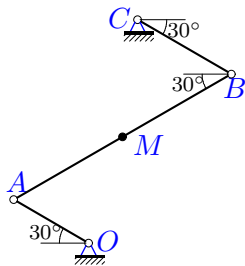
7



$AM = 9(\sin(\pi t/6) + t^2); t = 5 \text{ c},$   
 $\omega_{OA} = 0.4 \frac{1}{\text{c}},$   
 $OA = 200, AB = 459, BC = 300$

**Задача K12.9.**

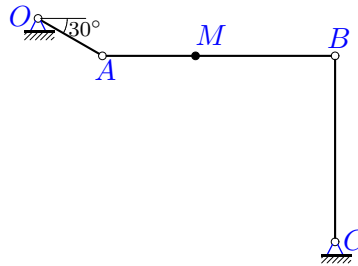
7



$AM = 29t(3 - t); t = 1 \text{ c},$   
 $\omega_{OA} = 1.7 \frac{1}{\text{c}},$   
 $OA = 40, AB = 116, BC = 50$

**Задача K12.10.**

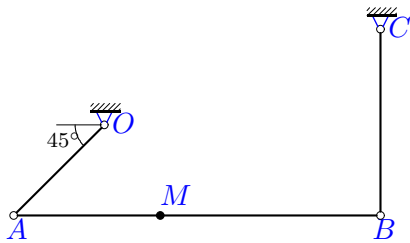
7



$AM = 10(\sin(\pi t/6) + t^2); t = 3 \text{ c},$   
 $\omega_{OA} = 0.8 \frac{1}{\text{c}},$   
 $OA = 80, AB = 250, BC = 200$

**Задача K12.11.**

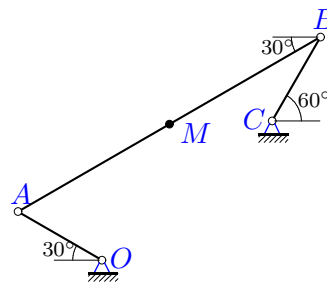
7



$AM = 24t(3 - t); t = 1 \text{ c},$   
 $\omega_{OA} = 1.6 \frac{1}{\text{c}},$   
 $OA = 42, AB = 120, BC = 61$

**Задача K12.12.**

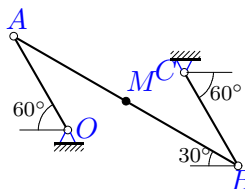
7



$AM = 6t + 8 \sin^2(\pi t/3); t = 3 \text{ c},$   
 $\omega_{OA} = 1.6 \frac{1}{\text{c}},$   
 $OA = 10, AB = 36, BC = 10$

**Задача K12.13.**

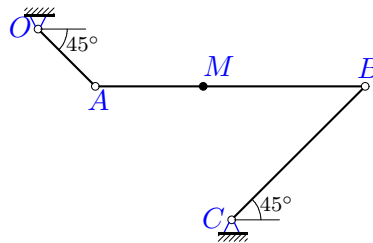
7



$BM = 10t + 8 \sin^2(\pi t/6); t = 1 \text{ c},$   
 $\omega_{OA} = 2.4 \frac{1}{\text{c}},$   
 $OA = 10, AB = 24, BC = 10$

**Задача K12.14.**

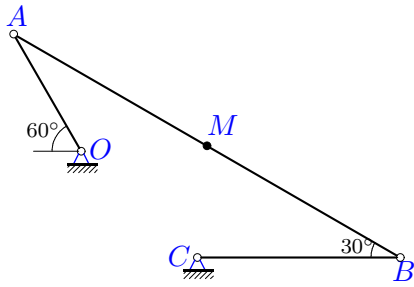
7



$AM = 16t + 8 \sin^2(\pi t/4); t = 2 \text{ c},$   
 $\omega_{OA} = 1.5 \frac{1}{\text{c}},$   
 $OA = 30, AB = 100, BC = 70$

**Задача K12.15.**

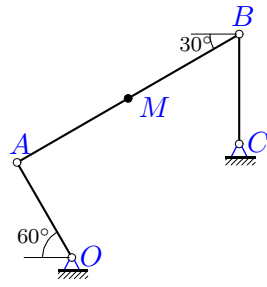
7



$BM = 11t(2 + \cos(\pi t/3)); t = 2 \text{ с},$   
 $\omega_{OA} = 1.2 \frac{1}{\text{с}},$   
 $OA = 20, AB = 66, BC = 30$

**Задача K12.16.**

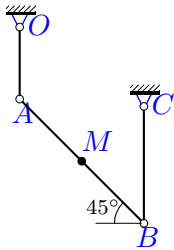
7



$AM = 13t(2 + \cos(\pi t/3)); t = 6 \text{ с},$   
 $\omega_{OA} = 1.2 \frac{1}{\text{с}},$   
 $OA = 200, AB = 468, BC = 200$

**Задача K12.17.**

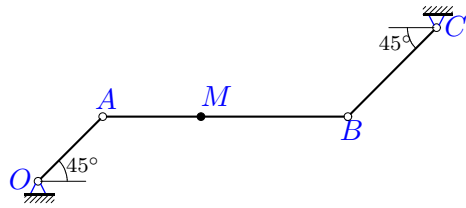
7



$BM = 13t(2 + \cos(\pi t/3)); t = 2 \text{ с},$   
 $\omega_{OA} = 1.1 \frac{1}{\text{с}},$   
 $OA = 32, AB = 78, BC = 52$

**Задача K12.18.**

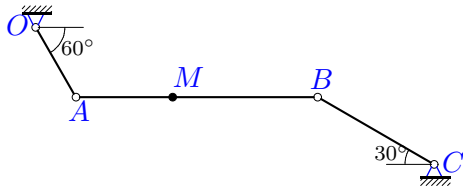
7



$AM = 13t(2 + \cos(\pi t/3)); t = 4 \text{ с},$   
 $\omega_{OA} = 1.9 \frac{1}{\text{с}},$   
 $OA = 73, AB = 195, BC = 100$

**Задача K12.19.**

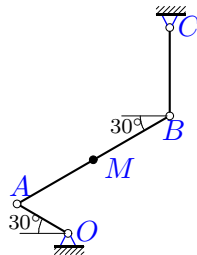
7



$AM = 12t(5 - t); t = 2 \text{ с},$   
 $\omega_{OA} = 1.2 \frac{1}{\text{с}},$   
 $OA = 60, AB = 180, BC = 100$

**Задача K12.20.**

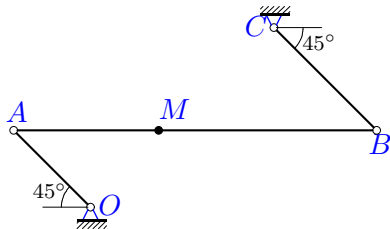
7



$AM = 30t(3 - t); t = 1 \text{ с},$   
 $\omega_{OA} = 1.8 \frac{1}{\text{с}},$   
 $OA = 40, AB = 120, BC = 60$

**Задача K12.21.**

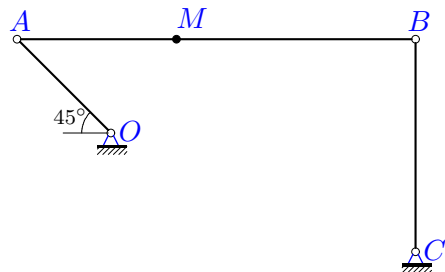
7



$AM = 16t + 8 \sin^2(\pi t/4); t = 2 \text{ с},$   
 $\omega_{OA} = 1.5 \frac{1}{\text{с}},$   
 $OA = 30, AB = 100, BC = 40$

**Задача K12.22.**

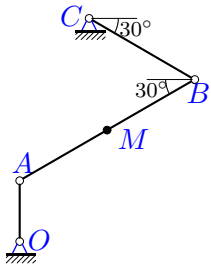
7



$AM = 10t(2 + \cos(\pi t/3)); t = 4 \text{ с},$   
 $\omega_{OA} = 2 \frac{1}{\text{с}},$   
 $OA = 50, AB = 150, BC = 80$

**Задача K12.23.**

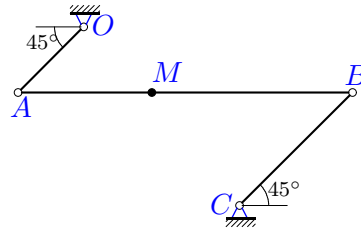
7



$AM = 13(\sin(\pi t/6) + t^2); t = 5 \text{ с},$   
 $\omega_{OA} = 0.6 \frac{1}{\text{с}},$   
 $OA = 200, AB = 663, BC = 400$

**Задача K12.24.**

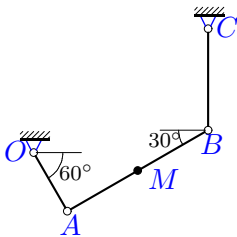
7



$AM = 14t + 8 \sin^2(\pi t/4); t = 2 \text{ с},$   
 $\omega_{OA} = 1.6 \frac{1}{\text{с}},$   
 $OA = 25, AB = 90, BC = 43$

**Задача K12.25.**

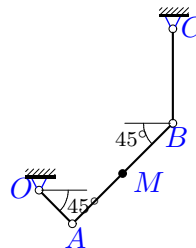
7



$AM = 8t + 8 \sin^2(\pi t/3); t = 3 \text{ с},$   
 $\omega_{OA} = 1.4 \frac{1}{\text{с}},$   
 $OA = 20, AB = 48, BC = 30$

**Задача K12.26.**

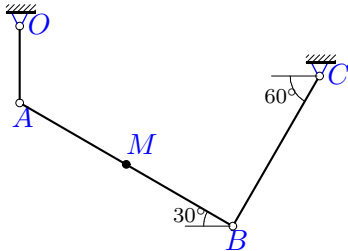
7



$AM = 15t(3 - t); t = 1 \text{ с},$   
 $\omega_{OA} = 1.8 \frac{1}{\text{с}},$   
 $OA = 20, AB = 60, BC = 40$

**Задача K12.27.**

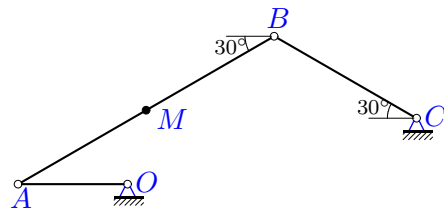
7



$BM = 4t(10 - t); t = 2 \text{ с},$   
 $\omega_{OA} = 1.6 \frac{1}{\text{с}},$   
 $OA = 40, AB = 128, BC = 90$

**Задача K12.28.**

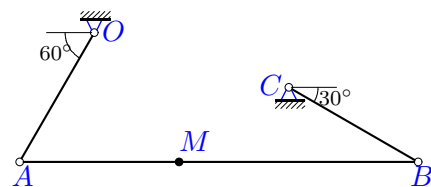
7



$AM = 15t(2 + \cos(\pi t/3)); t = 6 \text{ с},$   
 $\omega_{OA} = 1.2 \frac{1}{\text{с}},$   
 $OA = 200, AB = 540, BC = 300$

**Задача K12.29.**

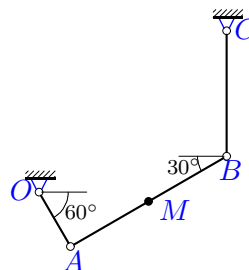
7



$AM = 12t + 8 \sin^2(\pi t/4); t = 2 \text{ с},$   
 $\omega_{OA} = 1.4 \frac{1}{\text{с}},$   
 $OA = 30, AB = 80, BC = 30$

**Задача K12.30.**

7



$AM = 8t(2 + \cos(\pi t/3)); t = 6 \text{ с},$   
 $\omega_{OA} = 1.2 \frac{1}{\text{с}},$   
 $OA = 100, AB = 288, BC = 200$

**К12 Ответы.****Сложное движение точки, плоское переносное движение**

07.04.2012

| №  | $\omega_e$ | $\varepsilon_e$ | $v_r^T$ | $v_{xe}$ | $v_{ye}$ | $v_e$   | $v$     | $a_r^T$ | $a_e$  | $a_C$ | $a$     |
|----|------------|-----------------|---------|----------|----------|---------|---------|---------|--------|-------|---------|
| 1  | 0.657      | 0.107           | 33.00   | 65.00    | 112.58   | 130.000 | 159.435 | -72.377 | 167.52 | 43.33 | 223.210 |
| 2  | 1.050      | 2.500           | 12.00   | 36.37    | 12.60    | 38.494  | 49.987  | -9.870  | 131.07 | 25.20 | 156.928 |
| 3  | 0.000      | 0.094           | 72.00   | -60.62   | 35.00    | 70.000  | 36.803  | 20.710  | 39.61  | 0.00  | 31.349  |
| 4  | -0.000     | -1.455          | 3.45    | -0.00    | -24.00   | 24.000  | 25.899  | 7.889   | 41.85  | 0.00  | 46.977  |
| 5  | 0.635      | -1.073          | -11.63  | -15.88   | 16.50    | 22.898  | 34.222  | -2.193  | 59.27  | 14.77 | 74.161  |
| 6  | -0.000     | 0.391           | -48.00  | -106.07  | 106.07   | 150.000 | 198.000 | 24.000  | 168.75 | 0.00  | 170.448 |
| 7  | 0.417      | -0.100          | 12.00   | 45.00    | 25.98    | 51.962  | 63.962  | -24.000 | 59.94  | 10.00 | 65.139  |
| 8  | -0.302     | 0.460           | 85.92   | 103.92   | -20.00   | 105.830 | 179.803 | 16.766  | 139.14 | 51.87 | 85.785  |
| 9  | -0.000     | 2.071           | 29.00   | -34.00   | -58.89   | 68.000  | 45.270  | -58.000 | 61.17  | 0.00  | 20.024  |
| 10 | -0.222     | -0.123          | 60.00   | 32.00    | 33.26    | 46.151  | 97.826  | 17.258  | 51.02  | 26.60 | 34.648  |
| 11 | 0.396      | -0.325          | 24.00   | 47.52    | -28.51   | 55.415  | 76.991  | -48.000 | 91.34  | 19.01 | 82.033  |
| 12 | 0.889      | -2.898          | 6.00    | -16.00   | -0.00    | 16.000  | 11.213  | 17.546  | 74.35  | 10.67 | 65.680  |
| 13 | 0.000      | 9.600           | -13.63  | -20.78   | -12.00   | 24.000  | 32.997  | -2.193  | 99.77  | 0.00  | 98.688  |
| 14 | -0.636     | -0.004          | 16.00   | 31.82    | 6.36     | 32.450  | 48.241  | -9.870  | 79.68  | 20.36 | 78.652  |
| 15 | 0.630      | -0.331          | 3.45    | -10.39   | 6.00     | 12.000  | 8.548   | 7.889   | 27.96  | 4.35  | 28.805  |
| 16 | 0.296      | -0.281          | 39.00   | -242.49  | -60.00   | 249.800 | 212.605 | -85.537 | 354.45 | 23.09 | 347.350 |
| 17 | 0.000      | -0.270          | 4.08    | 35.20    | -0.00    | 35.200  | 38.194  | 9.323   | 32.15  | 0.00  | 24.696  |
| 18 | 0.000      | 3.306           | 66.66   | -98.08   | 98.08    | 138.700 | 102.985 | 52.092  | 199.61 | 0.00  | 152.131 |
| 19 | 0.400      | -2.837          | 12.00   | 62.35    | 64.80    | 89.928  | 98.628  | -24.000 | 140.50 | 9.60  | 143.352 |
| 20 | 0.600      | 1.663           | 30.00   | -54.00   | -31.18   | 62.354  | 32.354  | -60.000 | 44.96  | 36.00 | 28.911  |
| 21 | -0.000     | 1.671           | 16.00   | -31.82   | -31.82   | 45.000  | 35.535  | -9.870  | 51.41  | 0.00  | 42.402  |
| 22 | 0.471      | 0.526           | 51.28   | -70.71   | -42.43   | 82.462  | 46.666  | 40.070  | 168.74 | 48.34 | 179.055 |
| 23 | -0.181     | 0.106           | 124.11  | -90.00   | -51.96   | 103.923 | 20.182  | 24.218  | 54.11  | 44.92 | 75.457  |
| 24 | -0.000     | -1.590          | 14.00   | 28.28    | -28.28   | 40.000  | 50.872  | -9.870  | 46.82  | 0.00  | 37.364  |
| 25 | -0.337     | 0.087           | 8.00    | 28.29    | 7.00     | 29.143  | 36.896  | 17.546  | 41.38  | 5.39  | 38.841  |
| 26 | -0.600     | 0.943           | 15.00   | 38.18    | 12.73    | 40.249  | 54.083  | -30.000 | 93.71  | 18.00 | 85.456  |
| 27 | -0.250     | -0.426          | -24.00  | 56.00    | -13.86   | 57.689  | 35.264  | 8.000   | 82.57  | 12.00 | 87.272  |
| 28 | 0.257      | 0.358           | 45.00   | -34.64   | -180.00  | 183.303 | 157.560 | -98.696 | 236.40 | 23.09 | 135.112 |
| 29 | 1.050      | 2.500           | 12.00   | 36.37    | 12.60    | 38.494  | 49.987  | -9.870  | 131.07 | 25.20 | 156.928 |
| 30 | -0.241     | -0.097          | 24.00   | 121.24   | 30.00    | 124.900 | 148.108 | -52.638 | 130.25 | 11.55 | 133.210 |

К12 файл o12k7A

| $N_0$ | $a_{xr}$ | $a_{yr}$ | $a_{xe}$ | $a_{ye}$ | $a_x$    | $a_y$    |
|-------|----------|----------|----------|----------|----------|----------|
| 1     | -62.680  | -36.189  | -84.500  | 144.651  | -168.847 | 145.990  |
| 2     | -9.870   | 0.000    | -5.880   | 130.936  | -15.750  | 156.136  |
| 3     | 20.710   | 0.000    | -24.500  | -31.119  | -3.790   | -31.119  |
| 4     | 6.832    | -3.944   | 4.800    | -41.569  | 11.632   | -45.514  |
| 5     | -1.899   | 1.097    | -33.058  | -49.191  | -42.342  | -60.885  |
| 6     | 16.971   | -16.971  | -119.324 | -119.324 | -102.354 | -136.295 |
| 7     | -20.785  | -12.000  | -7.217   | 59.500   | -33.001  | 56.160   |
| 8     | 14.520   | 8.383    | -86.893  | 108.672  | -46.435  | 72.130   |
| 9     | -50.229  | -29.000  | 40.045   | 46.240   | -10.184  | 17.240   |
| 10    | 17.258   | 0.000    | -49.256  | 13.312   | -31.997  | -13.292  |
| 11    | -48.000  | 0.000    | 68.502   | 60.423   | 20.502   | 79.430   |
| 12    | 15.195   | 8.773    | 35.937   | -65.089  | 45.799   | -47.078  |
| 13    | -1.899   | 1.097    | 86.400   | 49.883   | 84.501   | 50.980   |
| 14    | -9.870   | 0.000    | -63.930  | 47.565   | -73.799  | 27.201   |
| 15    | 6.832    | -3.944   | -2.400   | -27.858  | 6.606    | -28.037  |
| 16    | -74.077  | -42.768  | 159.165  | -316.708 | 73.541   | -339.476 |
| 17    | 6.593    | -6.593   | -7.446   | 31.274   | -0.854   | 24.681   |
| 18    | 52.092   | 0.000    | -186.344 | 71.556   | -134.252 | 71.556   |
| 19    | -24.000  | 0.000    | -54.720  | -129.404 | -78.720  | -119.804 |
| 20    | -51.962  | -30.000  | 43.648   | 10.800   | -26.314  | 11.977   |
| 21    | -9.870   | 0.000    | 47.730   | 19.092   | 37.860   | 19.092   |
| 22    | 40.070   | 0.000    | 128.088  | -109.853 | 168.158  | -61.509  |
| 23    | 20.973   | 12.109   | -27.054  | -46.860  | 16.381   | -73.657  |
| 24    | -9.870   | 0.000    | 45.255   | -11.998  | 35.385   | -11.998  |
| 25    | 15.195   | 8.773    | -23.002  | 34.396   | -5.113   | 38.503   |
| 26    | -21.213  | -21.213  | -73.460  | 58.186   | -81.945  | 24.245   |
| 27    | 6.928    | -4.000   | -17.101  | 80.780   | -4.173   | 87.172   |
| 28    | -85.473  | -49.348  | 224.211  | 74.930   | 127.191  | 45.582   |
| 29    | -9.870   | 0.000    | -5.880   | 130.936  | -15.750  | 156.136  |
| 30    | -45.586  | -26.319  | -72.209  | 108.403  | -112.021 | 72.084   |