

## Декартовы координаты. Плоская траектория

Точка движется по закону  $x = x(t), y = y(t)$ . Для момента времени  $t = t_1$  найти скорость, ускорение точки и радиус кривизны траектории ( $x$  и  $y$  даны в сантиметрах,  $t_1$  — в секундах).

Кирсанов М.Н. **Решбник. Теоретическая механика**/Под ред. А. И. Кириллова.— М.: ФИЗМАТЛИТ, 2008. — 384 с. (с.131.)

### Задача K1.1.

$$\begin{aligned}x &= 11 \sin(3t), \\y &= 12 + 4 \cos(6t), \\t_1 &= 13\pi/18.\end{aligned}$$

### Задача K1.2.

$$\begin{aligned}x &= 11 \sin(2t), \\y &= \frac{11}{1 + \sin^2(2t)}, \\t_1 &= \pi/30.\end{aligned}$$

### Задача K1.3.

$$\begin{aligned}x &= t, \\y &= 4(e^{t/8} + e^{-t/8}), \\t_1 &= 5.\end{aligned}$$

### Задача K1.4.

$$\begin{aligned}x &= 16e^{t/16}, \\y &= 16e^{t/16}(0.1e^{t/8} - 1), \\t_1 &= 4.\end{aligned}$$

### Задача K1.5.

$$\begin{aligned}x &= 9 \cos^3(5t), \\y &= 9 \sin^3(5t), \\t_1 &= \pi/30.\end{aligned}$$

### Задача K1.6.

$$\begin{aligned}x &= 9 \sin(5t), \\y &= 10 + 6 \cos(10t), \\t_1 &= 7\pi/15.\end{aligned}$$

### Задача K1.7.

$$\begin{aligned}x &= \frac{2(t^2-1)}{1+t^2}, \\y &= \frac{2(t^2-1)t}{1+t^2}, \\t_1 &= 9.\end{aligned}$$

### Задача K1.8.

$$\begin{aligned}x &= 9 \cos(24t), \\y &= 6 \sin^2(12t), \\t_1 &= 4\pi/27.\end{aligned}$$

### Задача K1.9.

$$\begin{aligned}x &= 300/(t+7), \\y &= (t-800)/(t+7)^2, \\t_1 &= 1.\end{aligned}$$

### Задача K1.10.

$$\begin{aligned}x &= 8 \cos(14t), \\y &= 6 \sin^2(7t), \\t_1 &= 7\pi/48.\end{aligned}$$

### Задача K1.11.

$$\begin{aligned}x &= 8t^2/(1+t^2), \\y &= 8t^3/(1+t^2), \\t_1 &= 5.\end{aligned}$$

### Задача K1.12.

$$\begin{aligned}x &= 15t/(1+t^3), \\y &= 15t^2/(1+t^3), \\t_1 &= 0.1.\end{aligned}$$

### Задача K1.13.

$$\begin{aligned}x &= 6 \cos(10t), \\y &= 4 \sin^2(5t), \\t_1 &= 5\pi/36.\end{aligned}$$

### Задача K1.14.

$$\begin{aligned}x &= \frac{1}{11}(33/(e^{3t}+1)+1), \\y &= e^{3t}, \\t_1 &= 0.04.\end{aligned}$$

### Задача K1.15.

$$\begin{aligned}x &= 7(3t - \sin(3t)), \\y &= 7(1 - \cos(3t)), \\t_1 &= 2\pi/9.\end{aligned}$$

### Задача K1.16.

$$\begin{aligned}x &= 12e^{-4t}, \\y &= 36\sqrt{1 - e^{-8t}}, \\t_1 &= 0.07.\end{aligned}$$

### Задача K1.17.

$$\begin{aligned}x &= 4/(t+1), \\y &= (10 - 10t)/(t+1)^3, \\t_1 &= 0.8.\end{aligned}$$

### Задача K1.18.

$$\begin{aligned}x &= 6 \sin(2t), \\y &= 7 + 3 \cos(4t), \\t_1 &= 13\pi/12.\end{aligned}$$

### Задача K1.19.

$$\begin{aligned}x &= 10e^{t/10}, \\y &= 10e^{t/10}(0.1e^{t/5} - 1), \\t_1 &= 2.\end{aligned}$$

### Задача K1.20.

$$\begin{aligned}x &= 8e^{-2t}, \\y &= 24\sqrt{1 - e^{-4t}}, \\t_1 &= 0.01.\end{aligned}$$

### Задача K1.21.

$$\begin{aligned}x &= 9e^{t/9}, \\y &= 9e^{t/9}(0.1e^{2t/9} - 1), \\t_1 &= 7.\end{aligned}$$

**Задача K1.22.** /

$$x = \frac{1}{8} \left( \frac{50}{\sin(4t)+2} + 1 \right),$$

$$y = 8 \sin(4t),$$

$$t_1 = 13\pi/24.$$

**Задача K1.23.** /

$$x = 33t/(1 + t^3),$$

$$y = 33t^2/(1 + t^3),$$

$$t_1 = 0.8.$$

**Задача K1.24.** /

$$x = 6e^{2t} + 7,$$

$$y = e^{4t}/2,$$

$$t_1 = 0.5.$$

**Задача K1.25.** /

$$x = \frac{5(t^2-1)}{1+t^2},$$

$$y = \frac{5(t^2-1)t}{1+t^2},$$

$$t_1 = 1.$$

**Задача K1.26.** /

$$x = 13e^{t/13},$$

$$y = 13e^{t/13}(0.1e^{2t/13} - 1),$$

$$t_1 = 5.$$

**Задача K1.27.** /

$$x = 8 \sin(4t),$$

$$y = 15 \cos(4t) + 9,$$

$$t_1 = \pi/24.$$

**K1 Ответы.**  
**Декартовы координаты. Плоская траектория**

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	$v_x$	$v_y$	$v$	$a_x$	$a_y$	$a$	$a_\tau$	$a_n$	$R$
№	см/с			см/с <sup>2</sup>					см
1	28.58	-20.78	35.34	-49.50	-72.00	87.37	2.32	87.34	14.30
2	21.52	-8.22	23.04	-9.15	-61.05	61.73	13.24	60.29	8.80
3	1.00	0.67	1.20	0.00	0.15	0.15	0.08	0.13	11.55
4	1.28	-0.65	1.44	0.08	0.04	0.09	0.05	0.07	29.21
5	-50.63	29.23	58.46	-146.14	421.88	446.47	337.50	292.28	11.69
6	22.50	-51.96	56.62	-194.86	300.00	357.73	-352.73	59.60	53.79
7	0.01	2.05	2.05	-0.00	-0.01	0.01	-0.01	0.00	1212.49
8	212.72	-70.91	224.22	-900.19	300.06	948.89	-948.89	0.00	$\infty$
9	-4.69	3.14	5.64	1.17	-1.18	1.66	-1.63	0.33	97.14
10	-14.62	5.48	15.61	-1554.59	582.97	1660.30	1660.30	0.00	98016.95
11	0.12	8.28	8.28	-0.07	-0.10	0.12	-0.10	0.07	1041.13
12	14.94	2.99	15.24	-1.79	29.70	29.75	4.07	29.47	7.88
13	56.38	-18.79	59.43	205.21	-68.40	216.31	216.31	0.00	$\infty$
14	-2.24	3.38	4.06	0.40	10.15	10.16	8.24	5.94	2.77
15	31.50	18.19	36.37	54.56	-31.50	63.00	31.50	54.56	24.25
16	-36.28	125.61	130.75	145.11	-1674.24	1680.52	-1648.77	325.13	52.58
17	-1.23	-2.29	2.60	1.37	6.99	7.12	-6.80	2.11	3.20
18	10.39	-10.39	14.70	-12.00	-24.00	26.83	8.49	25.46	8.49
19	1.22	-0.67	1.40	0.12	0.04	0.13	0.09	0.10	20.35
20	-15.68	232.90	233.43	31.37	-12345.21	12345.25	-12319.42	798.14	68.27
21	2.18	0.92	2.36	0.24	0.79	0.83	0.53	0.63	8.81
22	-3.46	27.71	27.93	17.60	-64.00	66.38	-65.69	9.53	81.88
23	-0.35	17.18	17.19	-54.55	-44.33	70.29	-43.22	55.43	5.33
24	32.62	14.78	35.81	65.24	59.11	88.04	83.82	26.92	47.63
25	5.00	5.00	7.07	-5.00	5.00	7.07	0.00	7.07	7.07
26	1.47	-0.52	1.56	0.11	0.11	0.16	0.07	0.14	17.58
27	27.71	-30.00	40.84	-64.00	-207.85	217.48	109.25	188.05	8.87