

## 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.

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$$\begin{aligned}x &= 11t^5, \\y &= 12\sqrt{1-t^{10}}, \\t_1 &= 0.88.\end{aligned}$$

### Задача K1.2.

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$$\begin{aligned}x &= 22/(t+3), \\y &= (60-90t)/(t+3)^3, \\t_1 &= 0.6.\end{aligned}$$

### Задача K1.3.

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$$\begin{aligned}x &= 5t^2, \\y &= 6\sqrt{1-t^4}, \\t_1 &= 0.88.\end{aligned}$$

### Задача K1.4.

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$$\begin{aligned}x &= \frac{1}{10}(50/(e^{5t}+1)+1), \\y &= e^{5t}, \\t_1 &= 0.1.\end{aligned}$$

### Задача K1.5.

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$$\begin{aligned}x &= 12/(t+1), \\y &= (30-30t)/(t+1)^3, \\t_1 &= 1.\end{aligned}$$

### Задача K1.6.

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$$\begin{aligned}x &= 4t^2/(1+t^2), \\y &= 4t^3/(1+t^2), \\t_1 &= 6.\end{aligned}$$

### Задача K1.7.

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$$\begin{aligned}x &= \frac{1}{3}(9/(e^{3t}+1)+1), \\y &= e^{3t}, \\t_1 &= 0.01.\end{aligned}$$

### Задача K1.8.

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$$\begin{aligned}x &= 5\sin(2t), \\y &= 6+3\cos(4t), \\t_1 &= \pi/6.\end{aligned}$$

### Задача K1.9.

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$$\begin{aligned}x &= 7e^{2t}+8, \\y &= e^{4t}/2, \\t_1 &= 1.\end{aligned}$$

### Задача K1.10.

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$$\begin{aligned}x &= 7e^{-5t}, \\y &= 21\sqrt{1-e^{-10t}}, \\t_1 &= 0.09.\end{aligned}$$

### Задача K1.11.

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$$\begin{aligned}x &= 6e^{-5t}, \\y &= 18\sqrt{1-e^{-10t}}, \\t_1 &= 0.08.\end{aligned}$$

### Задача K1.12.

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

### Задача K1.13.

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$$\begin{aligned}x &= 9e^{t/9}, \\y &= 9e^{t/9}(0.1e^{2t/9}-1), \\t_1 &= 3.\end{aligned}$$

### Задача K1.14.

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

### Задача K1.15.

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$$\begin{aligned}x &= 2\sin(4t), \\y &= 3\cos(4t)+3, \\t_1 &= 5\pi/24.\end{aligned}$$

### Задача K1.16.

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$$\begin{aligned}x &= 11\sin(2t), \\y &= -1.1(9+\cos^2(2t))\sin(2t), \\t_1 &= 13\pi/12.\end{aligned}$$

### Задача K1.17.

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$$\begin{aligned}x &= 8e^{2t}+9, \\y &= e^{4t}/2, \\t_1 &= 0.9.\end{aligned}$$

### Задача K1.18.

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$$\begin{aligned}x &= 3\sin(3t), \\y &= -0.3(9+\cos^2(3t))\sin(3t), \\t_1 &= 4\pi/9.\end{aligned}$$

### Задача K1.19.

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$$\begin{aligned}x &= \cos(3t)(6+5\cos(3t)), \\y &= \sin(3t)(6+5\cos(3t)), \\t_1 &= 5\pi/9.\end{aligned}$$

### Задача K1.20.

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$$\begin{aligned}x &= 38/(t+4), \\y &= (120-160t)/(t+4)^3, \\t_1 &= 0.7.\end{aligned}$$

### Задача K1.21.

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$$\begin{aligned}x &= 8\cos^3(5t), \\y &= 8\sin^3(5t), \\t_1 &= 11\pi/30.\end{aligned}$$

**Задача К1.22.**

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$$x = 5t^2/(1+t^2),$$

$$y = 5t^3/(1+t^2),$$

$$t_1 = 10.$$

**Задача К1.23.**

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$$x = 27t/(1+t^3),$$

$$y = 27t^2/(1+t^3),$$

$$t_1 = 0.8.$$

**Задача К1.24.**

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$$x = 11 \sin(9t),$$

$$y = \frac{11}{1+\sin^2(9t)},$$

$$t_1 = 4\pi/15.$$

**Задача К1.25.**

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$$x = 10e^{t/10},$$

$$y = 10e^{t/10}(0.1e^{t/5} - 1),$$

$$t_1 = 8.$$

**Задача К1.26.**

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$$x = \cos(2t)(6 + 5 \cos(2t)),$$

$$y = \sin(2t)(6 + 5 \cos(2t)),$$

$$t_1 = 7\pi/12.$$

**Задача К1.27.**

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$$x = 22/(t+2),$$

$$y = (20 - 100t)/(t+2)^3,$$

$$t_1 = 0.2.$$

**К1 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	32.98	-22.36	39.85	149.92	-277.66	315.55	279.89	145.73	10.89
2	-1.70	-2.04	2.65	0.94	3.33	3.46	-3.16	1.41	4.98
3	8.80	-12.93	15.64	10.00	-88.07	88.64	78.43	41.30	5.92
4	-5.88	8.24	10.12	7.19	41.22	41.84	29.39	29.78	3.44
5	-3.00	-3.75	4.80	3.00	11.25	11.64	-10.66	4.69	4.92
6	0.04	4.10	4.10	-0.02	-0.03	0.04	-0.03	0.02	1011.93
7	-2.25	3.09	3.82	0.10	9.27	9.27	7.44	5.54	2.64
8	5.00	-10.39	11.53	-17.32	24.00	29.60	-29.14	5.20	25.56
9	103.45	109.20	150.42	206.89	436.79	483.31	459.38	150.20	150.64
10	-22.32	55.42	59.74	111.58	-744.00	752.32	-731.82	174.42	20.46
11	-20.11	54.50	58.09	100.55	-767.29	773.85	-754.65	171.30	19.70
12	0.03	2.07	2.07	-0.02	-0.03	0.03	-0.03	0.02	260.28
13	1.40	-0.58	1.51	0.16	0.12	0.19	0.10	0.17	13.65
14	2.88	11.16	11.53	-3.17	-0.58	3.22	-1.35	2.92	45.44
15	-6.93	-6.00	9.17	-16.00	41.57	44.54	-15.12	41.90	2.00
16	19.05	-17.62	25.95	-22.00	30.25	37.40	-36.69	7.27	92.68
17	96.79	73.20	121.35	193.59	292.79	351.00	331.01	116.77	126.12
18	-4.50	3.49	5.69	23.38	-21.63	31.85	-31.73	2.77	11.69
19	28.58	1.50	28.62	18.00	124.71	126.00	24.51	123.59	6.63
20	-1.72	-1.59	2.34	0.73	2.01	2.14	-1.90	0.98	5.61
21	45.00	25.98	51.96	-129.90	-375.00	396.86	-300.00	259.81	10.39
22	0.01	5.05	5.05	-0.00	-0.01	0.01	-0.01	0.00	8838.30
23	-0.28	14.06	14.06	-44.63	-36.27	57.51	-35.37	45.35	4.36
24	30.59	-16.04	34.54	-847.39	486.59	977.16	-976.44	37.38	31.92
25	2.23	1.08	2.47	0.22	0.77	0.80	0.54	0.59	10.29
26	-2.66	-5.39	6.01	0.78	-22.64	22.65	19.96	10.72	3.37
27	-4.55	-9.39	10.43	4.13	25.61	25.94	-24.85	7.44	14.63