

## 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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$$\begin{aligned}x &= 8t^2/(1+t^2), \\y &= 8t^3/(1+t^2), \\t_1 &= 6.\end{aligned}$$

### Задача K1.2.

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$$\begin{aligned}x &= 14e^{t/14}, \\y &= 14e^{t/14}(0.1e^{t/7} - 1), \\t_1 &= 11.\end{aligned}$$

### Задача K1.3.

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$$\begin{aligned}x &= 7e^{2t} + 8, \\y &= e^{4t}/3, \\t_1 &= 0.3.\end{aligned}$$

### Задача K1.4.

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$$\begin{aligned}x &= 7 \sin(5t), \\y &= 13 \cos(5t) + 8, \\t_1 &= 13\pi/30.\end{aligned}$$

### Задача K1.5.

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$$\begin{aligned}x &= \cos(5t)(11 + 10 \cos(5t)), \\y &= \sin(5t)(11 + 10 \cos(5t)), \\t_1 &= 7\pi/30.\end{aligned}$$

### Задача K1.6.

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$$\begin{aligned}x &= 11t^3, \\y &= 12\sqrt{1-t^6}, \\t_1 &= 0.87.\end{aligned}$$

### Задача K1.7.

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$$\begin{aligned}x &= 10 \sin(3t), \\y &= 11 + 4 \cos(6t), \\t_1 &= 7\pi/9.\end{aligned}$$

### Задача K1.8.

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$$\begin{aligned}x &= t, \\y &= 8(e^{t/16} + e^{-t/16}), \\t_1 &= 5.\end{aligned}$$

### Задача K1.9.

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$$\begin{aligned}x &= 6e^{-2t}, \\y &= 18\sqrt{1-e^{-4t}}, \\t_1 &= 0.1.\end{aligned}$$

### Задача K1.10.

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$$\begin{aligned}x &= 6(2t - \sin(2t)), \\y &= 6(1 - \cos(2t)), \\t_1 &= 2\pi/3.\end{aligned}$$

### Задача K1.11.

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

### Задача K1.12.

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$$\begin{aligned}x &= 6 + 6 \cos(t), \\y &= 6 \operatorname{tg}(t) + 6 \sin t, \\t_1 &= 11\pi/30.\end{aligned}$$

### Задача K1.13.

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$$\begin{aligned}x &= 12e^{-3t}, \\y &= 36\sqrt{1-e^{-6t}}, \\t_1 &= 0.1.\end{aligned}$$

### Задача K1.14.

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

### Задача K1.15.

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$$\begin{aligned}x &= \frac{1}{3}(240/(t^5+1)+1), \\y &= t^5, \\t_1 &= 1.4.\end{aligned}$$

### Задача K1.16.

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$$\begin{aligned}x &= 10 \sin(2t), \\y &= 19 \cos(2t) + 11, \\t_1 &= \pi/6.\end{aligned}$$

### Задача K1.17.

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

### Задача K1.18.

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$$\begin{aligned}x &= \frac{5(t^2-1)}{1+t^2}, \\y &= \frac{5(t^2-1)t}{1+t^2}, \\t_1 &= 7.\end{aligned}$$

### Задача K1.19.

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$$\begin{aligned}x &= \frac{1}{4}(8/(e^{2t}+1)+1), \\y &= e^{2t}, \\t_1 &= 0.03.\end{aligned}$$

### Задача K1.20.

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$$\begin{aligned}x &= t, \\y &= 12(e^{t/24} + e^{-t/24}), \\t_1 &= 2.\end{aligned}$$

### Задача K1.21.

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$$\begin{aligned}x &= \frac{1}{11} \left( \frac{14}{\sin(2t)+2} + 1 \right), \\y &= 11 \sin(2t), \\t_1 &= 5\pi/6.\end{aligned}$$

**Задача K1.22.** 5  
 $x = 9(2t - \sin(2t)),$   
 $y = 9(1 - \cos(2t)),$   
 $t_1 = 13\pi/12.$

**Задача K1.23.** 5  
 $x = \frac{1}{7}(1850/(t^5 + 1) + 1),$   
 $y = t^5,$   
 $t_1 = 1.6.$

**Задача K1.24.** 5  
 $x = \frac{2(t^2-1)}{1+t^2},$   
 $y = \frac{2(t^2-1)t}{1+t^2},$   
 $t_1 = 7.$

**Задача K1.25.** 5  
 $x = 10 \sin(3t),$   
 $y = 11 + 4 \cos(6t),$   
 $t_1 = 4\pi/9.$

**Задача K1.26.** 5  
 $x = 9t^3,$   
 $y = 10\sqrt{1-t^6},$   
 $t_1 = 0.89.$

**Задача K1.27.** 5  
 $x = 6e^{-5t},$   
 $y = 18\sqrt{1-e^{-10t}},$   
 $t_1 = 0.05.$

**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	0.07	8.20	8.20	-0.03	-0.06	0.07	-0.06	0.03	2023.86	
2	2.19	0.97	2.40	0.16	0.52	0.55	0.36	0.41	13.93	
3	25.51	4.43	25.89	51.02	17.71	54.00	53.30	8.72	76.84	
4	30.31	-32.50	44.44	-87.50	-281.46	294.75	146.15	255.96	7.72	
5	-15.80	-22.63	27.60	-11.84	-295.51	295.75	249.08	159.46	4.78	
6	24.98	-23.84	34.53	57.42	-199.97	208.05	179.61	105.00	11.36	
7	15.00	-20.78	25.63	-77.94	72.00	106.11	-104.00	21.07	31.19	
8	1.00	0.32	1.05	0.00	0.07	0.07	0.02	0.06	17.61	
9	-9.82	42.03	43.16	19.65	-339.02	339.59	-334.59	58.04	32.10	
10	18.00	-10.39	20.78	-20.78	-12.00	24.00	-12.00	20.78	20.78	
11	16.87	9.74	19.49	-48.71	-140.63	148.82	-112.50	97.43	3.90	
12	-5.48	38.71	39.09	-2.44	157.44	157.46	156.22	19.66	77.75	
13	-26.67	88.24	92.18	80.01	-851.44	855.19	-838.18	169.74	50.06	
14	8.96	1.80	9.14	-1.08	17.82	17.85	2.44	17.68	4.73	
15	-37.77	19.21	42.38	119.58	54.88	131.57	-81.71	103.12	17.41	
16	10.00	-32.91	34.39	-34.64	-38.00	51.42	26.29	44.19	26.77	
17	-13.50	7.79	15.59	-23.38	67.50	71.44	54.00	46.77	5.20	
18	0.06	5.19	5.19	-0.02	-0.05	0.06	-0.05	0.02	1182.30	
19	-1.00	2.12	2.35	0.06	4.25	4.25	3.82	1.86	2.96	
20	1.00	0.08	1.00	0.00	0.04	0.04	0.00	0.04	24.17	
21	-0.99	11.00	11.04	-1.68	38.11	38.14	38.10	1.74	70.16	
22	2.41	9.00	9.32	18.00	31.18	36.00	34.77	9.32	9.32	
23	-65.65	32.77	73.37	210.45	81.92	225.83	-151.71	167.29	32.18	
24	0.02	2.08	2.08	-0.01	-0.02	0.02	-0.02	0.01	472.92	
25	-15.00	-20.78	25.63	77.94	72.00	106.11	-104.00	21.07	31.19	
26	21.39	-23.62	31.86	48.06	-211.36	216.75	188.93	106.24	9.56	
27	-23.36	87.02	90.11	116.82	-1540.98	1545.40	-1518.56	286.74	28.31	