

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 К1.1.

$$\begin{aligned}x &= 33t/(1+t^3), \\y &= 33t^2/(1+t^3), \\t_1 &= 0.5.\end{aligned}$$

Задача К1.2.

$$\begin{aligned}x &= 6 \cos(18t), \\y &= 5 \sin^2(9t), \\t_1 &= 5\pi/36.\end{aligned}$$

Задача К1.3.

$$\begin{aligned}x &= 9 \cos(16t), \\y &= 7 \sin^2(8t), \\t_1 &= 4\pi/27.\end{aligned}$$

Задача К1.4.

$$\begin{aligned}x &= 5 \cos(24t), \\y &= 7 \sin^2(12t), \\t_1 &= 2\pi/15.\end{aligned}$$

Задача К1.5.

$$\begin{aligned}x &= 33/(t+4), \\y &= (20-160t)/(t+4)^3, \\t_1 &= 0.1.\end{aligned}$$

Задача К1.6.

$$\begin{aligned}x &= 11 \sin(8t), \\y &= \frac{11}{1+\sin^2(8t)}, \\t_1 &= 7\pi/30.\end{aligned}$$

Задача К1.7.

$$\begin{aligned}x &= 16e^{t/16}, \\y &= 16e^{t/16}(0.1e^{t/8} - 1), \\t_1 &= 2.\end{aligned}$$

Задача К1.8.

$$\begin{aligned}x &= 2 \sin(11t), \\y &= \frac{2}{1+\sin^2(11t)}, \\t_1 &= \pi/3.\end{aligned}$$

Задача К1.9.

$$\begin{aligned}x &= \frac{1}{3} \left(\frac{7}{\sin(4t)+2} + 1 \right), \\y &= 3 \sin(4t), \\t_1 &= 7\pi/24.\end{aligned}$$

Задача К1.10.

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

Задача К1.11.

$$\begin{aligned}x &= 9t^2/(1+t^2), \\y &= 9t^3/(1+t^2), \\t_1 &= 7.\end{aligned}$$

Задача К1.12.

$$\begin{aligned}x &= \frac{1}{5} \left(\frac{31}{\sin(4t)+2} + 1 \right), \\y &= 5 \sin(4t), \\t_1 &= \pi/24.\end{aligned}$$

Задача К1.13.

$$\begin{aligned}x &= 2300/(t+10), \\y &= (t-26800)/(t+10)^2, \\t_1 &= 10.\end{aligned}$$

Задача К1.14.

$$\begin{aligned}x &= 2t^2, \\y &= 3\sqrt{1-t^4}, \\t_1 &= 0.81.\end{aligned}$$

Задача К1.15.

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

Задача К1.16.

$$\begin{aligned}x &= 4 \sin(3t), \\y &= -0.4(9 + \cos^2(3t)) \sin(3t), \\t_1 &= 7\pi/9.\end{aligned}$$

Задача К1.17.

$$\begin{aligned}x &= 4t^5, \\y &= 5\sqrt{1-t^{10}}, \\t_1 &= 0.88.\end{aligned}$$

Задача К1.18.

$$\begin{aligned}x &= 2t^2, \\y &= 3\sqrt{1-t^4}, \\t_1 &= 0.86.\end{aligned}$$

Задача К1.19.

$$\begin{aligned}x &= \frac{1}{10}(20/(e^{2t}+1)+1), \\y &= e^{2t}, \\t_1 &= 0.05.\end{aligned}$$

Задача К1.20.

$$\begin{aligned}x &= 9 \sin(4t), \\y &= 17 \cos(4t) + 10, \\t_1 &= 5\pi/12.\end{aligned}$$

Задача К1.21.

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

Задача K1.22. 4
 $x = \frac{1}{10}(930/(t^3 + 1) + 1),$
 $y = t^3,$
 $t_1 = 1.8.$

Задача K1.23. 4
 $x = 8t^3,$
 $y = 9\sqrt{1 - t^6},$
 $t_1 = 0.86.$

Задача K1.24. 4
 $x = 10 \cos(14t),$
 $y = 7 \sin^2(7t),$
 $t_1 = 13\pi/60.$

Задача K1.25. 4
 $x = \cos(5t)(7 + 6 \cos(5t)),$
 $y = \sin(5t)(7 + 6 \cos(5t)),$
 $t_1 = 7\pi/15.$

Задача K1.26. 4
 $x = 8 \sin(7t),$
 $y = \frac{8}{1 + \sin^2(7t)},$
 $t_1 = \pi/3.$

Задача K1.27. 4
 $x = 3 \sin(3t),$
 $y = 4 + 4 \cos(6t),$
 $t_1 = \pi/18.$

K1 Ответы.
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	v_x	v_y	v	a_x	a_y	a	a_τ	a_n	R
№	см/с			см/с ²					см
1	19.56	24.44	31.30	-65.19	6.52	65.51	-35.63	54.97	17.83
2	-108.00	45.00	117.00	0.00	-0.00	0.00	-0.00	0.00	∞
3	-132.22	51.42	141.87	-912.57	354.89	979.15	979.15	0.00	∞
4	70.53	-49.37	86.10	2329.97	-1630.98	2844.09	2844.09	0.00	∞
5	-1.96	-2.36	3.07	0.96	3.44	3.57	-3.26	1.46	6.47
6	80.39	48.15	93.71	286.34	-202.41	350.66	141.65	320.78	27.37
7	1.13	-0.70	1.33	0.07	0.01	0.07	0.05	0.05	38.07
8	11.00	6.22	12.64	209.58	146.75	255.85	254.67	24.56	6.50
9	3.59	-10.39	11.00	8.30	24.00	25.39	-19.97	15.68	7.71
10	0.78	1.39	1.59	2.90	3.07	4.22	4.10	1.03	2.46
11	0.05	9.17	9.17	-0.02	-0.05	0.05	-0.05	0.02	4051.38
12	-3.44	17.32	17.66	17.46	-40.00	43.64	-42.63	9.34	33.38
13	-5.75	6.70	8.83	0.58	-1.01	1.16	-1.14	0.22	357.17
14	3.24	-4.23	5.32	4.00	-23.53	23.87	21.11	11.15	2.54
15	0.78	-0.75	1.08	2.90	1.93	3.48	0.74	3.40	0.34
16	6.00	-4.65	7.59	-31.18	28.84	42.47	-42.31	3.70	15.59
17	11.99	-9.31	15.19	54.52	-115.69	127.89	114.02	57.93	3.98
18	3.44	-5.67	6.63	4.00	-35.70	35.93	32.60	15.10	2.91
19	-1.00	2.21	2.43	0.10	4.42	4.42	3.99	1.91	3.08
20	18.00	58.89	61.58	124.71	-136.00	184.52	-93.61	159.01	23.85
21	-1.00	2.12	2.35	0.06	4.25	4.25	3.82	1.86	2.96
22	-19.37	9.72	21.67	33.59	10.80	35.28	-25.17	24.72	19.00
23	17.75	-16.46	24.21	41.28	-134.71	140.90	121.87	70.71	8.29
24	14.63	-5.12	15.50	1949.26	-682.24	2065.21	2065.21	0.00	61282.25
25	-56.29	2.50	56.35	62.50	-411.36	416.08	-80.69	408.18	7.78
26	28.00	-15.84	32.17	-339.48	237.71	414.43	-412.52	39.79	26.01
27	7.79	-20.78	22.20	-13.50	-72.00	73.25	62.68	37.92	12.99