

Декартовы координаты. Пространственная траектория

Точка движется по закону $x = x(t), y = y(t), z = z(t)$. Определить скорость, ускорение точки и радиус кривизны траектории при $t = t_1$ (x, y и z даны в см, t и t_1 — в с).

Кирсанов М.Н. **Решebник. Теоретическая механика**/Под ред. А. И. Кириллова.— М.:ФИЗМАТЛИТ, 2002.— 384 с. (с.137.)

Задача 2.1.

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$$\begin{aligned}x &= 4(t+1)^{3/10}, \\y &= 13e^{t/4}, \\z &= 3e^{(t^2)}, \quad t_1 = 0.2.\end{aligned}$$

Задача 2.2.

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$$\begin{aligned}x &= 16e^{t/3}, \\y &= \frac{1}{2} \sin^2 6t - 6t, \\z &= 2t^2 + 6t + 3, \quad t_1 = 0.5.\end{aligned}$$

Задача 2.3.

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$$\begin{aligned}x &= 2t^2 + 5t + 3, \\y &= \frac{1}{2} \sin^2 6t - 5t, \\z &= 4 \ln(3t + 2), \quad t_1 = 0.4.\end{aligned}$$

Задача 2.4.

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$$\begin{aligned}x &= 3t + \frac{1}{2} \cos^2 6t, \\y &= 12e^{t/3}, \\z &= 2\sqrt{3t+2}, \quad t_1 = 0.1.\end{aligned}$$

Задача 2.5.

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$$\begin{aligned}x &= 16e^{t/3}, \\y &= 3\arcsin(t/6), \\z &= 7t + \frac{1}{2} \cos^2 6t, \quad t_1 = 0.5.\end{aligned}$$

Задача 2.6.

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$$\begin{aligned}x &= \frac{1}{2} \sin^2 6t - 4t, \\y &= 4\sqrt{3t+4}, \\z &= 5t + \frac{1}{2} \cos^2 6t, \quad t_1 = 0.3.\end{aligned}$$

Задача 2.7.

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$$\begin{aligned}x &= 3e^{(t^2)}, \\y &= 4\operatorname{tg}(t/3), \\z &= 3\sqrt{3t+3}, \quad t_1 = 0.2.\end{aligned}$$

Задача 2.8.

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$$\begin{aligned}x &= 2t^2 + 11t + 3, \\y &= 10 \ln(3t + 2), \\z &= 3\arcsin(t/11), \quad t_1 = 1.\end{aligned}$$

Задача 2.9.

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$$\begin{aligned}x &= \frac{1}{2} \sin 4t + 5t, \\y &= 4 \ln(4t + 2), \\z &= 15e^{t/2}, \quad t_1 = 0.4.\end{aligned}$$

Задача 2.10.

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$$\begin{aligned}x &= 4\arcsin(t/3), \\y &= 3e^{(t^2)}, \\z &= 4(t+1)^{3/10}, \quad t_1 = 0.2.\end{aligned}$$

Задача 2.11.

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$$\begin{aligned}x &= \frac{1}{2} \sin^2 8t - 5t, \\y &= 4 \ln(2t + 2), \\z &= \frac{8}{3t + 4}, \quad t_1 = 0.4.\end{aligned}$$

Задача 2.12.

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$$\begin{aligned}x &= 20e^{t/4}, \\y &= 9 \ln(2t + 2), \\z &= 11t + \cos^2 4t, \quad t_1 = 0.9.\end{aligned}$$

Задача 2.13.

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$$\begin{aligned}x &= 2\arcsin(t/9), \\y &= \frac{12}{t+2}, \\z &= 9e^{(t^2)}, \quad t_1 = 0.8.\end{aligned}$$

Задача 2.14.

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$$\begin{aligned}x &= 3 \ln(3t + 2), \\y &= 4e^{(t^2)}, \\z &= 5t + \frac{1}{2} \cos^2 6t, \quad t_1 = 0.3.\end{aligned}$$

Задача 2.15.

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$$\begin{aligned}x &= \frac{1}{2} \sin 8t + 9t, \\y &= 19e^{t/4}, \\z &= \frac{12}{3t+4}, \quad t_1 = 0.8.\end{aligned}$$

Задача 2.16.

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$$\begin{aligned}x &= 4 \ln(2t + 2), \\y &= 5e^{(t^2)}, \\z &= 4\arcsin(t/5), \quad t_1 = 0.4.\end{aligned}$$

Задача 2.17.

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$$\begin{aligned}x &= 5\sqrt{2t + 5}, \\y &= 5\operatorname{tg}(t/4), \\z &= 5\sqrt{2t + 5}, \quad t_1 = 0.4.\end{aligned}$$

Задача 2.18.

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$$\begin{aligned}x &= 3t^2 + 7t + 2, \\y &= 8t + \cos^2 4t, \\z &= 5\operatorname{tg}(t/4), \quad t_1 = 0.6.\end{aligned}$$

Задача 2.19.

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$$\begin{aligned}x &= \frac{10}{2t + 3}, \\y &= 3\arcsin(t/7), \\z &= 4\operatorname{tg}(t/3), \quad t_1 = 0.6.\end{aligned}$$

Задача 2.20.

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$$\begin{aligned}x &= t^2 + 8t + 4, \\y &= 8e^{(t^2)}, \\z &= 2\arcsin(t/8), \quad t_1 = 0.7.\end{aligned}$$

Задача 2.21.

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$$\begin{aligned}x &= \frac{12}{2t + 3}, \\y &= 10(t + 1)^{1/5}, \\z &= 9\sqrt{3t + 9}, \quad t_1 = 0.8.\end{aligned}$$

Задача 2.22.

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$$\begin{aligned}x &= 3 \ln(3t + 2), \\y &= 5(t + 1)^{1/5}, \\z &= \frac{1}{2} \sin 6t + 4t, \quad t_1 = 0.3.\end{aligned}$$

Задача 2.23.

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$$\begin{aligned}x &= \frac{1}{2} \sin^2 8t - 5t, \\y &= 5\sqrt{2t + 5}, \\z &= 5\operatorname{tg}(t/4), \quad t_1 = 0.4.\end{aligned}$$

Задача 2.24.

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$$\begin{aligned}x &= 4\arcsin(t/9), \\y &= 8 \ln(2t + 2), \\z &= \frac{1}{2} \sin^2 8t - 9t, \quad t_1 = 0.8.\end{aligned}$$

Задача 2.25.

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$$\begin{aligned}x &= 5 \ln(2t + 2), \\y &= 3t^2 + 6t + 2, \\z &= 7t + \cos^2 4t, \quad t_1 = 0.5.\end{aligned}$$

Задача 2.26.

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$$\begin{aligned}x &= 20e^{t/4}, \\y &= 9 \ln(2t + 2), \\z &= 10\sqrt{2t + 10}, \quad t_1 = 0.9.\end{aligned}$$

Задача 2.27.

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$$\begin{aligned}x &= \frac{11}{3t + 4}, \\y &= \frac{1}{2} \sin 8t + 8t, \\z &= 4\arcsin(t/8), \quad t_1 = 0.7.\end{aligned}$$

Задача 2.28.

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$$\begin{aligned}x &= 2t^2 + 10t + 3, \\y &= 20e^{t/3}, \\z &= 4\operatorname{tg}(t/3), \quad t_1 = 0.9.\end{aligned}$$

Задача 2.29.

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$$\begin{aligned}x &= \ln(2t + 2), \\y &= 12e^{t/4}, \\z &= 3t^2 + 2t + 2, \quad t_1 = 0.1.\end{aligned}$$

Задача 2.30.

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$$\begin{aligned}x &= \frac{1}{2} \sin 8t + 8t, \\y &= 7 \ln(2t + 2), \\z &= 8e^{(t^2)}, \quad t_1 = 0.7.\end{aligned}$$

Задача 2.31.

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$$\begin{aligned}x &= 9(t + 1)^{1/5}, \\y &= 3\arcsin(t/8), \\z &= 18e^{t/3}, \quad t_1 = 0.7.\end{aligned}$$

Задача 2.32.

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$$\begin{aligned}x &= \frac{1}{2} \sin^2 6t - 3t, \\y &= \frac{1}{2} \sin 6t + 3t, \\z &= 4t + \frac{1}{2} \cos^2 6t, \quad t_1 = 0.2.\end{aligned}$$

Задача 2.33.

5

$$\begin{aligned}x &= \frac{1}{2} \sin 6t + 3t, \\y &= 3\sqrt{3t + 3}, \\z &= 13e^{t/3}, \quad t_1 = 0.2.\end{aligned}$$

Декартовы координаты. Пространственная траектория

№	v_x	v_y	v_z	v	a_x	a_y	a_z	a	a_τ	a_n	R
1	1.06	3.42	1.25	3.79	-0.62	0.85	6.74	6.83	2.82	6.22	2.309
2	6.30	-6.84	8.00	12.27	2.10	34.57	4.00	34.86	-15.58	31.18	4.825
3	6.60	-7.99	3.75	11.02	4.00	3.15	-3.52	6.19	-1.08	6.09	19.936
4	0.20	4.14	1.98	4.59	-13.04	1.38	-1.29	13.18	0.11	13.18	1.598
5	6.30	0.50	7.84	10.07	2.10	0.01	-34.57	34.63	-25.59	23.33	4.346
6	-5.33	2.71	6.33	8.70	-32.28	-0.83	32.28	45.66	42.97	15.45	4.903
7	1.25	1.34	2.37	3.00	6.74	0.06	-0.99	6.82	2.06	6.50	1.381
8	15.00	6.00	0.27	16.16	4.00	-3.60	0.00	5.38	2.38	4.83	54.073
9	4.94	4.44	9.16	11.32	-8.00	-4.94	4.58	10.46	-1.72	10.31	12.421
10	1.34	1.25	1.06	2.11	0.03	6.74	-0.62	6.77	3.70	5.67	0.786
11	-4.53	2.86	-0.89	5.43	63.56	-2.04	1.02	63.60	-54.29	33.13	0.891
12	6.26	4.74	7.83	11.09	1.57	-2.49	-19.47	19.69	-13.92	13.92	8.827
13	0.22	-1.53	27.31	27.35	0.00	1.09	77.83	77.84	77.65	5.48	136.446
14	3.10	2.63	6.33	7.52	-3.21	10.33	32.28	34.05	29.44	17.10	3.308
15	12.97	5.80	-0.88	14.24	-3.73	1.45	0.82	4.09	-2.86	2.92	69.434
16	2.86	4.69	0.80	5.55	-2.04	15.49	0.01	15.62	12.04	9.95	3.099
17	2.08	1.26	2.08	3.20	-0.36	0.06	-0.36	0.51	-0.44	0.26	39.566
18	10.60	11.98	1.28	16.05	6.00	-2.80	0.10	6.62	1.88	6.35	40.574
19	-1.13	0.43	1.39	1.84	1.08	0.01	0.19	1.10	-0.52	0.96	3.525
20	9.40	18.28	0.25	20.56	2.00	51.71	0.00	51.75	46.90	21.87	19.321
21	-1.13	1.25	4.00	4.34	0.99	-0.56	-0.53	1.25	-0.90	0.86	21.841
22	3.10	0.81	3.32	4.62	-3.21	-0.50	-17.53	17.83	-14.85	9.86	2.159
23	-4.53	2.08	1.26	5.14	63.56	-0.36	0.06	63.56	-56.15	29.79	0.888
24	0.45	4.44	-8.07	9.23	0.00	-2.47	62.26	62.31	-55.67	27.99	3.042
25	3.33	9.00	10.03	13.88	-2.22	6.00	20.92	21.87	18.47	11.72	16.436
26	6.26	4.74	2.91	8.37	1.57	-2.49	-0.25	2.95	-0.33	2.94	23.882
27	-0.89	11.10	0.50	11.15	0.87	20.20	0.01	20.22	20.05	2.64	47.159
28	13.60	9.00	1.46	16.37	4.00	3.00	0.30	5.01	5.00	0.33	816.792
29	0.91	3.08	2.60	4.13	-0.83	0.77	6.00	6.11	4.17	4.46	3.822
30	11.10	4.12	18.28	21.78	20.20	-2.42	51.71	55.57	53.24	15.92	29.805
31	1.18	0.38	7.58	7.68	-0.55	0.00	2.53	2.59	2.41	0.94	62.550
32	-0.97	4.09	1.97	4.64	-26.55	-16.78	26.55	41.12	2.08	41.07	0.525
33	4.09	2.37	4.63	6.62	-16.78	-0.99	1.54	16.88	-9.64	13.86	3.160