

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

### Задача 2.1.

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

### Задача 2.2.

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$$\begin{aligned}x &= \frac{1}{2}\sin^2 8t - 11t, \\y &= \frac{14}{3t+4}, \\z &= 11e^{(t^2)}, \quad t_1 = 1.\end{aligned}$$

### Задача 2.3.

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$$\begin{aligned}x &= 2t^2 + 10t + 3, \\y &= 3\arcsin(t/10), \\z &= \frac{1}{2}\sin^2 6t - 10t, \quad t_1 = 0.9.\end{aligned}$$

### Задача 2.4.

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

### Задача 2.5.

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

### Задача 2.6.

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$$\begin{aligned}x &= \frac{9}{2t+3}, \\y &= 6\sqrt{3t+6}, \\z &= 7t + \frac{1}{2}\cos^2 6t, \quad t_1 = 0.5.\end{aligned}$$

### Задача 2.7.

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$$\begin{aligned}x &= 19e^{t/3}, \\y &= 8\ln(3t+2), \\z &= 19e^{t/3}, \quad t_1 = 0.8.\end{aligned}$$

### Задача 2.8.

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$$\begin{aligned}x &= 10t + \frac{1}{4}\cos^2 8t, \\y &= 9\sqrt{4t+9}, \\z &= 10t + \frac{1}{4}\cos^2 8t, \quad t_1 = 0.8.\end{aligned}$$

### Задача 2.9.

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$$\begin{aligned}x &= 21e^{t/3}, \\y &= \frac{1}{2}\sin 6t + 11t, \\z &= 4\operatorname{tg}(t/3), \quad t_1 = 1.\end{aligned}$$

### Задача 2.10.

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$$\begin{aligned}x &= 11t + \frac{1}{2}\cos^2 6t, \\y &= \frac{1}{2}\sin 6t + 10t, \\z &= 3\arcsin(t/10), \quad t_1 = 0.9.\end{aligned}$$

### Задача 2.11.

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$$\begin{aligned}x &= \frac{1}{2}\sin 8t + 10t, \\y &= \frac{1}{2}\sin^2 8t - 10t, \\z &= 5\operatorname{tg}(t/4), \quad t_1 = 0.9.\end{aligned}$$

### Задача 2.12.

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$$\begin{aligned}x &= 10e^{(t^2)}, \\y &= 3\operatorname{tg}(t/2), \\z &= 11t + \frac{1}{4}\cos^2 8t, \quad t_1 = 0.9.\end{aligned}$$

### Задача 2.13.

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$$\begin{aligned}x &= 7(t+1)^{3/10}, \\y &= \frac{1}{2}\sin 8t + 6t, \\z &= 4\arcsin(t/6), \quad t_1 = 0.5.\end{aligned}$$

### Задача 2.14.

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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 2.15.

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$$\begin{aligned}x &= t^2 + 2t + 4, \\y &= \frac{1}{2}\sin^2 4t - 2t, \\z &= 3\operatorname{tg}(t/2), \quad t_1 = 0.1.\end{aligned}$$

**Задача 2.16.**

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$$\begin{aligned}x &= 12(t+1)^{1/10}, \\y &= 2\arcsin(t/11), \\z &= 21e^{t/2}, \quad t_1 = 1.\end{aligned}$$

**Задача 2.17.**

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$$\begin{aligned}x &= 8t + \frac{1}{2}\cos^2 6t, \\y &= 17e^{t/3}, \\z &= 3\arcsin(t/7), \quad t_1 = 0.6.\end{aligned}$$

**Задача 2.18.**

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$$\begin{aligned}x &= 3t + \frac{1}{4}\cos^2 8t, \\y &= 2\sqrt{4t+2}, \\z &= 2e^{(t^2)}, \quad t_1 = 0.1.\end{aligned}$$

**Задача 2.19.**

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$$\begin{aligned}x &= 4\arcsin(t/6), \\y &= 16e^{t/4}, \\z &= 7(t+1)^{3/10}, \quad t_1 = 0.5.\end{aligned}$$

**Задача 2.20.**

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$$\begin{aligned}x &= 2t^2 + 6t + 3, \\y &= 3\arcsin(t/6), \\z &= \frac{9}{2t+3}, \quad t_1 = 0.5.\end{aligned}$$

**Задача 2.21.**

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$$\begin{aligned}x &= \frac{1}{2}\sin 8t + 6t, \\y &= 7t + \cos^2 4t, \\z &= 6e^{(t^2)}, \quad t_1 = 0.5.\end{aligned}$$

**Задача 2.22.**

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$$\begin{aligned}x &= 3\ln(2t+2), \\y &= 14e^{t/4}, \\z &= 3t^2 + 4t + 2, \quad t_1 = 0.3.\end{aligned}$$

**Задача 2.23.**

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

**Задача 2.24.**

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

**Задача 2.25.**

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$$\begin{aligned}x &= 9(t+1)^{1/5}, \\y &= 7\ln(3t+2), \\z &= 8\sqrt{3t+8}, \quad t_1 = 0.7.\end{aligned}$$

**Задача 2.26.**

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$$\begin{aligned}x &= 3\arcsin(t/7), \\y &= 8t + \frac{1}{2}\cos^2 6t, \\z &= \frac{1}{2}\sin^2 6t - 7t, \quad t_1 = 0.6.\end{aligned}$$

**Задача 2.27.**

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$$\begin{aligned}x &= \frac{1}{2}\sin^2 6t - 2t, \\y &= 2e^{(t^2)}, \\z &= 4\operatorname{tg}(t/3), \quad t_1 = 0.1.\end{aligned}$$

**Задача 2.28.**

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$$\begin{aligned}x &= \frac{1}{2}\sin 4t + 6t, \\y &= 7(t+1)^{1/10}, \\z &= 5\ln(4t+2), \quad t_1 = 0.5.\end{aligned}$$

**Задача 2.29.**

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$$\begin{aligned}x &= \frac{1}{2}\sin^2 4t - 6t, \\y &= 7t + \frac{1}{4}\cos^2 8t, \\z &= \frac{1}{2}\sin 4t + 6t, \quad t_1 = 0.5.\end{aligned}$$

**Задача 2.30.**

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$$\begin{aligned}x &= 18e^{t/2}, \\y &= \frac{11}{t+2}, \\z &= \frac{1}{2}\sin 4t + 8t, \quad t_1 = 0.7.\end{aligned}$$

**Задача 2.31.**

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$$\begin{aligned}x &= 2t^2 + 4t + 3, \\y &= 5t + \frac{1}{2}\cos^2 6t, \\z &= 14e^{t/3}, \quad t_1 = 0.3.\end{aligned}$$

**Задача 2.32.**

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$$\begin{aligned}x &= 4\arcsin(t/9), \\y &= 9e^{(t^2)}, \\z &= 10(t+1)^{3/10}, \quad t_1 = 0.8.\end{aligned}$$

**Задача 2.33.**

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$$\begin{aligned}x &= 10e^{(t^2)}, \\y &= 9\ln(3t+2), \\z &= 20e^{t/3}, \quad t_1 = 0.9.\end{aligned}$$

**Декартовы координаты. Пространственная траектория**

№	$v_x$	$v_y$	$v_z$	$v$	$a_x$	$a_y$	$a_z$	$a$	$a_\tau$	$a_n$	$R$
1	4.69	2.08	-4.53	6.85	15.49	-0.36	63.56	65.43	-31.57	57.30	0.818
2	-12.15	-0.86	59.80	61.03	-61.29	0.73	179.41	189.59	187.99	24.57	151.590
3	13.60	0.30	-12.94	18.78	4.00	0.00	-7.00	8.06	7.72	2.31	152.403
4	3.80	2.31	4.63	6.42	4.00	-2.66	1.54	5.05	2.52	4.37	9.432
5	4.14	0.80	2.86	5.10	1.04	0.01	-2.04	2.29	-0.30	2.27	11.451
6	-1.13	3.29	7.84	8.57	1.13	-0.66	-34.57	34.59	-32.00	13.13	5.598
7	8.27	5.45	8.27	12.90	2.76	-3.72	2.76	5.39	1.96	5.02	33.179
8	9.54	5.15	9.54	14.44	-31.13	-0.84	-31.13	44.03	-41.43	14.92	13.968
9	9.77	13.88	1.49	17.04	3.26	5.03	0.34	6.00	5.99	0.29	986.725
10	13.94	11.90	0.30	18.34	7.00	13.91	0.00	15.57	14.35	6.04	55.657
11	12.43	-6.14	1.32	13.93	-25.40	-16.63	0.15	30.36	-15.33	26.20	7.404
12	40.46	1.85	9.07	41.51	117.79	0.89	8.31	118.09	116.68	18.17	94.835
13	1.58	3.39	0.67	3.80	-0.74	24.22	0.01	24.23	21.29	11.56	1.246
14	2.86	4.69	0.80	5.55	-2.04	15.49	0.01	15.62	12.04	9.95	3.099
15	2.20	-0.57	1.50	2.72	2.00	11.15	0.08	11.33	-0.66	11.31	0.656
16	0.64	0.18	17.31	17.32	-0.29	0.00	8.66	8.66	8.64	0.62	486.432
17	5.62	6.92	0.43	8.93	-21.90	2.31	0.01	22.02	-12.00	18.47	4.314
18	1.00	2.58	0.40	2.80	0.93	-2.15	4.12	4.74	-1.06	4.62	1.694
19	0.67	4.53	1.58	4.85	0.01	1.13	-0.74	1.35	0.82	1.08	21.853
20	8.00	0.50	-1.13	8.09	4.00	0.01	1.13	4.16	3.80	1.69	38.845
21	3.39	10.03	7.70	13.09	24.22	20.92	23.11	39.47	35.89	16.44	10.423
22	2.31	3.77	5.80	7.29	-1.78	0.94	6.00	6.33	4.70	4.24	12.548
23	0.60	2.79	0.60	2.91	0.01	-12.16	0.01	12.16	-11.62	3.56	2.384
24	1.01	-0.89	0.80	1.56	1.87	1.02	0.01	2.13	0.63	2.04	1.201
25	1.18	5.12	3.78	6.47	-0.55	-3.75	-0.56	3.83	-3.39	1.77	23.611
26	0.43	5.62	-4.62	7.29	0.01	-21.90	21.90	30.97	-30.77	3.52	15.080
27	0.80	0.40	1.33	1.61	13.04	4.12	0.03	13.68	7.53	11.42	0.226
28	5.17	0.49	5.00	7.21	-7.27	-0.29	-5.00	8.83	-8.70	1.49	34.755
29	-7.51	5.02	5.17	10.41	-10.46	4.66	-7.27	13.56	6.18	12.07	8.977
30	12.77	-1.51	6.12	14.24	6.39	1.12	-2.68	7.01	4.46	5.42	37.440
31	5.20	6.33	5.16	9.68	4.00	32.28	1.72	32.58	24.17	21.84	4.289
32	0.45	27.31	1.99	27.39	0.00	77.83	-0.77	77.84	77.56	6.54	114.593
33	40.46	5.74	9.00	41.85	117.79	-3.67	3.00	117.89	114.03	29.89	58.593