

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.

9

$$\begin{aligned}x &= \frac{1}{2} \sin^2 8t - 7t, \\y &= \frac{1}{2} \sin 8t + 7t, \\z &= 8t + \cos^2 4t, \quad t_1 = 0.6.\end{aligned}$$

Задача 2.2.

9

$$\begin{aligned}x &= \frac{1}{2} \sin 6t + 11t, \\y &= 12(t + 1)^{1/5}, \\z &= 11e^{(t^2)}, \quad t_1 = 1.\end{aligned}$$

Задача 2.3.

9

$$\begin{aligned}x &= 4\operatorname{tg}(t/3), \\y &= 7(t + 1)^{1/5}, \\z &= 7t + \frac{1}{2} \cos^2 6t, \quad t_1 = 0.5.\end{aligned}$$

Задача 2.4.

9

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

Задача 2.5.

9

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

Задача 2.6.

9

$$\begin{aligned}x &= \frac{7}{3t + 4}, \\y &= 3t^2 + 4t + 2, \\z &= 4\arcsin(t/4), \quad t_1 = 0.3.\end{aligned}$$

Задача 2.7.

9

$$\begin{aligned}x &= 13e^{t/4}, \\y &= 5\operatorname{tg}(t/4), \\z &= 2 \ln(2t + 2), \quad t_1 = 0.2.\end{aligned}$$

Задача 2.8.

9

$$\begin{aligned}x &= 5\operatorname{tg}(t/4), \\y &= 19e^{t/4}, \\z &= 10(t + 1)^{3/10}, \quad t_1 = 0.8.\end{aligned}$$

Задача 2.9.

9

$$\begin{aligned}x &= 4\operatorname{tg}(t/3), \\y &= 5 \ln(3t + 2), \\z &= 16e^{t/3}, \quad t_1 = 0.5.\end{aligned}$$

Задача 2.10.

9

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

Задача 2.11.

9

$$\begin{aligned}x &= \frac{13}{2t + 3}, \\y &= \frac{1}{2} \sin^2 6t - 10t, \\z &= 9 \ln(3t + 2), \quad t_1 = 0.9.\end{aligned}$$

Задача 2.12.

9

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

Задача 2.13.

9

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

Задача 2.14.

9

$$\begin{aligned}x &= 13e^{t/3}, \\y &= 4\operatorname{tg}(t/3), \\z &= \frac{1}{2} \sin 6t + 3t, \quad t_1 = 0.2.\end{aligned}$$

Задача 2.15.

9

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

Задача 2.16.

9

$$\begin{aligned}x &= \frac{1}{2} \sin^2 8t - 8t, \\y &= 18e^{t/4}, \\z &= 9(t+1)^{3/10}, \quad t_1 = 0.7.\end{aligned}$$

Задача 2.17.

9

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

Задача 2.18.

9

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

Задача 2.19.

9

$$\begin{aligned}x &= 5\operatorname{tg}(t/4), \\y &= \frac{11}{3t+4}, \\z &= \frac{1}{2} \sin^2 8t - 8t, \quad t_1 = 0.7.\end{aligned}$$

Задача 2.20.

9

$$\begin{aligned}x &= 3\arcsin(t/3), \\y &= 4\operatorname{tg}(t/3), \\z &= \frac{1}{2} \sin^2 6t - 3t, \quad t_1 = 0.2.\end{aligned}$$

Задача 2.21.

9

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

Задача 2.22.

9

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

Задача 2.23.

9

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

Задача 2.24.

9

$$\begin{aligned}x &= \frac{8}{2t+3}, \\y &= 4 \ln(3t+2), \\z &= 4\operatorname{tg}(t/3), \quad t_1 = 0.4.\end{aligned}$$

Задача 2.25.

9

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

Задача 2.26.

9

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

Задача 2.27.

9

$$\begin{aligned}x &= 9\sqrt{3t+9}, \\y &= 2t^2 + 9t + 3, \\z &= 4\operatorname{tg}(t/3), \quad t_1 = 0.8.\end{aligned}$$

Задача 2.28.

9

$$\begin{aligned}x &= 3(t+1)^{1/5}, \\y &= \ln(3t+2), \\z &= \frac{5}{2t+3}, \quad t_1 = 0.1.\end{aligned}$$

Задача 2.29.

9

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

Задача 2.30.

9

$$\begin{aligned}x &= 6(t+1)^{1/10}, \\y &= \frac{8}{t+2}, \\z &= 5\sqrt{4t+5}, \quad t_1 = 0.4.\end{aligned}$$

Задача 2.31.

9

$$\begin{aligned}x &= 3t^2 + 10t + 2, \\y &= 5\operatorname{tg}(t/4), \\z &= 20e^{t/4}, \quad t_1 = 0.9.\end{aligned}$$

Задача 2.32.

9

$$\begin{aligned}x &= 7(t+1)^{1/5}, \\y &= \frac{9}{2t+3}, \\z &= 3\arcsin(t/6), \quad t_1 = 0.5.\end{aligned}$$

Задача 2.33.

9

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

Декартовы координаты. Пространственная траектория

№	v_x	v_y	v_z	v	a_x	a_y	a_z	a	a_τ	a_n	R
1	-7.70	7.35	11.98	16.03	-63.02	31.88	-2.80	70.68	42.79	56.26	4.567
2	13.88	1.38	59.80	61.41	5.03	-0.55	179.41	179.48	175.84	35.95	104.902
3	1.37	1.01	7.84	8.02	0.15	-0.54	-34.57	34.57	-33.82	7.17	8.973
4	6.60	8.99	2.79	11.49	4.00	-3.15	-12.16	13.18	-3.12	12.81	10.316
5	40.46	9.00	1.46	41.48	117.79	3.00	0.30	117.83	115.57	22.96	74.939
6	-0.87	5.80	1.00	5.95	1.07	6.00	0.02	6.09	5.69	2.17	16.286
7	3.42	1.25	1.67	4.00	0.85	0.03	-1.39	1.63	0.16	1.62	9.872
8	1.30	5.80	1.99	6.27	0.13	1.45	-0.77	1.65	1.12	1.21	32.590
9	1.37	4.29	6.30	7.74	0.15	-3.67	2.10	4.23	-0.30	4.22	14.192
10	40.46	5.74	9.00	41.85	117.79	-3.67	3.00	117.89	114.03	29.89	58.593
11	-1.13	-12.94	5.74	14.21	0.94	-7.00	-3.67	7.95	4.82	6.33	31.877
12	5.00	4.24	-7.51	9.97	-5.00	-1.06	-10.46	11.64	4.92	10.55	9.428
13	0.40	40.46	2.11	40.52	0.00	117.79	-0.78	117.79	117.59	6.99	234.763
14	4.63	1.34	4.09	6.32	1.54	0.06	-16.78	16.85	-9.70	13.77	2.901
15	0.34	4.39	7.18	8.43	-0.25	-5.74	3.59	6.77	0.06	6.77	10.483
16	-11.92	5.36	1.86	13.20	12.99	1.34	-0.77	13.08	-11.29	6.61	26.375
17	-9.02	1.95	5.68	10.84	-2.33	1.06	-0.76	2.67	1.73	2.03	57.826
18	0.30	4.21	40.46	40.68	0.00	-0.50	117.79	117.79	117.10	12.71	130.200
19	1.29	-0.89	-11.92	12.02	0.11	0.87	12.99	13.02	-12.93	1.51	95.488
20	1.00	1.34	-0.97	1.94	0.02	0.06	-26.55	26.55	13.41	22.91	0.163
21	5.20	2.71	6.33	8.63	4.00	-0.83	32.28	32.54	25.83	19.79	3.760
22	-4.53	1.26	-0.89	4.79	63.56	0.06	1.02	63.57	-60.35	19.99	1.147
23	-0.97	1.25	4.09	4.38	-26.55	6.74	-16.78	32.12	-7.83	31.15	0.617
24	-1.11	3.75	1.36	4.14	1.17	-3.52	0.12	3.71	-3.46	1.33	12.840
25	0.34	4.39	7.18	8.43	-0.25	-5.74	3.59	6.77	0.06	6.77	10.483
26	5.20	0.75	1.35	5.42	4.00	0.01	0.09	4.00	3.86	1.06	27.859
27	4.00	12.20	1.43	12.92	-0.53	4.00	0.26	4.04	3.64	1.75	95.272
28	0.56	1.30	-0.98	1.72	-0.40	-1.70	1.22	2.13	-2.11	0.30	9.999
29	-0.89	-11.92	11.10	16.31	0.87	12.99	20.20	24.03	4.21	23.66	11.244
30	0.44	-1.39	3.89	4.16	-0.28	1.16	-1.18	1.68	-1.52	0.70	24.521
31	15.40	1.32	6.26	16.68	6.00	0.15	1.57	6.20	6.14	0.88	317.349
32	1.01	-1.13	0.50	1.59	-0.54	1.13	0.01	1.25	-1.13	0.52	4.889
33	2.71	1.35	3.10	4.33	-0.83	0.09	-3.21	3.32	-2.79	1.80	10.466