

Естественные координаты

Точка движется по плоской кривой $y = y(x)$ с постоянной скоростью v . Определить ускорение точки, радиус кривизны траектории и косинус угла наклона касательной к траектории с осью ox при заданном значении x .

Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова.– М.:ФИЗМАТЛИТ, 2002.– 384 с. (с.140.)

Задача 3.1.

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$$y = 2 \sin^2 \frac{x}{3} + \cos \frac{x}{3},$$
$$v = 16 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.2.

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$$y = \frac{4x^3 + 4x^2 + 1}{112},$$
$$v = 5 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.3.

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$$y = 3 \sin^2 \frac{x}{3} + \cos \frac{x}{3},$$
$$v = 9 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.4.

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$$y = 3x - 3 \arctan \frac{x}{5},$$
$$v = 2 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.5.

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$$y = \frac{x(2 + \sin(x/4))}{3},$$
$$v = 7 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.6.

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$$y = 2x - 4 \arctan \frac{x}{3},$$
$$v = 2 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.7.

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$$y = \left(\frac{x}{6}\right)^5 + \frac{48}{x},$$
$$v = 3 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.8.

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$$y = \frac{x^2}{4} + 5 \sin \frac{x}{8},$$
$$v = 5 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.9.

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$$y = \frac{7x^3 + 4x^2 + 1}{106},$$
$$v = 5 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.10.

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$$y = \frac{x}{1} e^{(x+1)/3},$$
$$v = 4 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.11.

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$$y = \cos \frac{x}{8} + 3 \sin \frac{x}{8},$$
$$v = 18 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.12.

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$$y = \frac{5x^3 + 3x^2 + 1}{264},$$
$$v = 7 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.13.

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$$y = 5 \sin^2(x/2) + 3x,$$
$$v = 3 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.14.

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$$y = -4 \cos^2 \frac{x}{2} + \frac{3}{x},$$
$$v = 1 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.15.

10

$$y = -5 \cos^2 \frac{x}{3} + \frac{3}{x},$$
$$v = 3 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.16.

10

$$y = 3 \sin^2 \frac{x}{2} + \cos \frac{x}{2},$$
$$v = 4 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.17.

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$$y = -2x^2 + 22x + 3,$$
$$v = 1 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.18.

10

$$y = 2 \sin^2 \frac{x}{3} + \cos \frac{x}{3},$$
$$v = 5 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.19.

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$$y = x(\sqrt{x+1} + 4)/6,$$
$$v = 13 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.20.

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$$y = \frac{x^2}{3} + 4 \sin \frac{x}{8},$$
$$v = 5 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.21.

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$$y = \frac{x}{222} (e^{x+1} + 4),$$
$$v = 2 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.22.

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$$y = 3 \cos \frac{x}{5} + \frac{x^2}{5},$$
$$v = 5 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.23.

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$$y = \frac{31}{\sin(x/4) + 2},$$
$$v = 3 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.24.

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$$y = 23 \frac{x}{x+2},$$
$$v = 4 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.25.

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$$y = -4 \cos^2 \frac{x}{3} + \frac{3}{x},$$
$$v = 4 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.26.

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$$y = \cos \frac{x}{16} + 8 \sin \frac{x}{16},$$
$$v = 27 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.27.

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$$y = \frac{4x^3 + 4x^2 + 1}{170},$$
$$v = 6 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.28.

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$$y = \frac{x(4 + \sin^2(4x))}{6},$$
$$v = 2 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.29.

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$$y = 3e^{x/8} - 3x,$$
$$v = 11 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.30.

10

$$y = 5 \cos^2 \frac{x}{2} + 4x,$$
$$v = 2 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.31.

10

$$y = 4x - 3 \arctan \frac{x}{5},$$
$$v = 2 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.32.

10

$$y = \frac{1}{5} (e^{x/3} + 3e^{-x/3}),$$
$$v = 5 \text{ м/с}, x = 8 \text{ м.}$$

Задача 3.33.

10

$$y = -2 \cos^2 \frac{x}{2} + \frac{2}{x},$$
$$v = 4 \text{ м/с}, x = 2 \text{ м.}$$

Естественные координаты

	y'	y''	v_x	v_y	$\cos(\alpha)$	a_x	a_y	a	R
1	0.442	0.017	14.635	6.466	0.915	-1.364	3.088	3.375	75.841
2	2.000	0.929	2.236	4.472	0.447	-1.857	0.929	2.076	12.040
3	0.766	0.070	7.145	5.472	0.794	-1.713	2.237	2.817	28.750
4	2.634	0.071	0.710	1.870	0.355	-0.012	0.005	0.013	313.338
5	1.035	-0.113	4.865	5.033	0.695	1.335	-1.291	1.857	26.385
6	1.520	0.154	1.099	1.671	0.550	-0.085	0.056	0.102	39.213
7	-1.518	1.090	1.650	-2.505	0.550	1.363	0.898	1.632	5.514
8	2.082	0.471	2.165	4.507	0.433	-0.863	0.414	0.957	26.126
9	2.009	1.264	2.228	4.476	0.446	-2.502	1.245	2.795	8.945
10	4.530	2.416	0.862	3.906	0.216	-0.378	0.083	0.387	41.331
11	0.303	-0.032	17.226	5.222	0.957	2.612	-8.617	9.004	35.984
12	1.000	0.477	4.950	4.950	0.707	-5.847	5.847	8.268	5.926
13	1.108	-1.634	2.010	2.227	0.670	3.284	-2.964	4.423	2.035
14	-1.317	7.081	0.605	-0.796	0.605	1.247	0.947	1.566	0.639
15	1.182	-0.240	1.937	2.290	0.646	0.445	-0.376	0.582	15.457
16	1.022	0.591	2.797	2.860	0.699	-2.311	2.260	3.233	4.950
17	2.000	-4.000	0.447	0.894	0.447	0.320	-0.160	0.358	2.795
18	-0.808	-0.244	3.890	-3.142	0.778	-1.807	-2.237	2.875	8.695
19	0.961	0.103	9.372	9.009	0.721	-4.525	4.707	6.530	25.882
20	1.163	0.659	3.260	3.791	0.652	-3.462	2.978	4.566	5.475
21	1.002	1.230	1.413	1.415	0.706	-1.228	1.225	1.734	2.306
22	0.861	0.301	3.789	3.263	0.758	-2.136	2.480	3.273	7.637
23	-0.789	0.291	2.356	-1.858	0.785	0.786	0.997	1.269	7.092
24	1.278	-0.426	2.465	3.150	0.616	1.256	-0.983	1.595	10.029
25	0.879	-0.148	3.004	2.641	0.751	0.661	-0.752	1.001	15.982
26	0.457	-0.013	24.561	11.214	0.910	3.037	-6.651	7.312	99.700
27	2.000	0.753	2.683	5.367	0.447	-2.168	1.084	2.424	14.849
28	2.151	18.532	0.843	1.814	0.422	-5.036	2.341	5.554	0.720
29	-2.299	0.088	4.387	-10.087	0.399	0.616	0.268	0.672	180.019
30	1.896	-1.351	0.933	1.769	0.466	0.485	-0.256	0.548	7.295
31	3.423	0.044	0.561	1.920	0.280	-0.004	0.001	0.004	1021.941
32	0.946	0.324	3.633	3.435	0.727	-2.138	2.261	3.112	8.034
33	0.409	0.084	3.702	1.515	0.925	-0.403	0.984	1.064	15.045