

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.

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

Задача 3.2.

$$y = 15 \ln(x/3 + 1),$$
$$v = 4 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.3.

$$y = x(\sqrt{x+1} + 5)/7,$$
$$v = 16 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.4.

$$y = 4x \cos \frac{x+1}{9},$$
$$v = 2 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.5.

$$y = \frac{x(5 + \cos(x/3))}{4},$$
$$v = 6 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.6.

$$y = \frac{16}{\sin(x/2) + 2},$$
$$v = 2 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.7.

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

Задача 3.8.

$$y = \frac{x(4 + \sin(x/3))}{5},$$
$$v = 7 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.9.

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

Задача 3.10.

$$y = \frac{x}{90} e^{(x+4)/2},$$
$$v = 4 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.11.

$$y = \frac{1}{45} (e^{x/2} + 5e^{-x/2}),$$
$$v = 4 \text{ м/с}, x = 9 \text{ м.}$$

Задача 3.12.

$$y = \frac{7x^3 + 4x^2 + 1}{14},$$
$$v = 3 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.13.

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

Задача 3.14.

$$y = \frac{6x^3 + 4x^2 + 1}{160},$$
$$v = 5 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.15.

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

Задача 3.16.

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

Задача 3.17.

$$y = 20 \ln(x/2 + 1),$$
$$v = 3 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.18.

$$y = \frac{6x^3 + 3x^2 + 1}{684},$$
$$v = 8 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.19.

9

$$y = 2e^{x/8} - 2x,$$
$$v = 14 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.20.

9

$$y = \frac{11}{x+2},$$
$$v = 6 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.21.

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$$y = x(\sqrt{x+2} + 7)/5,$$
$$v = 18 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.22.

9

$$y = \frac{1}{9} (e^{x/3} + 3e^{-x/3}),$$
$$v = 4 \text{ м/с}, x = 10 \text{ м.}$$

Задача 3.23.

9

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

Задача 3.24.

9

$$y = \frac{x(4 + \sin(x/3))}{5},$$
$$v = 17 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.25.

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$$y = \cos \frac{x}{14} + 8 \sin \frac{x}{14},$$
$$v = 27 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.26.

9

$$y = 3x \cos \frac{x+3}{7},$$
$$v = 2 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.27.

9

$$y = x(\sqrt{x+1} + 6)/8,$$
$$v = 15 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.28.

9

$$y = 2e^{x/4} - 3x,$$
$$v = 7 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.29.

9

$$y = \frac{17}{x+2},$$
$$v = 7 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.30.

9

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

Задача 3.31.

9

$$y = \frac{x(7 + \cos(x/4))}{6},$$
$$v = 8 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.32.

9

$$y = x \sin \frac{x+1}{10},$$
$$v = 7 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.33.

9

$$y = -2x^2 + 14x + 3,$$
$$v = 1 \text{ м/с}, x = 3 \text{ м.}$$

Естественные координаты

	y'	y''	v_x	v_y	$\cos(\alpha)$	a_x	a_y	a	R
1	-0.769	2.648	1.585	-1.219	0.793	3.216	4.182	5.275	0.758
2	3.000	-0.600	1.265	3.795	0.316	0.288	-0.096	0.304	52.705
3	1.044	0.069	11.066	11.556	0.692	-4.205	4.027	5.822	43.971
4	0.979	-0.835	1.429	1.399	0.715	0.853	-0.871	1.219	3.281
5	0.985	-0.188	4.275	4.210	0.712	1.719	-1.745	2.450	14.696
6	0.949	0.647	1.451	1.377	0.725	-0.680	0.716	0.988	4.050
7	4.364	-0.624	0.893	3.899	0.223	0.108	-0.025	0.111	143.761
8	0.928	0.119	5.130	4.763	0.733	-1.558	1.678	2.290	21.401
9	2.338	-31.797	0.787	1.839	0.393	7.113	-3.043	7.737	0.517
10	3.501	2.250	1.099	3.846	0.275	-0.717	0.205	0.746	21.443
11	1.000	0.500	2.829	2.828	0.707	-2.002	2.003	2.833	5.649
12	2.071	3.571	1.304	2.702	0.435	-2.379	1.148	2.641	3.408
13	1.543	0.593	1.088	1.678	0.544	-0.320	0.208	0.382	10.481
14	2.000	0.950	2.236	4.472	0.447	-1.900	0.950	2.124	11.769
15	1.082	-0.203	3.394	3.672	0.679	1.168	-1.080	1.591	15.712
16	0.758	-0.295	2.391	1.812	0.797	0.811	-1.070	1.342	6.705
17	4.000	-0.800	0.728	2.910	0.243	0.100	-0.025	0.103	87.616
18	1.000	0.325	5.657	5.657	0.707	-5.193	5.193	7.344	8.715
19	-1.588	0.052	7.461	-11.846	0.533	1.293	0.814	1.528	128.243
20	-0.688	0.344	4.944	-3.399	0.824	3.923	5.706	6.925	5.199
21	2.178	0.057	7.511	16.358	0.417	-1.229	0.564	1.353	239.545
22	1.034	0.347	2.780	2.876	0.695	-1.342	1.298	1.867	8.571
23	1.076	0.037	4.084	4.396	0.681	-0.308	0.286	0.420	85.632
24	1.076	0.016	11.571	12.454	0.681	-1.064	0.989	1.453	198.926
25	0.543	-0.014	23.726	12.887	0.879	3.226	-5.940	6.759	107.849
26	0.992	-0.768	1.420	1.408	0.710	0.774	-0.781	1.100	3.637
27	0.971	0.077	10.762	10.449	0.717	-4.477	4.610	6.426	35.013
28	-1.941	0.265	3.205	-6.223	0.458	1.107	0.570	1.245	39.361
29	-0.680	0.272	5.788	-3.936	0.827	4.238	6.232	7.536	6.502
30	-1.790	16.738	0.976	-1.746	0.488	6.785	3.791	7.772	0.515
31	0.929	-0.088	5.861	5.445	0.733	1.500	-1.614	2.203	29.050
32	1.103	0.114	4.701	5.186	0.672	-1.257	1.140	1.697	28.874
33	2.000	-4.000	0.447	0.894	0.447	0.320	-0.160	0.358	2.795