

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.

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

Задача 3.2.

$$y = \frac{1}{27} (e^{x/2} + 3e^{-x/2}),$$
$$v = 4 \text{ м/с}, x = 8 \text{ м.}$$

Задача 3.3.

$$y = \frac{x}{221} (e^{x+1} + 3),$$
$$v = 2 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.4.

$$y = 2e^{x/8} - 2x,$$
$$v = 13 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.5.

$$y = 16 \ln(x/2 + 1),$$
$$v = 5 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.6.

$$y = \frac{x(5 + \sin(x/4))}{6},$$
$$v = 9 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.7.

$$y = \frac{x}{2020} (e^{x+2} + 3),$$
$$v = 2 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.8.

$$y = \frac{x^2}{6} + 5 \sin \frac{x}{10},$$
$$v = 6 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.9.

$$y = \frac{25}{x+2},$$
$$v = 7 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.10.

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

Задача 3.11.

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

Задача 3.12.

$$y = \frac{32}{\sin(x/2) + 3},$$
$$v = 2 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.13.

$$y = 32 \ln(x/2 + 1),$$
$$v = 4 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.14.

$$y = \frac{x^2}{7} + 12 \sin \frac{x}{14},$$
$$v = 7 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.15.

$$y = \cos \frac{x}{14} + 9 \sin \frac{x}{14},$$
$$v = 20 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.16.

$$y = \frac{x^2}{4} + \sin \frac{x}{10},$$
$$v = 5 \text{ м/с}, x = 2 \text{ м.}$$

Задача 3.17.

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

Задача 3.18.

$$y = 2e^{x/9} - 2x,$$
$$v = 15 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.19.

7

$$y = \frac{22}{\sin(x/2) + 3},$$
$$v = 3 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.20.

7

$$y = \frac{x(3 + \sin(x/3))}{4},$$
$$v = 9 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.21.

7

$$y = 2e^{x/8} - 3x,$$
$$v = 13 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.22.

7

$$y = \frac{71}{\sin(x/5) + 3},$$
$$v = 3 \text{ м/с}, x = 4 \text{ м.}$$

Задача 3.23.

7

$$y = \frac{x(6 + \cos(x/3))}{7},$$
$$v = 10 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.24.

7

$$y = \frac{x^2}{3} + 4 \sin \frac{x}{10},$$
$$v = 5 \text{ м/с}, x = 1 \text{ м.}$$

Задача 3.25.

7

$$y = \frac{x}{596} (e^{x+2} + 2),$$
$$v = 2 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.26.

7

$$y = \left(\frac{x}{8}\right)^4 + \frac{62}{x},$$
$$v = 3 \text{ м/с}, x = 6 \text{ м.}$$

Задача 3.27.

7

$$y = \cos \frac{x}{8} + \frac{x^2}{6},$$
$$v = 5 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.28.

7

$$y = \frac{1}{27} (e^{x/2} + 5e^{-x/2}),$$
$$v = 4 \text{ м/с}, x = 8 \text{ м.}$$

Задача 3.29.

7

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

Задача 3.30.

7

$$y = \frac{28}{\sin(x/2) + 3},$$
$$v = 2 \text{ м/с}, x = 5 \text{ м.}$$

Задача 3.31.

7

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

Задача 3.32.

7

$$y = 3\sqrt{4x+3},$$
$$v = 8 \text{ м/с}, x = 3 \text{ м.}$$

Задача 3.33.

7

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

Естественные координаты

	y'	y''	v_x	v_y	$\cos(\alpha)$	a_x	a_y	a	R
1	1.398	-0.967	1.745	2.440	0.582	1.395	-0.998	1.715	5.248
2	1.010	0.506	2.814	2.843	0.704	-2.004	1.984	2.820	5.674
3	1.002	1.235	1.413	1.415	0.706	-1.233	1.231	1.742	2.296
4	-1.533	0.058	7.103	-10.888	0.546	1.348	0.879	1.609	105.018
5	2.000	-0.250	2.236	4.472	0.447	0.500	-0.250	0.559	44.721
6	0.986	0.063	6.407	6.320	0.712	-1.296	1.314	1.846	43.887
7	1.000	1.198	1.414	1.414	0.707	-1.198	1.198	1.694	2.361
8	1.794	0.314	2.921	5.241	0.487	-1.139	0.635	1.304	27.600
9	-0.694	0.231	5.750	-3.993	0.821	3.585	5.163	6.285	7.796
10	1.060	-0.666	1.373	1.454	0.686	0.626	-0.591	0.861	4.645
11	3.000	-0.600	1.265	3.795	0.316	0.288	-0.096	0.304	52.705
12	-0.586	0.539	1.726	-1.011	0.863	0.700	1.194	1.384	2.890
13	4.000	-0.500	0.970	3.881	0.243	0.111	-0.028	0.114	140.186
14	2.494	0.260	2.605	6.497	0.372	-0.610	0.245	0.657	74.532
15	0.555	-0.024	17.487	9.706	0.874	3.078	-5.546	6.343	63.063
16	1.098	0.498	3.367	3.697	0.673	-2.810	2.559	3.801	6.577
17	1.727	1.040	1.002	1.731	0.501	-0.453	0.262	0.524	7.637
18	-1.613	0.043	7.905	-12.748	0.527	1.204	0.747	1.417	158.771
19	1.104	0.427	2.014	2.223	0.671	-0.861	0.780	1.162	7.746
20	1.071	-0.069	6.141	6.579	0.682	1.294	-1.208	1.770	45.763
21	-2.471	0.066	4.877	-12.050	0.375	0.547	0.222	0.590	286.246
22	-0.716	0.201	2.439	-1.746	0.813	0.566	0.791	0.973	9.250
23	0.977	-0.046	7.154	6.987	0.715	1.181	-1.209	1.690	59.156
24	1.065	0.663	3.423	3.644	0.685	-3.875	3.640	5.316	4.703
25	0.999	1.245	1.415	1.414	0.707	-1.246	1.247	1.762	2.270
26	-1.511	0.680	1.655	-2.502	0.552	0.857	0.567	1.028	8.758
27	0.954	0.319	3.617	3.452	0.723	-2.083	2.183	3.018	8.284
28	1.009	0.506	2.815	2.842	0.704	-2.007	1.988	2.825	5.665
29	0.889	-0.593	2.990	2.657	0.747	2.630	-2.959	3.959	4.042
30	0.866	0.516	1.512	1.309	0.756	-0.584	0.674	0.892	4.484
31	4.231	0.059	0.460	1.946	0.230	-0.003	0.001	0.003	1388.542
32	1.549	-0.207	4.339	6.721	0.542	1.772	-1.144	2.109	30.351
33	2.909	-0.277	1.625	4.728	0.325	0.225	-0.077	0.238	104.944