

## 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.

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

### Задача 3.2.

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

### Задача 3.3.

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

### Задача 3.4.

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

### Задача 3.5.

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

### Задача 3.6.

$$y = \left(\frac{x}{3}\right)^5 + \frac{2}{x},$$
$$v = 2 \text{ м/с}, x = 1 \text{ м.}$$

### Задача 3.7.

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

### Задача 3.8.

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

### Задача 3.9.

$$y = \frac{34}{x+2},$$
$$v = 8 \text{ м/с}, x = 5 \text{ м.}$$

### Задача 3.10.

$$y = \frac{7x^3 + 4x^2 + 1}{50},$$
$$v = 4 \text{ м/с}, x = 2 \text{ м.}$$

### Задача 3.11.

$$y = \frac{32}{x+2},$$
$$v = 5 \text{ м/с}, x = 3 \text{ м.}$$

### Задача 3.12.

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

### Задача 3.13.

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

### Задача 3.14.

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

### Задача 3.15.

$$y = 2e^{x/10} - 2x,$$
$$v = 17 \text{ м/с}, x = 6 \text{ м.}$$

### Задача 3.16.

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

### Задача 3.17.

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

### Задача 3.18.

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

**Задача 3.19.**

4

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

**Задача 3.20.**

4

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

**Задача 3.21.**

4

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

**Задача 3.22.**

4

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

**Задача 3.23.**

4

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

**Задача 3.24.**

4

$$y = \frac{7x^3 + 3x^2 + 1}{555},$$
$$v = 7 \text{ м/с}, x = 5 \text{ м.}$$

**Задача 3.25.**

4

$$y = \frac{40}{x+3},$$
$$v = 6 \text{ м/с}, x = 3 \text{ м.}$$

**Задача 3.26.**

4

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

**Задача 3.27.**

4

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

**Задача 3.28.**

4

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

**Задача 3.29.**

4

$$y = 3\sqrt{3x+2},$$
$$v = 9 \text{ м/с}, x = 4 \text{ м.}$$

**Задача 3.30.**

4

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

**Задача 3.31.**

4

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

**Задача 3.32.**

4

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

**Задача 3.33.**

4

$$y = 1x - 3 \arctan \frac{x}{3},$$
$$v = 2 \text{ м/с}, x = 6 \text{ м.}$$

**Естественные координаты**

	$y'$	$y''$	$v_x$	$v_y$	$\cos(\alpha)$	$a_x$	$a_y$	$a$	$R$
1	0.943	-0.759	2.182	2.058	0.727	1.805	-1.914	2.631	3.421
2	1.049	0.042	4.141	4.342	0.690	-0.357	0.340	0.493	73.017
3	0.303	0.244	4.785	1.451	0.957	-1.553	5.122	5.352	4.671
4	1.028	0.077	5.577	5.736	0.697	-1.202	1.168	1.676	38.185
5	1.036	0.097	4.863	5.035	0.695	-1.142	1.102	1.587	30.876
6	-1.979	4.082	0.902	-1.785	0.451	1.336	0.675	1.497	2.672
7	4.261	0.726	0.457	1.947	0.228	-0.034	0.008	0.035	115.468
8	1.173	-0.648	1.298	1.522	0.649	0.539	-0.460	0.709	5.645
9	-0.694	0.198	6.573	-4.561	0.822	4.011	5.781	7.037	9.095
10	2.000	1.840	1.789	3.578	0.447	-2.355	1.178	2.633	6.076
11	-1.280	0.512	3.078	-3.940	0.616	2.354	1.839	2.987	8.370
12	-0.795	15.576	1.566	-1.244	0.783	18.602	23.413	29.903	0.134
13	1.106	-0.630	1.341	1.484	0.671	0.563	-0.509	0.759	5.269
14	0.409	0.084	3.702	1.515	0.925	-0.403	0.984	1.064	15.045
15	-1.636	0.036	8.868	-14.504	0.522	1.275	0.780	1.495	193.330
16	0.457	-0.013	24.561	11.214	0.910	3.037	-6.651	7.312	99.700
17	3.512	0.095	0.548	1.924	0.274	-0.008	0.002	0.008	511.638
18	-0.680	0.272	5.788	-3.936	0.827	4.238	6.232	7.536	6.502
19	0.953	-0.543	1.448	1.380	0.724	0.568	-0.596	0.824	4.855
20	1.313	-0.656	1.818	2.386	0.606	1.046	-0.797	1.315	6.846
21	0.750	-0.375	3.200	2.400	0.800	1.843	-2.458	3.072	5.208
22	4.683	1.081	0.626	2.934	0.209	-0.087	0.018	0.089	101.610
23	1.095	0.015	11.461	12.555	0.674	-0.978	0.892	1.324	218.329
24	1.000	0.389	4.950	4.950	0.707	-4.768	4.768	6.742	7.267
25	-1.111	0.370	4.014	-4.460	0.669	2.967	2.670	3.992	9.019
26	-1.702	0.433	3.040	-5.173	0.507	1.747	1.027	2.027	17.761
27	-2.557	0.773	0.728	-1.863	0.364	0.139	0.054	0.149	26.778
28	2.610	-0.791	1.073	2.801	0.358	0.304	-0.117	0.326	27.613
29	1.203	-0.129	5.754	6.920	0.639	2.097	-1.744	2.728	29.695
30	0.895	0.285	3.726	3.334	0.745	-1.966	2.197	2.948	8.479
31	2.400	0.120	0.769	1.846	0.385	-0.025	0.011	0.027	146.467
32	3.624	2.114	1.064	3.856	0.266	-0.614	0.169	0.636	25.139
33	0.800	0.053	1.562	1.249	0.781	-0.063	0.079	0.102	39.379