

Полярные координаты

Задан закон движения точки в полярных координатах: $\rho = \rho(t)$ (в метрах), $\varphi = \varphi(t)$. В указанный момент времени найти скорость и ускорение точки в полярных, декартовых и естественных координатах.

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Задача 4.1.

9

$$r = 27/(1 + \frac{5}{4}t),$$
$$\varphi = \arccos(t/4), \quad t = 3 \text{ с.}$$

Задача 4.2.

9

$$r = \frac{5}{3}t - \frac{30}{t},$$
$$\varphi = \arccos(t/6), \quad t = 2 \text{ с.}$$

Задача 4.3.

9

$$r = 80/t + 10,$$
$$\varphi = \arccos(t/10), \quad t = 8 \text{ с.}$$

Задача 4.4.

9

$$r = \frac{24}{1+5 \cos(t/7)},$$
$$\varphi = \frac{t}{7}, \quad t = 6 \text{ с.}$$

Задача 4.5.

9

$$r = 27/(1 + 4t/45),$$
$$\varphi = \arccos(t/9), \quad t = 5 \text{ с.}$$

Задача 4.6.

9

$$r = 8e^{t/18},$$
$$\varphi = t/2, \quad t = 7 \text{ с.}$$

Задача 4.7.

9

$$r = 9e^{t/6},$$
$$\varphi = e^{t/6}, \quad t = 1 \text{ с.}$$

Задача 4.8.

9

$$r = 28/(1 + \frac{5}{4}t),$$
$$\varphi = \arccos(t/4), \quad t = 3 \text{ с.}$$

Задача 4.9.

9

$$r = 20/t + 5,$$
$$\varphi = \arccos(t/5), \quad t = 2 \text{ с.}$$

Задача 4.10.

9

$$r = 19e^{-t/14},$$
$$\varphi = e^{t/14}, \quad t = 9 \text{ с.}$$

Задача 4.11.

9

$$r = \frac{24}{1+2 \cos(t/3)},$$
$$\varphi = \frac{t}{3}, \quad t = 2 \text{ с.}$$

Задача 4.12.

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$$r = 5 \cos(t/11) + 8,$$
$$\varphi = t/11, \quad t = 7 \text{ с.}$$

Задача 4.13.

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$$r = 22(t/11)^5,$$
$$\varphi = (t/11)^5, t = 10 \text{ c.}$$

Задача 4.14.

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$$r = 22(t/10)^2,$$
$$\varphi = (t/10)^2, t = 9 \text{ c.}$$

Задача 4.15.

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$$r = \frac{22}{1+3\cos(t/9)},$$
$$\varphi = \frac{t}{9}, t = 8 \text{ c.}$$

Задача 4.16.

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$$r = 21/(1 + 2t/25),$$
$$\varphi = \arccos(t/5), t = 3 \text{ c.}$$

Задача 4.17.

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$$r = \frac{12\sin^2(t/12)}{\cos(t/12)},$$
$$\varphi = \frac{t}{12}, t = 9 \text{ c.}$$

Задача 4.18.

9

$$r = 4t\sin(t/9),$$
$$\varphi = t, t = 3 \text{ c.}$$

Задача 4.19.

9

$$r = -\frac{20\cos(t/7)}{\cos(t/14)},$$
$$\varphi = \frac{t}{14}, t = 9 \text{ c.}$$

Задача 4.20.

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$$r = 10e^{t/4},$$
$$\varphi = e^{t/4}, t = 1 \text{ c.}$$

Задача 4.21.

9

$$r = 72/t + 8,$$
$$\varphi = \arccos(t/8), t = 4 \text{ c.}$$

Задача 4.22.

9

$$r = \frac{28}{1+2\cos(t/8)},$$
$$\varphi = \frac{t}{8}, t = 7 \text{ c.}$$

Задача 4.23.

9

$$r = 26/(1 + \frac{4}{3}t),$$
$$\varphi = \arccos(t/3), t = 2 \text{ c.}$$

Задача 4.24.

9

$$r = 6(t/2 + 0.5)^{-4},$$
$$\varphi = (t/2 + 0.5)^4, t = 1 \text{ c.}$$

Задача 4.25.

9

$$r = 13e^{t/8},$$
$$\varphi = e^{t/8}, t = 3 \text{ c.}$$

Задача 4.26.

9

$$r = \frac{29}{1+\cos(t/7)},$$
$$\varphi = \frac{t}{7}, t = 3 \text{ c.}$$

Задача 4.27.

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$$r = 26 / (1 + \frac{2}{5}t),$$
$$\varphi = \arccos(t/10), \quad t = 9 \text{ c.}$$

Задача 4.28.

9

$$r = 17e^{-t/13},$$
$$\varphi = e^{t/13}, \quad t = 10 \text{ c.}$$

Задача 4.29.

9

$$r = -\frac{19 \cos(t/6)}{\cos(t/12)},$$
$$\varphi = \frac{t}{12}, \quad t = 9 \text{ c.}$$

Задача 4.30.

9

$$r = \frac{25}{1 + \cos(t/11)},$$
$$\varphi = \frac{t}{11}, \quad t = 7 \text{ c.}$$

Задача 4.31.

9

$$r = 2e^{t/5},$$
$$\varphi = t, \quad t = 4 \text{ c.}$$

Задача 4.32.

9

$$r = \frac{24}{1 + \cos(t/13)},$$
$$\varphi = \frac{t}{13}, \quad t = 9 \text{ c.}$$

Задача 4.33.

9

$$r = 6 + 6\text{tg}^2(\pi t/5),$$
$$\varphi = \cos^2(\pi t/5), \quad t = 1 \text{ c.}$$

Задача 4.34.

9

$$r = 5t \sin(t/11),$$
$$\varphi = t, \quad t = 4 \text{ c.}$$

Полярные координаты

№	ρ	$\dot{\rho}$	φ	$\dot{\varphi}$	v_ρ	v_φ	v	v_x	v_y	Кривая
1	5.684	-1.496	0.723	-0.378	-1.496	-2.148	2.618	0.299	-2.601	Гипербола
2	-11.667	9.167	1.231	-0.177	9.167	2.062	9.396	1.111	9.330	Строфоида
3	20.000	-1.250	0.644	-0.167	-1.250	-3.333	3.560	1.000	-3.417	Конхоида Никомеда
4	5.617	0.710	0.857	0.143	0.710	0.802	1.071	-0.142	1.062	Гипербола
5	18.692	-1.150	0.982	-0.134	-1.150	-2.498	2.750	1.438	-2.344	Эллипс
6	11.803	0.656	3.500	0.500	0.656	5.901	5.938	1.456	-5.756	Логарифмическая спираль
7	10.632	1.772	1.181	0.197	1.772	2.093	2.743	-1.264	2.434	Архимедова спираль
8	5.895	-1.551	0.723	-0.378	-1.551	-2.228	2.715	0.310	-2.697	Гипербола
9	15.000	-5.000	1.159	-0.218	-5.000	-3.273	5.976	1.000	-5.892	Конхоида Никомеда
10	9.990	-0.714	1.902	0.136	-0.714	1.357	1.533	-1.051	-1.116	Гиперболическая спираль
11	9.332	1.496	0.667	0.333	1.496	3.111	3.452	-0.748	3.370	Гипербола
12	12.021	-0.270	0.636	0.091	-0.270	1.093	1.126	-0.867	0.718	Улитка Паскаля
13	13.660	6.830	0.621	0.310	6.830	4.241	8.040	3.088	7.423	Архимедова спираль
14	17.820	3.960	0.810	0.180	3.960	3.208	5.096	0.407	5.080	Архимедова спираль
15	7.610	0.681	0.889	0.111	0.681	0.846	1.086	-0.227	1.062	Гипербола
16	16.935	-1.093	0.927	-0.250	-1.093	-4.234	4.373	2.732	-3.414	Эллипс
17	7.620	1.955	0.750	0.083	1.955	0.635	2.055	0.997	1.797	Циссоида
18	3.926	2.569	3.000	1.000	2.569	3.926	4.692	-3.097	-3.525	
19	-7.028	3.050	0.643	0.071	3.050	-0.502	3.091	2.742	1.426	Строфоида
20	12.840	3.210	1.284	0.321	3.210	4.122	5.224	-3.045	4.245	Архимедова спираль
21	26.000	-4.500	1.047	-0.144	-4.500	-3.753	5.859	1.000	-5.774	Конхоида Никомеда
22	12.270	1.032	0.875	0.125	1.032	1.534	1.848	-0.516	1.775	Гипербола
23	7.091	-2.579	0.841	-0.447	-2.579	-3.171	4.087	0.645	-4.036	Гипербола
24	6.000	-12.000	1.000	2.000	-12.000	12.000	16.971	-16.581	-3.614	Гиперболическая спираль
25	18.915	2.364	1.455	0.182	2.364	3.440	4.174	-3.144	2.746	Архимедова спираль
26	15.187	0.472	0.429	0.143	0.472	2.170	2.220	-0.472	2.170	Парабола
27	5.652	-0.491	0.451	-0.229	-0.491	-1.297	1.387	0.123	-1.381	Гипербола
28	7.877	-0.606	2.158	0.166	-0.606	1.308	1.441	-0.753	-1.229	Гиперболическая спираль
29	-1.837	4.174	0.750	0.083	4.174	-0.153	4.177	3.159	2.733	Строфоида
30	13.856	0.415	0.636	0.091	0.415	1.260	1.326	-0.415	1.260	Парабола
31	4.451	0.890	4.000	1.000	0.890	4.451	4.539	2.787	-3.583	Логарифмическая спираль
32	13.561	0.376	0.692	0.077	0.376	1.043	1.109	-0.376	1.043	Парабола
33	9.167	8.370	0.655	-0.598	8.370	-5.478	10.003	9.975	0.749	Гиперболическая спираль
34	7.114	3.478	4.000	1.000	3.478	7.114	7.918	3.110	-7.282	

№	$\ddot{\rho}$	$\ddot{\varphi}$	W_ρ	W_φ	a	W_x	W_y	$ W_\tau $	W_n
1	0.787	-0.162	-0.025	0.210	0.211	-0.157	0.141	-0.158	0.140
2	-7.500	-0.011	-7.135	-3.112	7.785	0.556	-7.765	-7.644	1.470
3	0.313	-0.037	-0.243	-0.324	0.405	-0.000	-0.405	0.389	0.114
4	0.267	0.000	0.153	0.203	0.254	-0.053	0.248	0.253	0.020
5	0.142	-0.012	-0.192	0.084	0.210	-0.177	-0.113	0.004	0.210
6	0.036	0.000	-2.914	0.656	2.987	2.959	0.408	0.330	2.969
7	0.295	0.033	-0.117	1.047	1.053	-1.013	0.289	0.723	0.765
8	0.816	-0.162	-0.026	0.218	0.219	-0.163	0.146	-0.164	0.145
9	5.000	-0.021	4.286	1.870	4.676	0.000	4.676	-4.610	0.782
10	0.051	0.010	-0.133	-0.097	0.165	0.135	-0.095	-0.024	0.163
11	1.113	0.000	0.076	0.997	1.000	-0.557	0.831	0.932	0.363
12	-0.033	0.000	-0.133	-0.049	0.141	-0.077	-0.118	-0.016	0.140
13	2.732	0.124	1.415	5.937	6.104	-2.303	5.653	4.334	4.297
14	0.440	0.020	-0.137	1.782	1.787	-1.385	1.129	1.015	1.471
15	0.183	0.000	0.089	0.151	0.176	-0.061	0.165	0.174	0.025
16	0.141	-0.047	-0.917	-0.248	0.950	-0.352	-0.883	0.469	0.827
17	0.373	0.000	0.320	0.326	0.456	0.012	0.456	0.405	0.211
18	0.791	0.000	-3.135	5.137	6.018	2.378	-5.528	2.583	5.436
19	0.434	0.000	0.470	0.436	0.641	0.115	0.630	0.393	0.506
20	0.803	0.080	-0.521	3.091	3.135	-3.112	0.375	2.119	2.310
21	2.250	-0.012	1.708	0.986	1.973	-0.000	1.973	-1.944	0.337
22	0.281	0.000	0.089	0.258	0.273	-0.141	0.234	0.264	0.070
23	1.875	-0.179	0.457	1.038	1.134	-0.469	1.033	-1.094	0.300
24	30.000	3.000	6.000	-30.000	30.594	28.486	-11.160	-25.456	16.971
25	0.296	0.023	-0.330	1.290	1.332	-1.320	-0.179	0.876	1.003
26	0.177	0.000	-0.133	0.135	0.189	-0.177	0.067	0.104	0.159
27	0.085	-0.109	-0.212	-0.389	0.443	-0.021	-0.442	0.439	0.060
28	0.047	0.013	-0.170	-0.101	0.198	0.178	-0.086	-0.020	0.197
29	0.686	0.000	0.699	0.696	0.986	0.037	0.986	0.673	0.721
30	0.076	0.000	-0.039	0.075	0.085	-0.076	0.038	0.060	0.060
31	0.178	0.000	-4.273	1.780	4.629	4.140	2.070	0.908	4.539
32	0.056	0.000	-0.024	0.058	0.063	-0.056	0.029	0.046	0.043
33	18.700	-0.244	15.427	-12.240	19.693	19.690	-0.319	19.611	1.793
34	0.791	0.000	-6.323	6.955	9.400	9.397	0.239	3.472	8.735