

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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<p>Задача 4.1 2</p> $r = \frac{24}{1+0.4 \cos(t/11)},$ $\varphi = \frac{t}{11}, t = 9 \text{ с.}$	<p>Задача 4.2 2</p> $r = 22/(1 + \frac{4}{5}t),$ $\varphi = \arccos(t/5), t = 4 \text{ с.}$
<p>Задача 4.3 2</p> $r = \frac{12 \sin^2(t/4)}{\cos(t/4)},$ $\varphi = \frac{t}{4}, t = 2 \text{ с.}$	<p>Задача 4.4 2</p> $r = \frac{25}{1+2 \cos(t/10)},$ $\varphi = \frac{t}{10}, t = 9 \text{ с.}$
<p>Задача 4.5 2</p> $r = 16 \cos^2(\pi t/13),$ $\varphi = \cos^2(\pi t/13), t = 10 \text{ с.}$	<p>Задача 4.6 2</p> $r = 14(t/7)^3,$ $\varphi = (t/7)^3, t = 6 \text{ с.}$
<p>Задача 4.7 2</p> $r = 16e^{-t/10},$ $\varphi = e^{t/10}, t = 6 \text{ с.}$	<p>Задача 4.8 2</p> $r = 11e^{t/9},$ $\varphi = t, t = 8 \text{ с.}$
<p>Задача 4.9 2</p> $r = -\frac{20 \cos(2t/5)}{\cos(t/5)},$ $\varphi = \frac{t}{5}, t = 1 \text{ с.}$	<p>Задача 4.10 2</p> $r = 8 \cos(t/12) + 10,$ $\varphi = t/12, t = 9 \text{ с.}$
<p>Задача 4.11 2</p> $r = \frac{11 \sin^2(t/6)}{\cos(t/6)},$ $\varphi = \frac{t}{6}, t = 3 \text{ с.}$	<p>Задача 4.12 2</p> $r = 8e^{-t/8},$ $\varphi = e^{t/8}, t = 3 \text{ с.}$
<p>Задача 4.13 2</p> $r = 5(t/18 + 0.5)^{-4},$ $\varphi = (t/18 + 0.5)^4, t = 9 \text{ с.}$	<p>Задача 4.14 2</p> $r = 22/(1 + t/2),$ $\varphi = \arccos(t/2), t = 1 \text{ с.}$
<p>Задача 4.15 2</p> $r = 28/(1 + \frac{2}{3}t),$ $\varphi = \arccos(t/5), t = 4 \text{ с.}$	<p>Задача 4.16 2</p> $r = 11 \cos^2(\pi t/11),$ $\varphi = \cos^2(\pi t/11), t = 5 \text{ с.}$
<p>Задача 4.17 2</p> $r = 44/t + 11,$ $\varphi = \arccos(t/11), t = 9 \text{ с.}$	<p>Задача 4.18 2</p> $r = 3t \cos(t/3),$ $\varphi = t, t = 2 \text{ с.}$

Задача 4.19 2 $r = \frac{2}{5}t - \frac{20}{t},$ $\varphi = \arccos(t/10), t = 6 \text{ c.}$	Задача 4.20 2 $r = \frac{28}{1+0.6 \cos(t/11)},$ $\varphi = \frac{t}{11}, t = 8 \text{ c.}$
Задача 4.21 2 $r = 15 \cos^2(\pi t/11),$ $\varphi = \cos^2(\pi t/11), t = 7 \text{ c.}$	Задача 4.22 2 $r = \frac{18}{5}t - \frac{45}{t},$ $\varphi = \arccos(t/5), t = 3 \text{ c.}$
Задача 4.23 2 $r = 11 \cos(t/7) + 12,$ $\varphi = t/7, t = 5 \text{ c.}$	Задача 4.24 2 $r = 2 \cos(t/6) + 5,$ $\varphi = t/6, t = 2 \text{ c.}$
Задача 4.25 2 $r = 6t \sin(t/10),$ $\varphi = t, t = 5 \text{ c.}$	Задача 4.26 2 $r = 8(t/2 + 0.5)^{-2},$ $\varphi = (t/2 + 0.5)^2, t = 1 \text{ c.}$
Задача 4.27 2 $r = 40(1 - (t/10)^2)/t,$ $\varphi = \arccos(t/10), t = 7 \text{ c.}$	Задача 4.28 2 $r = \frac{4}{3}t - \frac{96}{t},$ $\varphi = \arccos(t/12), t = 8 \text{ c.}$
Задача 4.29 2 $r = 30/(1 + t/35),$ $\varphi = \arccos(t/7), t = 6 \text{ c.}$	Задача 4.30 2 $r = 11e^{t/5},$ $\varphi = e^{t/5}, t = 1 \text{ c.}$

Полярные координаты

№	ρ	$\dot{\rho}$	φ	$\dot{\varphi}$	v_ρ	v_φ	v	v_x	v_y	Кривая
1	18.847	0.393	0.818	0.091	0.393	1.713	1.758	-0.982	1.458	Эллипс
2	5.238	-0.998	0.644	-0.333	-0.998	-1.746	2.011	0.249	-1.995	Гипербола
3	3.143	3.306	0.500	0.250	3.306	0.786	3.398	2.524	2.274	Циссоида
4	11.145	0.778	0.900	0.100	0.778	1.114	1.359	-0.389	1.302	Гипербола
5	8.964	3.838	0.560	0.240	3.838	2.151	4.400	2.109	3.862	Архимедова спираль
6	8.816	4.408	0.630	0.315	4.408	2.776	5.209	1.928	4.840	Архимедова спираль
7	8.781	-0.878	1.822	0.182	-0.878	1.600	1.825	-1.331	-1.248	Гиперболическая спираль
8	26.757	2.973	8.000	1.000	2.973	26.757	26.921	-26.905	-0.952	Логарифмическая спираль
9	-18.796	2.417	0.200	0.200	2.417	-3.759	4.469	3.115	-3.204	Строфоида
10	15.854	-0.454	0.750	0.083	-0.454	1.321	1.397	-1.233	0.657	Улитка Паскаля
11	2.881	2.020	0.500	0.167	2.020	0.480	2.076	1.543	1.390	Циссоида
12	5.498	-0.687	1.455	0.182	-0.687	1.000	1.213	-1.073	-0.567	Гиперболическая спираль
13	5.000	-1.111	1.000	0.222	-1.111	1.111	1.571	-1.535	-0.335	Гиперболическая спираль
14	14.667	-4.889	1.047	-0.577	-4.889	-8.468	9.778	4.889	-8.468	Парабола
15	10.769	-1.657	0.644	-0.333	-1.657	-3.590	3.954	0.828	-3.866	Гипербола
16	0.223	-0.885	0.020	-0.080	-0.885	-0.018	0.885	-0.885	-0.036	Архимедова спираль
17	15.889	-0.543	0.613	-0.158	-0.543	-2.512	2.570	1.000	-2.368	Конхоида Никомеда
18	4.715	1.121	2.000	1.000	1.121	4.715	4.847	-4.754	-0.943	
19	-0.933	0.956	0.927	-0.125	0.956	0.117	0.963	0.480	0.834	Строфоида
20	19.334	0.484	0.727	0.091	0.484	1.758	1.823	-0.807	1.635	Эллипс
21	2.589	3.238	0.173	0.216	3.238	0.559	3.285	3.094	1.106	Архимедова спираль
22	-4.200	8.600	0.927	-0.250	8.600	1.050	8.664	4.320	7.510	Строфоида
23	20.311	-1.029	0.714	0.143	-1.029	2.902	3.079	-2.679	1.518	Улитка Паскаля
24	6.890	-0.109	0.333	0.167	-0.109	1.148	1.153	-0.479	1.049	Улитка Паскаля
25	14.383	5.509	5.000	1.000	5.509	14.383	15.402	15.355	-1.203	
26	8.000	-8.000	1.000	1.000	-8.000	8.000	11.314	-11.054	-2.409	Гиперболическая спираль
27	2.914	-1.216	0.795	-0.140	-1.216	-0.408	1.283	-0.560	-1.154	Циссоида
28	-1.333	2.833	0.841	-0.112	2.833	0.149	2.837	1.778	2.211	Строфоида
29	25.610	-0.625	0.541	-0.277	-0.625	-7.103	7.130	3.123	-6.410	Эллипс
30	13.435	2.687	1.221	0.244	2.687	3.282	4.242	-2.164	3.648	Архимедова спираль

N_0	$\ddot{\rho}$	$\ddot{\varphi}$	W_ρ	W_φ	a	W_x	W_y	$ W_\tau $	W_n
1	0.050	0.000	-0.106	0.071	0.128	-0.125	-0.029	0.046	0.119
2	0.380	-0.148	-0.202	-0.111	0.230	-0.095	-0.210	0.196	0.120
3	2.023	0.000	1.826	1.653	2.463	0.810	2.326	2.159	1.186
4	0.170	0.000	0.059	0.156	0.166	-0.085	0.143	0.161	0.041
5	-0.225	-0.014	-0.741	1.715	1.869	-1.539	1.059	0.192	1.859
6	1.469	0.105	0.595	3.701	3.749	-1.699	3.342	2.476	2.815
7	0.088	0.018	-0.204	-0.160	0.259	0.206	-0.158	-0.042	0.256
8	0.330	0.000	-26.426	5.946	27.087	-2.038	-27.010	2.991	26.921
9	2.451	0.000	3.203	0.967	3.346	2.947	1.584	0.919	3.217
10	-0.041	0.000	-0.151	-0.076	0.169	-0.059	-0.158	-0.023	0.167
11	0.824	0.000	0.744	0.673	1.004	0.330	0.948	0.880	0.483
12	0.086	0.023	-0.096	-0.125	0.158	0.113	-0.110	-0.049	0.150
13	0.309	0.037	0.062	-0.309	0.315	0.293	-0.115	-0.262	0.175
14	3.259	-0.192	-1.630	2.823	3.259	-3.259	0.000	-1.630	2.823
15	0.510	-0.148	-0.687	-0.491	0.844	-0.255	-0.805	0.734	0.418
16	1.722	0.157	1.720	0.177	1.729	1.716	0.212	-1.724	0.142
17	0.121	-0.036	-0.277	-0.393	0.481	0.000	-0.481	0.443	0.187
18	-1.761	0.000	-6.476	2.242	6.853	0.656	-6.822	0.683	6.819
19	-0.185	-0.012	-0.171	-0.228	0.285	0.080	-0.273	-0.197	0.206
20	0.074	0.000	-0.086	0.088	0.123	-0.123	0.009	0.062	0.106
21	1.602	0.107	1.482	1.674	2.236	1.172	1.904	1.745	1.398
22	-3.333	-0.047	-3.071	-4.103	5.125	1.440	-4.919	-3.545	3.701
23	-0.170	0.000	-0.584	-0.294	0.654	-0.249	-0.605	-0.082	0.649
24	-0.052	0.000	-0.244	-0.036	0.247	-0.219	-0.114	-0.013	0.246
25	0.909	0.000	-13.473	11.019	17.405	6.744	16.046	5.470	16.523
26	12.000	0.500	4.000	-12.000	12.649	12.259	-3.118	-11.314	5.657
27	0.233	-0.019	0.176	0.285	0.335	-0.080	0.325	-0.257	0.214
28	-0.375	-0.011	-0.358	-0.619	0.715	0.222	-0.680	-0.390	0.599
29	0.030	-0.128	-1.940	-2.932	3.515	-0.152	-3.512	3.090	1.675
30	0.537	0.049	-0.264	1.969	1.987	-1.941	0.426	1.356	1.452