

Движение точки в плоскости

Точка движется по закону $x = x(t), y = y(t)$. Для момента времени $t = t_1$ найти скорость, ускорение точки и радиус кривизны траектории (x и y даны в см, t_1 — в с).

Кирсанов М.Н. **Решебник. Теоретическая механика** с. 131.

Вариант 1

$$\begin{aligned}x &= \cos(4t)(7 + 6 \cos(4t)), \\y &= \sin(4t)(7 + 6 \cos(4t)), \\t_1 &= 13\pi/24.\end{aligned}$$

Вариант 2

$$\begin{aligned}x &= 11/(t + 1), \\y &= (25 - 30t)/(t + 1)^3, \\t_1 &= 0.8.\end{aligned}$$

Вариант 3

$$\begin{aligned}x &= t, \\y &= 10(e^{t/20} + e^{-t/20}), \\t_1 &= 6.\end{aligned}$$

Вариант 4

$$\begin{aligned}x &= 8 \sin(2t), \\y &= 9 + 3 \cos(4t), \\t_1 &= 11\pi/12.\end{aligned}$$

Вариант 5

$$\begin{aligned}x &= 6 \cos(3t)(1 + \cos(3t)), \\y &= 6 \sin(3t)(1 + \cos(3t)), \\t_1 &= \pi/9.\end{aligned}$$

Вариант 6

$$\begin{aligned}x &= \frac{8(t^2 - 1)}{1 + t^2}, \\y &= \frac{8(t^2 - 1)t}{1 + t^2}, \\t_1 &= 5.\end{aligned}$$

Вариант 7

$$\begin{aligned}x &= 10 \cos(22t), \\y &= 7 \sin^2(11t), \\t_1 &= 13\pi/60.\end{aligned}$$

Вариант 8

$$\begin{aligned}x &= 2t^2/(1 + t^2), \\y &= 2t^3/(1 + t^2), \\t_1 &= 3.\end{aligned}$$

Вариант 9

$$\begin{aligned}x &= 10t^3, \\y &= 11\sqrt{1 - t^6}, \\t_1 &= 0.82.\end{aligned}$$

Вариант 10

$$\begin{aligned}x &= \frac{2(t^2 - 1)}{1 + t^2}, \\y &= \frac{2(t^2 - 1)t}{1 + t^2}, \\t_1 &= 10.\end{aligned}$$

Вариант 11

$$\begin{aligned}x &= \frac{1}{8}(100/(t^2 + 1) + 1), \\y &= t^2, \\t_1 &= 1.2.\end{aligned}$$

Вариант 12

$$\begin{aligned}x &= 8 \sin(4t), \\y &= -0.8(9 + \cos^2(4t)) \sin(4t), \\t_1 &= 13\pi/24.\end{aligned}$$

Вариант 13

$$\begin{aligned}x &= \frac{1}{9}(45/(e^{5t} + 1) + 1), \\y &= e^{5t}, \\t_1 &= 0.02.\end{aligned}$$

Вариант 14

$$\begin{aligned}x &= 200/(t + 2), \\y &= (t - 2500)/(t + 2)^2, \\t_1 &= 9.\end{aligned}$$

Вариант 15

$$\begin{aligned}x &= \cos(5t)(11 + 10 \cos(5t)), \\y &= \sin(5t)(11 + 10 \cos(5t)), \\t_1 &= \pi/3.\end{aligned}$$

Вариант 16

$$\begin{aligned}x &= 5e^{2t} + 6, \\y &= e^{4t}/4, \\t_1 &= 0.6.\end{aligned}$$

Вариант 17

$$\begin{aligned}x &= 2 \cos^3(4t), \\y &= 2 \sin^3(4t), \\t_1 &= 5\pi/12.\end{aligned}$$

Вариант 18

$$\begin{aligned}x &= \frac{1}{3} \left(\frac{7}{\sin(3t) + 2} + 1 \right), \\y &= 3 \sin(3t), \\t_1 &= 7\pi/18.\end{aligned}$$

<p>Вариант 19</p> $x = \cos(5t)(6 + 5 \cos(5t)),$ $y = \sin(5t)(6 + 5 \cos(5t)),$ $t_1 = \pi/15.$	<p>Вариант 20</p> $x = 5 + 3 \cos(t),$ $y = 5 \operatorname{tg}(t) + 3 \sin t,$ $t_1 = 5\pi/6.$
<p>Вариант 21</p> $x = 8e^{t/8},$ $y = 8e^{t/8}(0.1e^{t/4} - 1),$ $t_1 = 6.$	<p>Вариант 22</p> $x = \frac{11(t^2 - 1)}{1 + t^2},$ $y = \frac{11(t^2 - 1)t}{1 + t^2},$ $t_1 = 2.$
<p>Вариант 23</p> $x = 10 \cos(12t),$ $y = 4 \sin^2(6t),$ $t_1 = 13\pi/60.$	<p>Вариант 24</p> $x = 11 \cos^3(3t),$ $y = 11 \sin^3(3t),$ $t_1 = 4\pi/9.$
<p>Вариант 25</p> $x = 2 \sin(2t),$ $y = 3 + 3 \cos(4t),$ $t_1 = 7\pi/12.$	<p>Вариант 26</p> $x = 20/(t + 3),$ $y = (75 - 75t)/(t + 3)^3,$ $t_1 = 0.9.$
<p>Вариант 27</p> $x = 11e^{-5t},$ $y = 33\sqrt{1 - e^{-10t}},$ $t_1 = 0.03.$	<p>Вариант 28</p> $x = 3 \cos(8t)(1 + \cos(8t)),$ $y = 3 \sin(8t)(1 + \cos(8t)),$ $t_1 = 7\pi/48.$
<p>Вариант 29</p> $x = \frac{1}{10}(21780/(t^5 + 1) + 1),$ $y = t^5,$ $t_1 = 2.$	<p>Вариант 30</p> $x = 15e^{t/15},$ $y = 15e^{t/15}(0.1e^{2t/15} - 1),$ $t_1 = 5.$

Ответы

	v_x	v_y	v	W_x	W_y	W	W_τ	W_n	R
	sm/s			sm/s ²					sm
1	-34.78	36.25	50.24	-192.99	-222.28	294.37	-26.75	293.15	8.61
2	-3.40	-5.43	6.40	3.77	17.78	18.18	-17.08	6.23	6.58
3	1.00	0.30	1.05	0.00	0.05	0.05	0.02	0.05	21.85
4	13.86	10.39	17.32	16.00	-24.00	28.84	-1.60	28.80	10.42
5	-31.18	0.00	31.18	27.00	-140.30	142.87	-27.00	140.30	6.93
6	0.24	8.57	8.57	-0.13	-0.20	0.24	-0.20	0.13	568.86
7	-147.21	51.52	155.96	3596.82	-1258.89	3810.76	-3810.76	0.01	4565122.64
8	0.12	2.16	2.16	-0.10	-0.07	0.13	-0.08	0.10	46.87
9	20.17	-14.66	24.94	49.20	-112.86	123.11	106.16	62.35	9.98
10	0.01	2.04	2.04	-0.00	-0.01	0.01	-0.01	0.00	1813.11
11	-5.04	2.40	5.58	5.71	2.00	6.05	-4.30	4.26	7.31
12	27.71	-25.63	37.75	-64.00	88.00	108.81	-106.74	21.14	67.41
13	-6.23	5.53	8.33	1.56	27.63	27.67	17.16	21.71	3.20
14	-1.65	3.75	4.10	0.30	-1.02	1.07	-1.06	0.14	121.94
15	90.93	2.50	90.97	112.50	671.17	680.53	130.90	667.82	12.39
16	33.20	11.02	34.98	66.40	44.09	79.71	76.91	20.92	58.49
17	5.20	9.00	10.39	60.00	20.78	63.50	48.00	41.57	2.60
18	2.69	-7.79	8.25	4.67	13.50	14.28	-11.23	8.82	7.71
19	-47.63	2.50	47.70	50.00	-346.41	350.00	-68.09	343.31	6.63
20	-1.50	4.07	4.34	2.60	-9.20	9.56	-9.53	0.74	25.27
21	2.12	0.73	2.24	0.26	0.80	0.85	0.51	0.67	7.45
22	3.52	13.64	14.09	-3.87	-0.70	3.94	-1.65	3.57	55.53
23	-114.13	22.83	116.39	444.98	-89.00	453.80	-453.80	0.00	20836638.27
24	21.43	-37.12	42.87	-185.62	64.30	196.45	-148.50	128.60	14.29
25	-3.46	-10.39	10.95	4.00	-24.00	24.33	21.50	11.38	10.54
26	-1.31	-1.36	1.89	0.67	2.04	2.15	-1.94	0.94	3.83
27	-47.34	240.10	244.72	236.69	-5832.40	5837.20	-5768.03	895.99	66.84
28	-8.78	-8.78	12.42	-25.72	-236.55	237.95	185.46	149.08	1.04
29	-160.00	80.00	178.89	455.76	160.00	483.03	-336.09	346.93	92.24
30	1.40	-0.58	1.51	0.09	0.07	0.12	0.06	0.10	22.75