

Декартовы координаты. Плоская траектория

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**/Под ред. А. И. Кириллова.— М.:ФИЗМАТЛИТ, 2008.— 384 с. (с.131.)

Задача 1.1.

102

$$\begin{aligned}x &= 2 + 5 \cos(t), \\y &= 2 \operatorname{tg}(t) + 5 \sin t, \\t_1 &= 11\pi/24.\end{aligned}$$

Задача 1.2.

102

$$\begin{aligned}x &= 6(4t - \sin(4t)), \\y &= 6(1 - \cos(4t)), \\t_1 &= 5\pi/24.\end{aligned}$$

Задача 1.3.

102

$$\begin{aligned}x &= 42t/(1 + t^3), \\y &= 42t^2/(1 + t^3), \\t_1 &= 0.1.\end{aligned}$$

Задача 1.4.

102

$$\begin{aligned}x &= 4 + 3 \cos(t), \\y &= 4 \operatorname{tg}(t) + 3 \sin t, \\t_1 &= 13\pi/12.\end{aligned}$$

Задача 1.5.

102

$$\begin{aligned}x &= 3 \cos(2t)(1 + \cos(2t)), \\y &= 3 \sin(2t)(1 + \cos(2t)), \\t_1 &= \pi/12.\end{aligned}$$

Задача 1.6.

102

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

Задача 1.7.

102

$$\begin{aligned}x &= 8e^{2t} + 9, \\y &= e^{4t}/5, \\t_1 &= 0.7.\end{aligned}$$

Задача 1.8.

102

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

Задача 1.9.

102

$$\begin{aligned}x &= 21t/(1 + t^3), \\y &= 21t^2/(1 + t^3), \\t_1 &= 0.1.\end{aligned}$$

Задача 1.10.

102

$$\begin{aligned}x &= 3(3t - \sin(3t)), \\y &= 3(1 - \cos(3t)), \\t_1 &= 11\pi/18.\end{aligned}$$

Задача 1.11.

102

$$\begin{aligned}x &= 200/(t + 4), \\y &= (t - 200)/(t + 4)^2, \\t_1 &= 1.\end{aligned}$$

Задача 1.12.

102

$$\begin{aligned}x &= 10 \sin(3t), \\y &= -(9 + \cos^2(3t)) \sin(3t), \\t_1 &= \pi/18.\end{aligned}$$

Задача 1.13.

102

$$\begin{aligned}x &= \frac{10(t^2-1)}{1+t^2}, \\y &= \frac{10(t^2-1)t}{1+t^2}, \\t_1 &= 4.\end{aligned}$$

Задача 1.14.

102

$$\begin{aligned}x &= \frac{1}{2} \left(\frac{3}{\sin(5t)+2} + 1 \right), \\y &= 2 \sin(5t), \\t_1 &= 4\pi/15.\end{aligned}$$

Задача 1.15.

102

$$\begin{aligned}x &= 10 \cos(9t)(1 + \cos(9t)), \\y &= 10 \sin(9t)(1 + \cos(9t)), \\t_1 &= 4\pi/27.\end{aligned}$$

Задача 1.16.

102

$$\begin{aligned}x &= 1400/(t + 8), \\y &= (t - 17600)/(t + 8)^2, \\t_1 &= 10.\end{aligned}$$

Задача 1.17.

102

$$\begin{aligned}x &= 5 \sin(4t), \\y &= 6 + 5 \cos(8t), \\t_1 &= 5\pi/24.\end{aligned}$$

Задача 1.18.

102

$$\begin{aligned}x &= 8(3t - \sin(3t)), \\y &= 8(1 - \cos(3t)), \\t_1 &= 2\pi/9.\end{aligned}$$

Задача 1.19.

102

$$\begin{aligned}x &= 10 \sin(3t), \\y &= 11 + 4 \cos(6t), \\t_1 &= 13\pi/18.\end{aligned}$$

Задача 1.20.

102

$$\begin{aligned}x &= \frac{1}{5}(140/(t^3 + 1) + 1), \\y &= t^3, \\t_1 &= 1.4.\end{aligned}$$

Задача 1.21.

102

$$\begin{aligned}x &= 5 \sin(5t), \\y &= -0.5(9 + \cos^2(5t)) \sin(5t), \\t_1 &= \pi/3.\end{aligned}$$

Задача 1.22.

102

$$x = 7 \sin(3t),$$
$$y = \frac{7}{1 + \sin^2(3t)},$$
$$t_1 = \pi/15.$$

Задача 1.23.

102

$$x = \frac{1}{9}(18/(e^{2t} + 1) + 1),$$
$$y = e^{2t},$$
$$t_1 = 0.03.$$

Задача 1.24.

102

$$x = 21t/(1 + t^3),$$
$$y = 21t^2/(1 + t^3),$$
$$t_1 = 1.$$

Задача 1.25.

102

$$x = 4 \sin(2t),$$
$$y = 5 + 3 \cos(4t),$$
$$t_1 = 2\pi/3.$$

Задача 1.26.

102

$$x = 11e^{-3t},$$
$$y = 33\sqrt{1 - e^{-6t}},$$
$$t_1 = 0.01.$$

Задача 1.27.

102

$$x = 4 \cos(16t),$$
$$y = 7 \sin^2(8t),$$
$$t_1 = 11\pi/24.$$

Задача 1.28.

102

$$x = \frac{1}{4}(50/(t^4 + 1) + 1),$$
$$y = t^4,$$
$$t_1 = 1.1.$$

Задача 1.29.

102

$$x = 500/(t + 6),$$
$$y = (t - 2500)/(t + 6)^2,$$
$$t_1 = 5.$$

Задача 1.30.

102

$$x = 7e^{2t} + 8,$$
$$y = e^{4t}/5,$$
$$t_1 = 0.9.$$