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THE ACTUAL USE OF MATHEMATICAL ANALISIS IN THE RESERCH OF THE EQUATION OF BODY MOVEMENTS

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The problem of study and research of different types of functional dependencies always was and will be relevant. In all of the spheres of activity we have to deal with regularities and dependencies.

The mathematical functions help us to simulate real events and happenings, even to predict and describe them, to make research. .

The methods of mathematical analysis allow us to investigate the functional dependencies between any quantities in any processes and phenomena (both natural and social), thus making them predictable for any values of the initial parameters and for any number of them.

Modern information technologies allow, based on information about the properties of various types of functional dependencies, to create the whole system of software for very narrow spheres of human activity. This allows it to be simple, mobile, and more efficient.

Here is an example of the application of methods of mathematical analysis in the study of the laws of body movements.

Let the motion of a certain body be given an equation: $= t^3 - 2t^2 + t$, t – is the time of movement, S – is the displacement of the body during the time of movement. Let's investigate the equation as the mathematical function.

We need to find the definition area. $D(S) = [0; \infty)$.

It is obvious that this function does not have breakpoints, so for a vertical asymptotes.

Since $k = \lim_{t\to\infty}(t^2 - 2t + 1) = \infty$, where y = k*x + b, the function does not have neither vertical nor horizontal asymptotes. Based on the asymmetry of the definition area, we conclude that the function is neither paired nor odd nor periodic at all.

Then we are to find the points of intersection of the graph of the function with coordinate axes.

$$Ot:\ t^3 - 2t^2 + t = 0;\ t(t-1)^2 = 0;\ t_1 = 0;\ t_2 = 1;\ (0;0),\ (1;0);$$

OS: (0;0).

Let's investigate the function on monotony and extremums.

$$S' = 3t^2 - 4t + 1;\ 3t^2 - 4t + 1 = 0;\ t_1 = \frac{1}{3};\ t_2 = 1$$

t	$\left[0; \frac{1}{3}\right)$	$\frac{1}{3}$	$\left(\frac{1}{3}; 1\right)$	1	$(1; \infty)$
S'	+	0	-	0	+
S	↗	$\frac{4}{27}$	↘	0	↗
		max		min	

Then we have to investigate the function on points of convexity and bend.

$$S'' = 6t - 4;\ 6t - 4 = 0;\ t = \frac{2}{3}$$

t	$\left[0; \frac{2}{3}\right)$	$\frac{2}{3}$	$\left(\frac{2}{3}; \infty\right)$
S''	-	0	+
S	⌒	$\frac{2}{27}$	⌣

$t = \frac{2}{3}$ -- is the point of bend.

Now let's investigate the function of the velocity of this motion.

$$v = S' = 3t^2 - 4t + 1$$

Definition area: $D(v) = [0; \infty)$.

The function does not have neither breakpoints nor asymptotes, it is not odd, not pair and not periodical.

Points of intersection of the graph with coordinate axes are:

Ot: $(\frac{1}{3}; 0);\ (1; 0)$

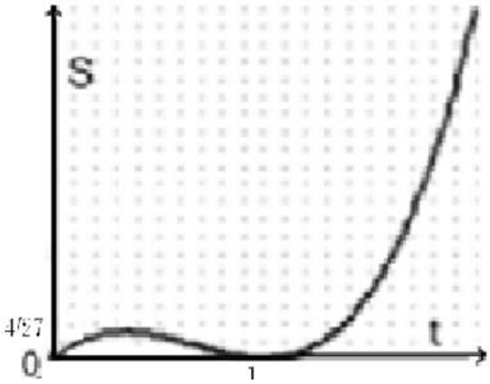
Ov: (0;1)

$v = S'' = 6t - 4$ – the equation of acceleration of movement.

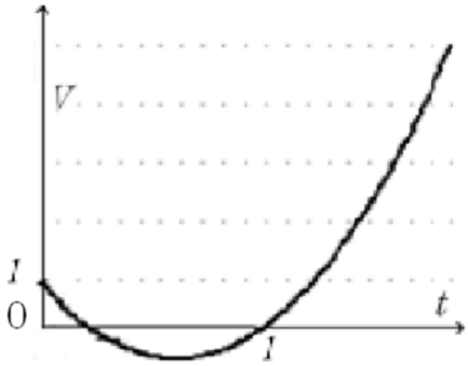
t	$[0; \frac{2}{3})$	$\frac{2}{3}$	$(\frac{2}{3}; \infty)$
v'	-	0	+
v	↘	$-\frac{1}{3}$	↗

$v'' = 6$ -- is the speed of change of the acceleration. $v'' > 0$ across the entire definition area.

We will construct the graphs of the investigated functions.



Pic 1. Graph of dependence. Movement from time



Pic 2. Graph of dependence. Speed from time

Since from the beginning of the movement there are 1/3 units of time and from this moment the movement is increasing to 1, and from 1/3 units up to 1 unit decreases, it means that the motion has a curvilinear trajectory. In the first 1/3 unit of time the body moves as far as possible from the initial position for 4/27 units and at the time of 1 unit it returns to this position, after which all time away from him. Initial speed is 1 unit. During the movement its module decreases to 0 twice and its direction changes twice. Acceleration over the entire time of the movement changes uniformly by 6 units for each unit of time.

So, describing and predicting the behavior of moving bodies is quite possible, having studied the laws of their movements, using methods of mathematical analysis.

The list of the literature we used

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