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Natural science education: a multiaspect system of models of mathematics

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Оглавление

1. What is mathematics today?

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This is the absence of powerful claws, weakness of the dental apparatus, insufficient muscle strength, etc.

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2) increase in energy supply;

2.1) The domestication of animals, their use of their power for transport, plowing and other activities.

2.2) Application of natural energy sources: water wheel, windmills, sail.

2.3) The emergence of mechanical energy sources: steam engines, internal combustion engines, nuclear energy, etc.

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The emergence of industry, mechanical feedback systems, etc.

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The appearance of devices to facilitate counting, the first mechanical programmable machines (Babbage machine, Hollerith tabulator).

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4) automation of algorithmic thinking activity;
5) automation of complex mental activity.

Modern information systems, including artificial intelligence systems. Newline The computer beat not only the world chess champion, but also the world champion in Go!

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Therefore, we proposed to formalize mathematics in the form of a *system of models*, each of which reflects only one aspect of it, to form a voluminous, complex, multifaceted understanding of mathematics.

1.1. Mathematics as a field of activity

System of mathematical theories and methods

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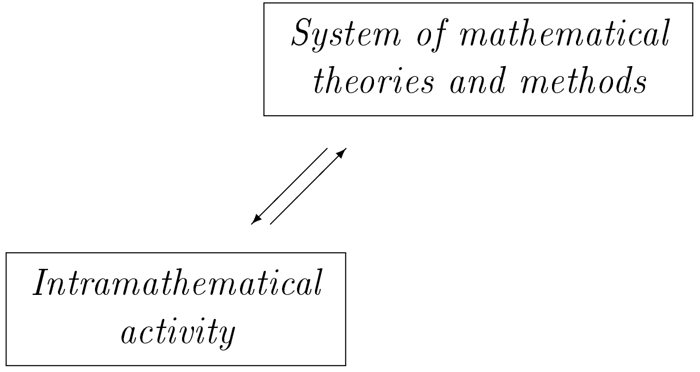

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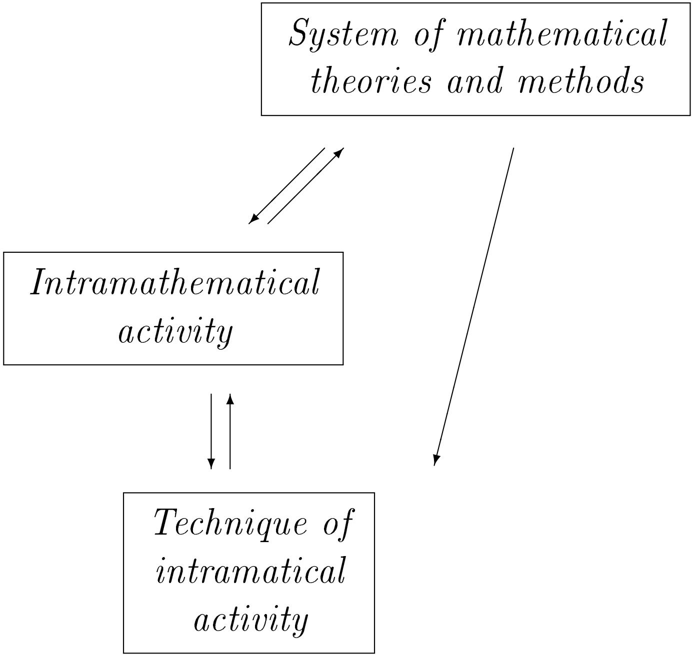

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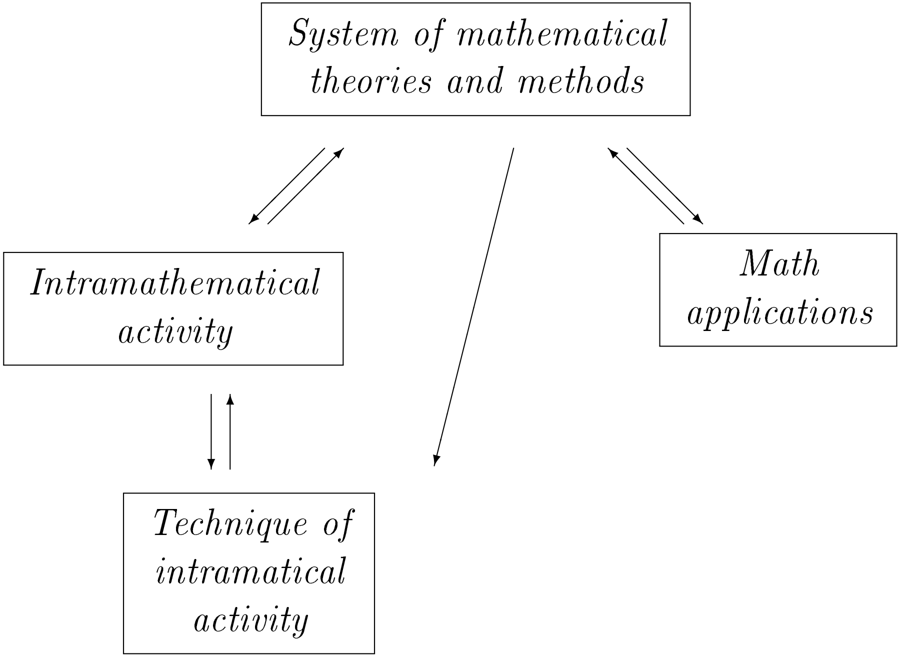

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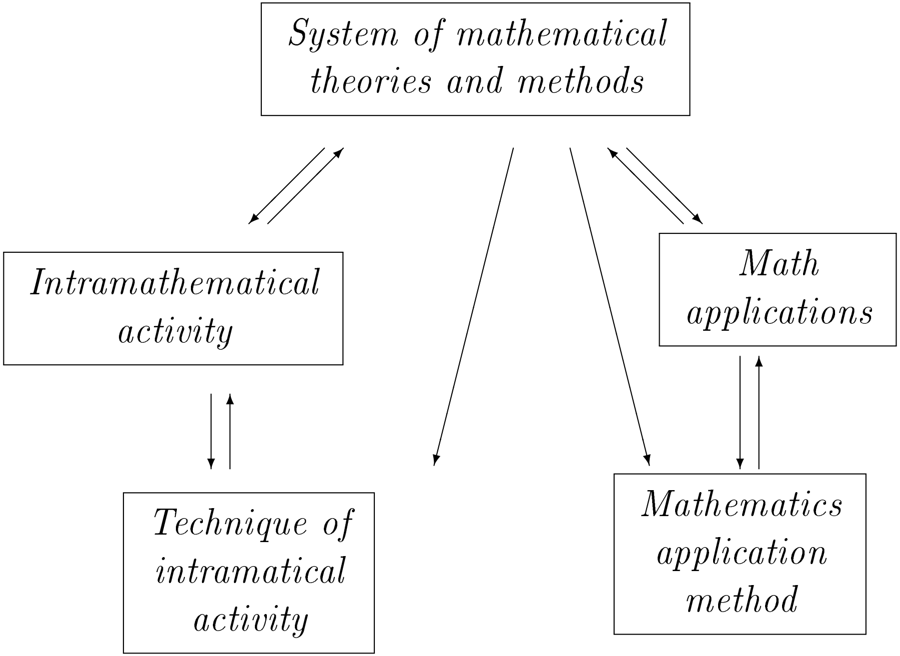

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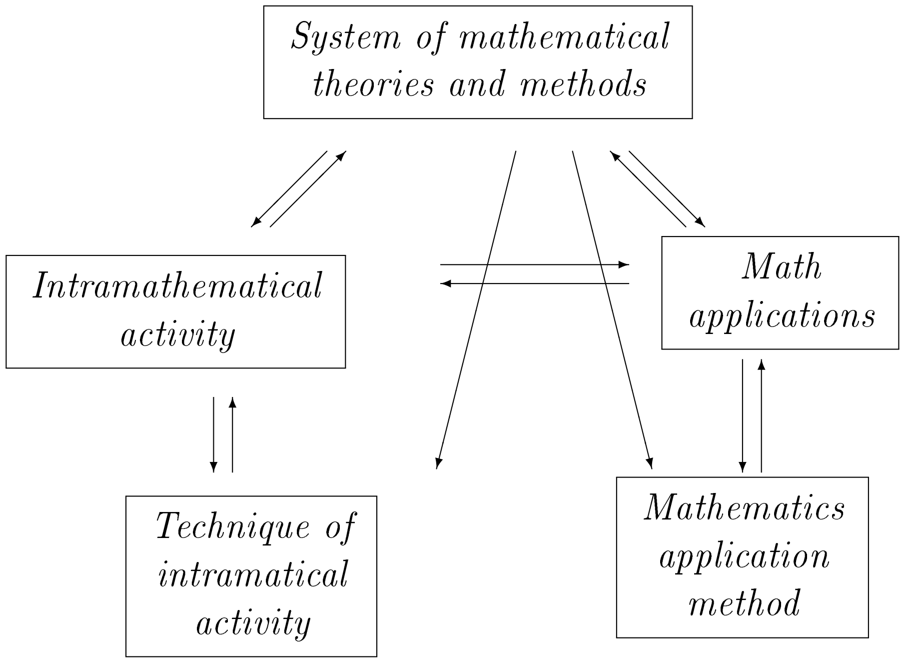

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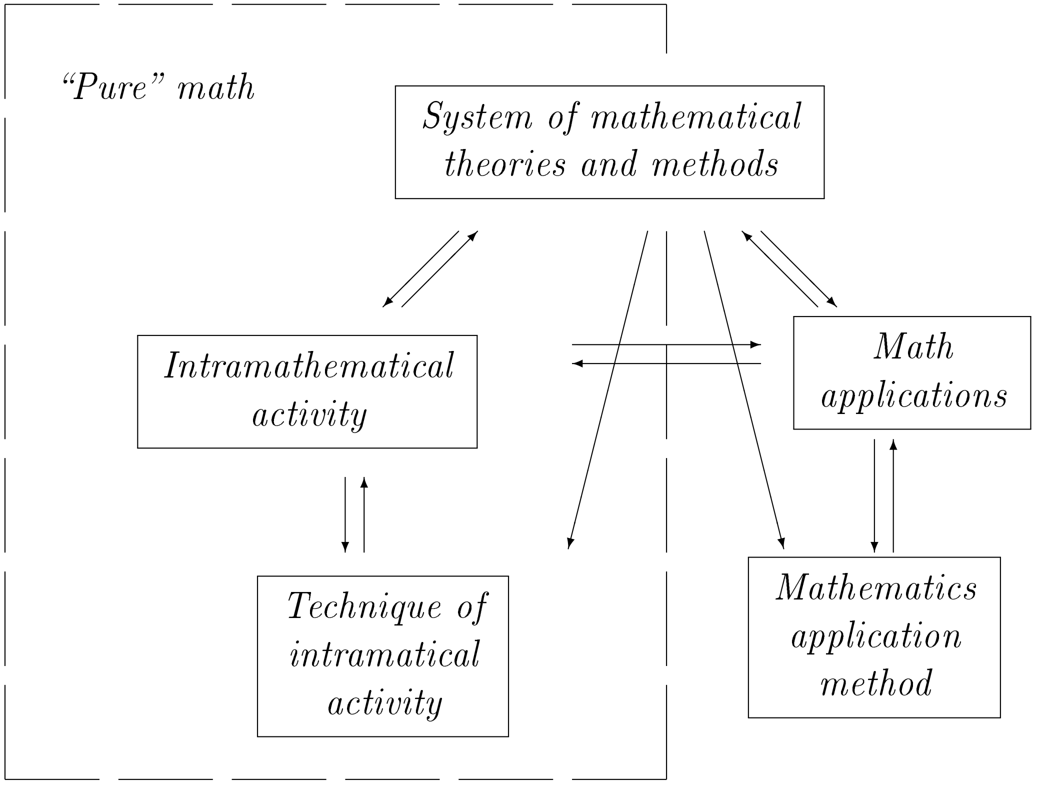

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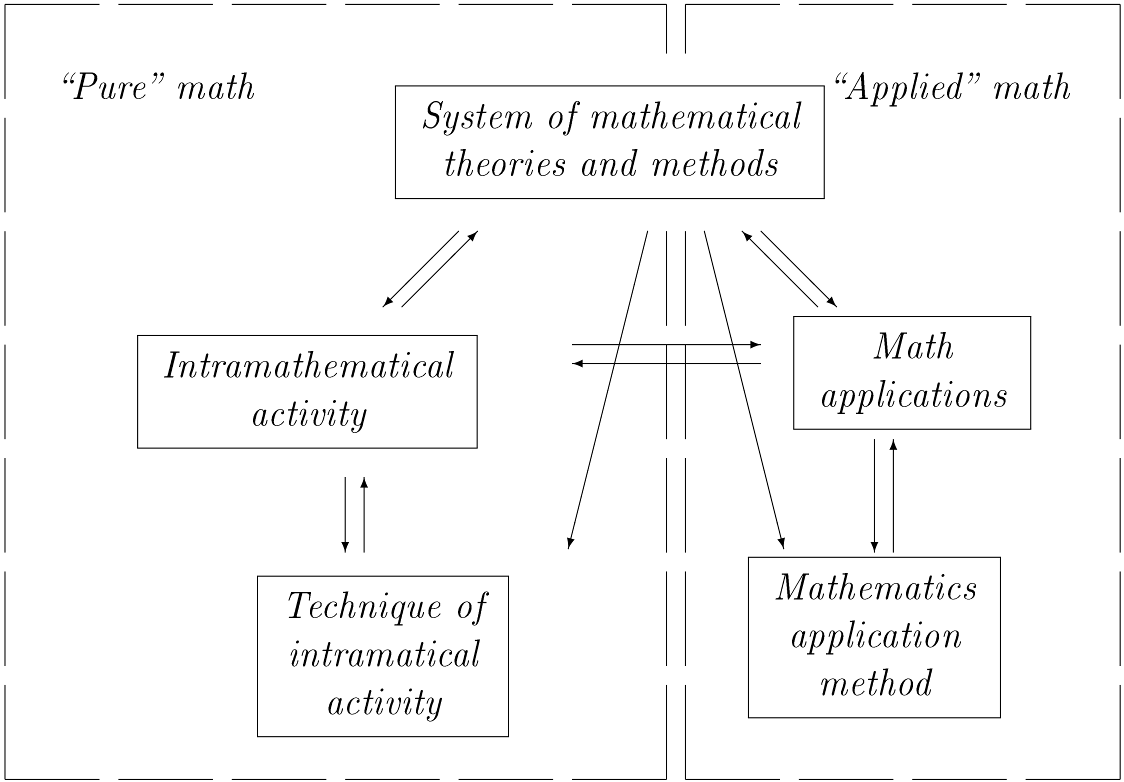

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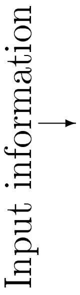

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Input information →

Conceptual apparatus

Converts information to the form standard for a given field of activity

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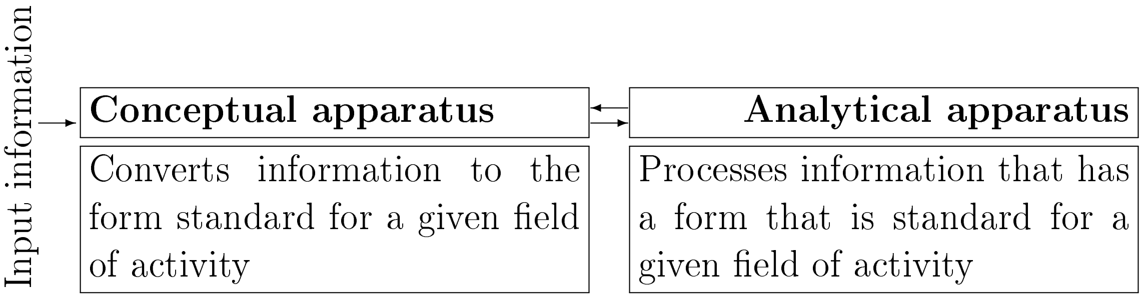

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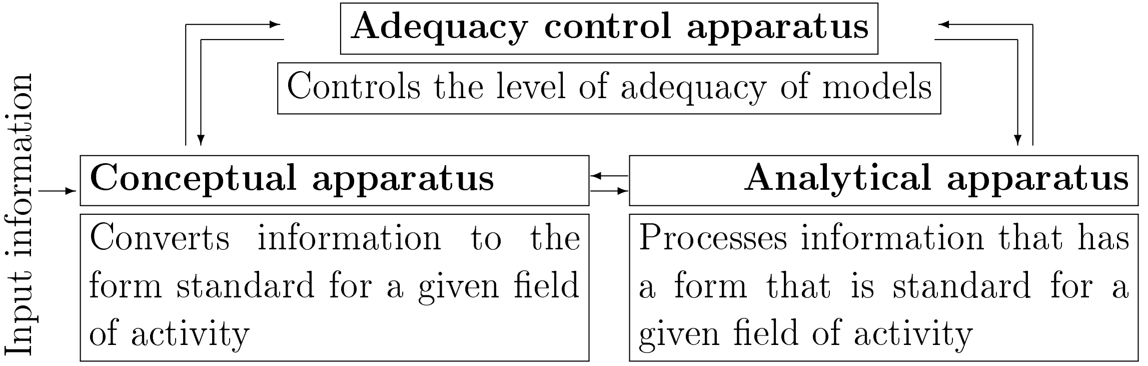

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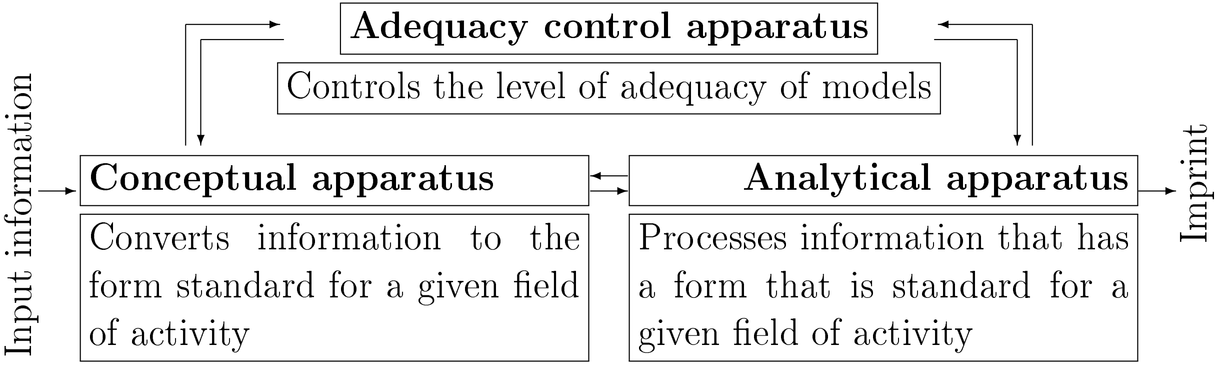

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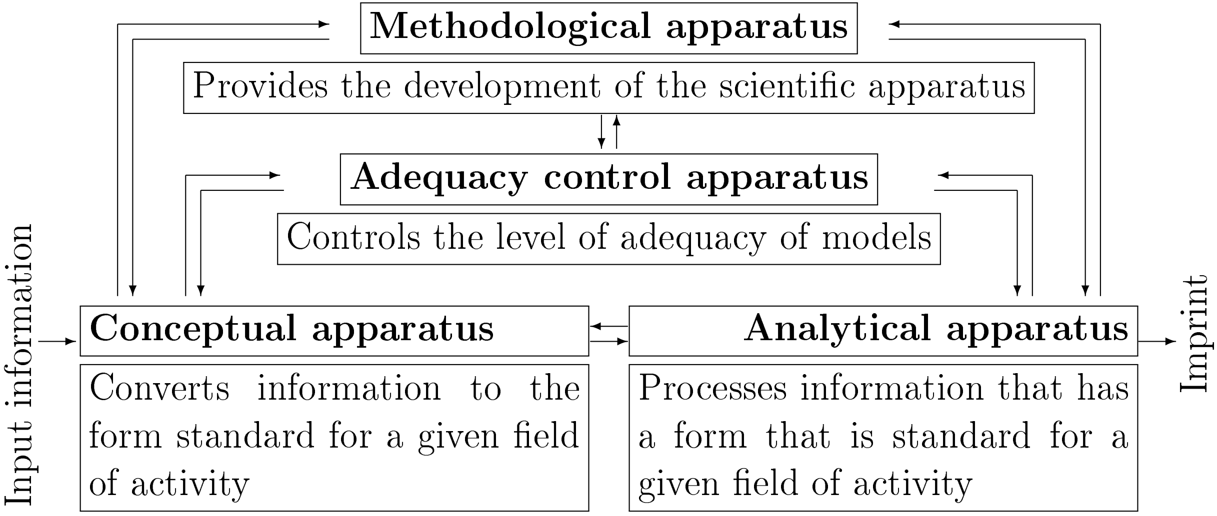

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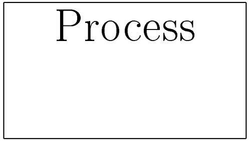

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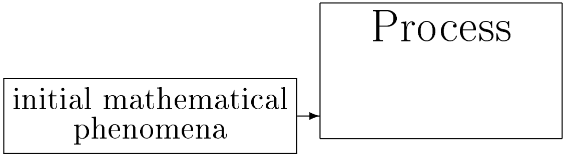

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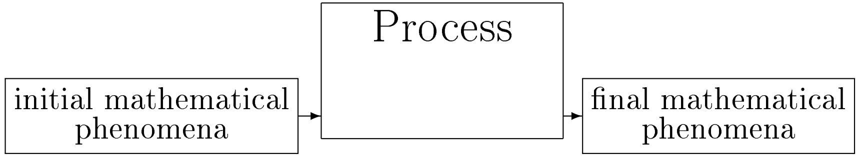

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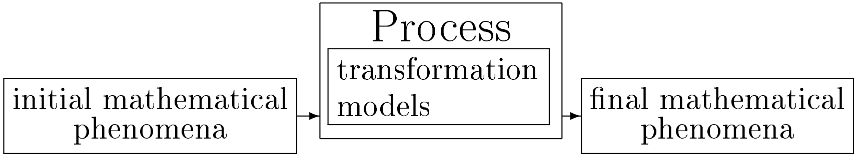

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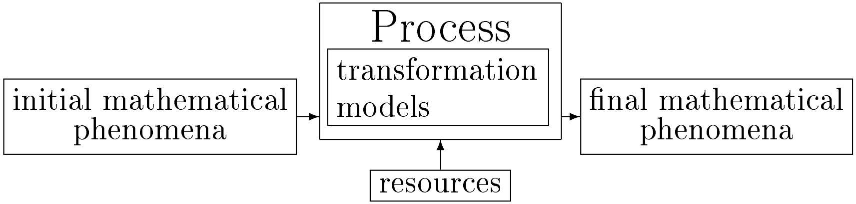

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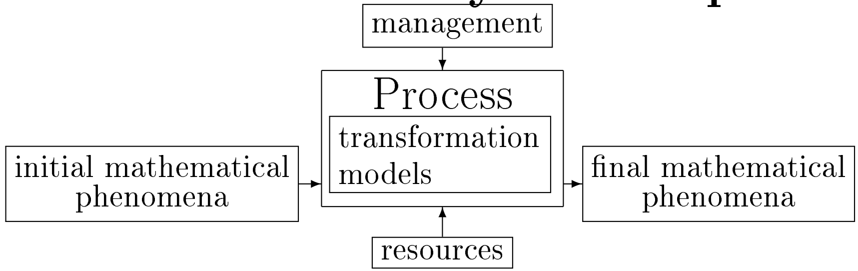

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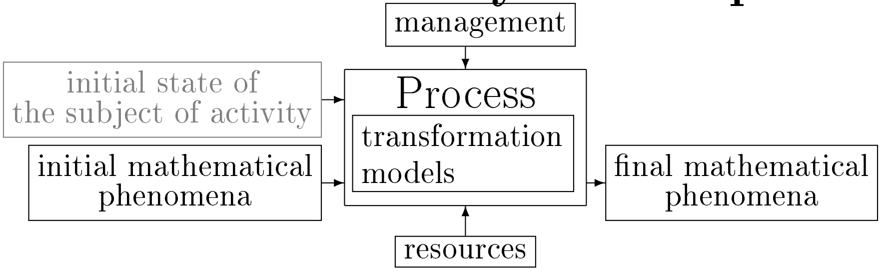

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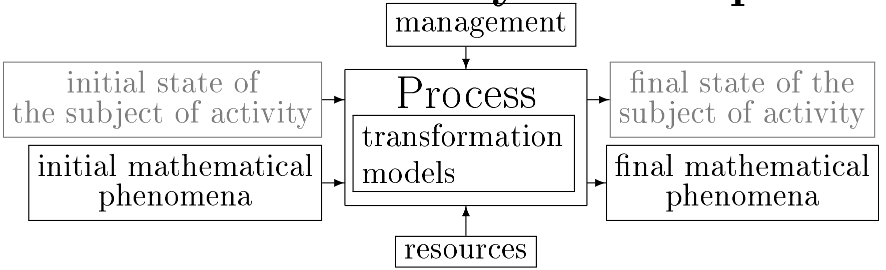

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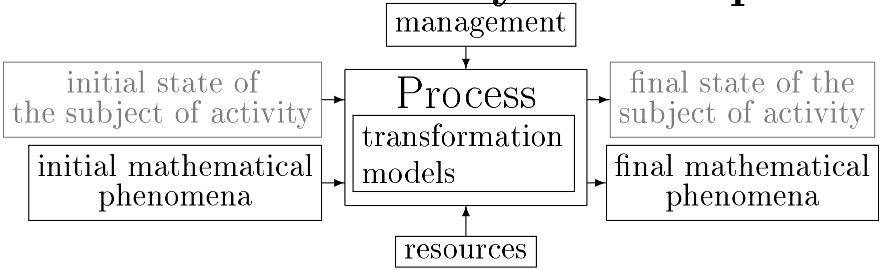

For educational activity, the most important thing is the changes in the subject of activity that occur as a result of managing the processes of changing mathematical phenomena: their formalization, transformations, translation into another mathematical language, search for a solution to the problem and, in particular, proof of mathematical statements.

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Algebraic approach to mathematical phenomena

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Algebraic approach to mathematical phenomena

Basic phenomena	**Transformations and combinations of phenomena**	**Approximation mechanism**
Basic concepts	Math concepts	Strategies of mathematical activity
Basic languages	Language combinations	
Basic algorithms	Math. approval	
	Algorithms and methods	

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2) phenomenological, the elements of which are mathematical phenomena, and the authors of these phenomena are considered their main attributes, the conditions for their discovery and application.

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1) personification;
2) phenomenological.

Usually, in teaching practice, historical models of mathematics are considered in combination with other models.

2. Applications of models of mathematics

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In particular, the properties of primes, methods of obtaining (the sieve of Eratosthenes) are considered.

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Moreover, Yu.B. Melnikov, S.A. Shitikov and S.G. Sintsova showed that for a student who does not plan to become a professional mathematician, when certain natural assumptions (taken as postulates) are fulfilled, only two variants of the attitude to the mathematical phenomenon: as an object of activity (for example, it must be remembered, studied, generalized, etc.) or as an instrument of activity (including the method of its application, the possibilities and limitations of use, etc.).

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Let's consider some applications of mathematics models.

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The model of mathematics as a field of activity and the hardware model of mathematics make it possible to assess how well the management of educational activities is organized in the course.

2.2. Using models of mathematics to form the content of mathematical courses

Analyzing our textbooks from the standpoint of the hardware model of mathematics, we came to the conclusion that it is necessary to significantly increase the amount of material related to the conceptual and methodological apparatus.

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Thus, the problems with obtaining the formulation that arise among students are of a methodological nature.

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The conceptual apparatus is not reduced to a system of definitions!

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Analysis of the content of the training course from the standpoint of other models leads to no less interesting changes in the training course.

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Using models of mathematics can increase motivation to learn and use mathematics.

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For example, translation from the language of geometric drawings into any language of mathematical text and vice versa.

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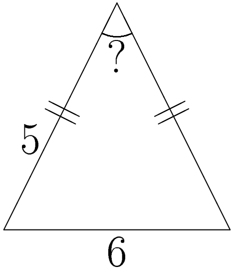

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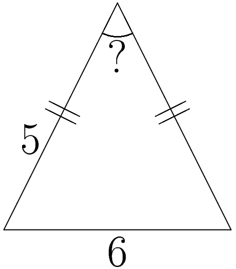
Find the angle at the vertex of an isosceles triangle with side 5 and base 6.



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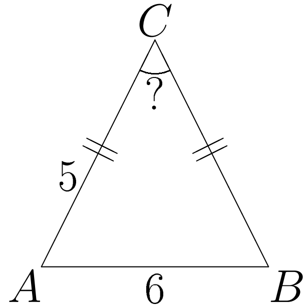

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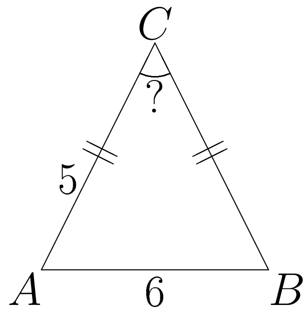

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For example, even outside mathematics, the ability to formalize information is relevant, to translate information from one language to another, with a fundamentally different grammar and other expressive capabilities, control the adequacy of statements by comparing fundamentally different models of the same object reflecting the same aspect of the prototype.

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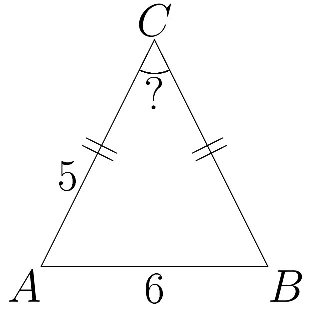

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Teaching mathematics allows you to form the ability to build and substantiate hypotheses, use typical strategies of activity (for example, reasoning "by contradiction"), etc.

The electronic manual — is a manual that cannot be printed!

Tutorial "Elementary Mathematics"(rus)

http://lib.usue.ru/resource/free/14/MelnikovAlgebra5/index.html

Tutorial "Mathematical analysis"

http://lib.usue.ru/resource/free/15/MelnikovAlgebra6/index.html

Tutorial "Higher mathematics. Linear Algebra and Geometry"

http://lib.usue.ru/resource/free/17/MelnikovAlgebra7/index.html

Thanks for your attention!

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Yury Borisovich Melnikov