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Сборник упражнений

(приложение к учебному пособию
English for Students
of Mathematics and Mechanics, Part one)

под ред. Л. Н. Выгонской

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Сборник упражнений является приложением к учебному пособию *English for Students of Mathematics and Mechanics, Part one.* Его цель — развитие и закрепление навыков и умений в области лексики и грамматики, предусмотренных программой I курса.

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Unit 1

I. Grammar

I. There is a mistake in each sentence. Find it and correct it.

1. The ultimate fate of the universe depend on its geometry.
2. The mathematical treatment may become the more complicated.
3. The theory of manifolds arosed in the 19th century.
4. Each point represents a pair of values for the variables to making the equation true.
5. This machine can to run on solar, nuclear or chemical fuel.
6. The element consist in equal numbers of protons and neutrons. (2)
7. Is there a cheap mean for the removal of corrosive compounds?
8. Investigations in the branch of physic make it clear that we face an analogous situation.
9. A perfect square is one that is completely make up of smaller squares, two of which are of the same size.
10. Four functional groups is recognized.
11. Charged particles in motion produces a magnetic field.

II. 1. Select the adjectives that form the Degrees of Comparison synthetically. Be careful of changes to the spelling: big, old-fashioned, beautiful, narrow, easy, short, exact, old & complicated, simple, close, interesting, common, full, simply, thin, widely, slowly, often, pretty, early.

2. Give two variants of the Comparative and Superlative degrees of the adjective **old**. Give examples.

III. Ask questions about the statements.

1. Mathematics is the oldest of the sciences. (What...)
2. Between 1825 and 1900 algebra and geometry underwent great changes. (When...)
3. Aristotle follows a similar procedure in logic. (Who...)
4. We can define all other geometric figures in terms of sets of points. (What...)
5. Many problems of geometry are solved with the methods of algebra. (How...)
6. There appears a new meaning of this term. (General question)
7. Signs and symbols constitute the most part of mathematical language. (What...)
8. Scientific laws seem independent due to their abstract character. (Why...)
9. They devised various methods by means of special geometric curves. (What...)
10. There arose a need for a formalized language. (General question).
11. The ancient Greek geometers tried to find other means to solve the trisection problem. (Who...) (What...)

IV. Active or Passive? Choose the correct form.

1. Hydrodynamics is concerned/concerns with liquids in motion.
2. Most mechanical laws are derived/derive inductively from experiments.
3. Space that is used/uses in Mechanics is Euclidean three-dimensional.
4. The description of motion is involved/involves general principles stated in mathematical terms.

V. Infinitive or -ing form? Put the verb in brackets in the correct form.

1. A mathematician uses numbers and signs (calculate) fixed quantities.
2. The natural philosophers of ancient Greece liked (do) experiments in their heads.
3. This general attraction is responsible for (keep) the Earth and other planets on their courses around the Sun.
4. Greek thinkers founded new methods in science — they began (look for) general schemes.
5. It reminds us that our whole behaviour in (seek) laws is artificial.
6. Our laws are man-made, because we make assumptions (suit) our hopes.
7. The evidence is still insufficient (provide) a clear picture.

VI. Put the verb in brackets in the correct form.

1. a. This fundamental law (discover) by D. Mendeleev made a revolution in chemistry.
   b. The law of universal gravitation (discover) by I. Newton.
2. a. New information (obtain) concerning the physical structure of Mars and Venus.
   b. The results (obtain) by a group of scientists in this experiment were surprising.
   c. The facts (obtain) showed the disadvantages of this method of research.
3. a. The method (apply) in this construction is well-known.
   b. New methods of research (apply) in this investigation.
   c. All the efforts the Greek geometers (apply) to handle the problem were in vain.
4. a. The problem (deal) with at the seminar was interesting.
   b. This article (deal) with environmental problems.

VII. Fill in the gaps with the Past Simple form of the verbs in brackets. There are regular and irregular verbs.

1. The graph (show) that the function was regular.

2. The Greeks (give) special attention to geometric constructions.
3. The Greeks (seek) to solve the trisection problem using straightedge and compass alone.
4. The Greek geometers (understand) that the allowable instruments were inadequate.
5. They (try) to find other means to solve the trisection problem.
6. Nicomedes (invent) a special curve, the conchoid.
7. The search for the solution under imposed restrictions (lead) the Greeks to many great mathematical discoveries.
8. They (draw) a conclusion that the construction problems are insoluble under the specified conditions.
9. An air-cushion vehicle (rise) a few feet above the surface.
10. Cable television (raise) a number of issues that remain to be finally resolved.

VIII. A/an or nothing. Some of the sentences need **a** or **an**. Some of the sentences are correct. Put **a/an** or nothing.

1. Addition is the basic process of arithmetic.
2. Dynamics is branch of mechanics.
3. A drawing of a circle is not circle. It suggests the idea of circle.
4. Point is a primary concept in Geometry.
5. Using only straightedge and compass the Greeks could easily divide line segment into any number of equal parts.
6. According to the Greeks all objects are composed of four basic elements: earth, air, fire and water.

IX. Match a line in A with a line in B to make a question.

A	B
1. What	a) designs and devises the language of mathematics?
2. Who	b) does a statement of a theorem appeal to mathematicians?
3. What	c) wording is more concise: verbal or symbolic?
4. When	d) constitutes the most part of mathematical language?
5. Why	e) do we call the result of addition?
6. Which	f) are scientific laws abstract?

II. Vocabulary

I. Say if it is true or false. Give the correct answer.

1. An expert in physics is a physician.
2. A doctor who performs both surgery and therapy is a physicist.
3. An expert in mathematics is a mathematician.
4. A person who prepares and sells medicines is a chemist.
5. A scientist who is trained in chemistry is an engineer.

II. Fill in a preposition in each gap.

1. The investigation... the effects of pressure may change the results obtained.
2. The surface of Mercury consists... heavily cratered terrains.
3. The reaction proceeds... means of a sequence of steps.
4. The accelerator has a set... functions.
5. Our attention is restricted... this phenomenon.
6. This concept provides answers... the problems.
7. ... the purpose... the investigation new experimental conditions were created.
8. This method can form the basis... solving the problem.

III. Match the italicized words with their synonyms given below: influence, to deal with, to supply with, a result, to figure out (2), to be limited to, in some other way, to comprise, to contain.

1. The derivatives of all other functions are *calculated.*
2. Background noise has no *effect* on the accuracy of the experiment.
3. Electric conductors *are provided with* a covering of flexible material.
4. The set *includes* a noise generator and a receiver.
5. The equation *involves* a series of volume terms.
6. These units have a *restricted* speed of response.
7. This paper *concerns* experimental control systems.

8. Phosphorus is stimulated electrically or *by some other means.*
9. Scientists can accurately *compute* the course of the rocket.
10. The *outcomes* of these experiments vary from one investigator to another.

IV. Fill in the blanks with the roots and their derivatives: mathematics, mathematical, mathematician(s), science, scientific, scientist(s).

1. The students study at the Department of Computing... and Cybernetics.
2. He is a great... in the theory of elasticity.
3. They solve... problems.
4. ... statistics plays an important role in solving many problems of... and engineering.
5. Modern... operates with zero concept in many different ways.
6. ... do not have enough evidence to fix the period in history of the invention of cardinal numbers.
7. Most... claim there is great beauty in... .

V. Match a word in A with its antonym in B.

A			B		
1	variable	8 division	*a*	incorrect	*h* lose
2	dividends	9 limited	*b*	approximate	*i* improper
3	correct	10 rest	*c*	loose	*j* improbable
4	fixed	11 symmetrical	*d*	liquid	*k* motion
5	solid	12 probable	*e*	invariable	*l* multiplication
6	exact	13 proper	*f*	losses	*m* asymmetrical
7	find		*g*	boundless	

VI. Fill in the gaps with the following expressions: the reason is that..., the reason why..., by reason of, for reason of, for what reason?, what is the reason for..., whatever the reason, the cause of... (3), to have every reason to believe that....

1. The relation between Cantor's set theory and mathematics never, in fact, ran smooth. The theory seemed shocking, contradictory and counterintuitive. That was.....

there was great resistance to it on the part of the mathematical world.

2. To correct the defects in Euclid's *Elements* many axiom systems were suggested. Among them Hilbert's system had the most profound effect. What is the..... such popularity? The first..... he is known as one of the outstanding mathematicians of the 20th century. The second..... his system as compared to the others is most similar to Euclid's. ....., Hilbert's system, though revised and refined over the years is still in existence.
3. The three famous problems of Antiquity were discarded... ..... unsolvability.
4. ..... does Fermat's conjecture generate great interest among mathematicians?
5. In this construction nickel was chosen..... economy.
6. We have..... that future belongs to computers.
7. The general theory of relativity was the..... heated arguments between its successors and competitors.
8. Kepler affirmed: "The reality of the world consists of its mathematical relations. Mathematical Laws are the true... ... phenomena".
9. A thunderstorm was the..... the power cut.

VII. Choose the proper verb. Consult your dictionary.

change — alter — modify — vary

1. The orange colour of the solution... to green.
2. We must... the reaction conditions from those usually employed.
3. Space charges, in the form of ions and other charged particles can radically... the electric field.
4. Climatic... may result from fluctuations in the oceanic circulation.
5. Mathematicians, in their search for representations of solutions, often... the meaning of "solution".

6. If an "X" and "Y" can be related through an equation or graph they are called "variables", i.e. one... in value as the other... in value.
7. The absorption of infrared emission... the atmospheric temperature.
8. The volume... linearly with the temperature.

III. Reading Comprehension

Supply the English equivalents.

Archimedes of Syracuse (c. 287–212 B. C.)

Greek математик who in his *Измерение Окружности*, Quadrature of the Parabola and On Spirals занимался трудными проблемами of description and mensuration в планиметрии. Сравнимая по масштабу работа в стереометрии была отражена [to display] in his *О Сфере и Цилиндре* and *On Conoids and Spheroids*. Equally original was Archimedes' *On Floating Bodies*, первое приложение математики к гидростатике and his work on the lever, specific gravity and центра тяжести разнообразных тел. В чистой математике ему удалось [to succeed] решить кубические уравнения, squaring a parabola, and summing higher-series as well as, in *The Sand Reckoner*, приводя обозначения для представления of very large numbers.

Unit 2

I. Grammar

I. Fill in the auxiliaries: is, are, was, were, has been, have been.

1. Mathematics and art... closely identified from ancient times.
2. In ancient Greece mathematics... transformed from a tool to an art.
3. Maths and art... fused harmoniously during the Renaissance.
4. The connection... reinforced again in the last century.
5. When a mathematician... confronted with a problem he does his best to solve it.
6. Despite the repeated efforts of the best Greek mathematicians the problem..... solved.
7. Such proofs of impossibility... effected by the ancients.
8. Since then any discourse conducted by formal axiomatics ..... regarded as a branch of pure maths.
9. The potentialities of the new logic as a scientific instrument... already... indicated.
10. Much progress..... made in analytic number theory since that time.
11. It ... estimated that Euler's collected works constitute 100 large volumes.

II. Present Perfect or Past Simple?

1. Lobatchevsky (succeed) in creating a new geometry.
2. Mathematical logicians (show) that for many interesting axiomatic theories the notion of theorem is not effective.
3. Simultaneously Cantor (begin) to develop the theory of sets of real numbers.
4. Modern arithmetic (begin) with Fermat.
5. Over the past twenty years mathematical statistics (assume) an increasingly major place in the sphere of applied mathematics.
6. Mathematicians (argue) for a long time about the "foundation" of probability theory.
7. That was how Galileo (discover) the "laws" of a simple pendulum.

III. Fill in the modal verbs **can** or **must**.

1. The mathematician's patterns, like the painter's or the poet's, ... be beautiful.
2. What is beautiful in mathematics... never be merely skin-deep.
3. But what... mathematics say about harmonic combinations of sounds?
4. Even the layman... soon learn to speak Fourier's language.
5. Every layman... know the foundations of maths.
6. ... every mathematician introduce any symbols he likes into the language of maths?
7. ... a scientist understand the meaning of the unfamiliar symbol in a formalized text?
8. We... ask whether there are general criteria which mark a good mathematical problem.
9. One... distinguish between mathematical objects and the mathematical method.

IV. Choose the correct form.

1. Every mathematical problem must be settled/settle either in the form of a direct answer to the question imposed, or by the proof of the impossibility of its solution.

2. One can in theory be proved/prove any theorem directly from the axiom.
3. It can hardly be denied/deny that the choice of axioms is creative work.
4. We can be stated/state therefore that the axioms imply theorems.

V. Find a mistake in each sentence.

1. The language of maths is consisted mostly of signs and symbols.
2. Any man of average intelligence can had access to mathematics.
3. In the 19th century it has been proved that the problem defies solution under the restrictions specified.
4. We can to draw a line determined by any two points.
5. People is responsible for their future.
6. The Spartans was a warlike people.
7. A logical deductive system must starting with a list of definitions.
8. In the 20th century the study of "abstract spaces" begun.
9. Can be assumed the field axioms?
10. The statistical methods has led to the idea of a statistical law.

VI. Ask questions about the statements.

1. It can finally become impossible for a single person to embrace all the areas of this knowledge. (What...)
2. The solution of the problem can be found by means of higher algebraic curves. (How...)
3. These problems are mostly of a standard type. (What type...)
4. Various mechanical solutions were used by other Greek mathematicians. (By whom...)
5. The further development of the method revealed its power. (What...)
6. The proof was not really understood. (Why...)

7. The problem has emerged in the past decade... (Since when...)
8. The method must be well developed. (What...)

VII. Give the Past Participle of the following verbs:

a) learn	*b*) develop	*c*) base	*d*) make	*e*) use
f) devise	*g*) represent	*h*) obtain	*i*) constitute	*j*) solve
k) add	*l*) work	*m*) deal	*n*) remain	*o*) call
p) appear	*r*) observe	*s*) express		

VIII. Find a word dropping out of a row:

a) mathematics, economics, physics, arithmetic, scientific
b) mathematical, economic, physical, arithmetic, scientific, politics
c) added, tripled, applied, called, counting, had, expressed

IX. Fill in Participle I or Participle II.

1) Maths is a (live) plant which flourishes and fades with the rise and fall of civilizations, respectively.
2) The creative work in maths is (do) by individuals.
3) An (educate) mind is (compose) of all the minds of preceding ages.
4) Much of the scientific knowledge is (produce) by deductive reasoning.
5) Nobody speaks the (formalize) language of maths.
6) The numbers (use) in counting, such as one, two, three, are called "cardinals".
7) (Use) these simple rules the ancient Greeks were able to create a great deal of first-rate mathematics.
8) Menaechmus gave two solutions, one (involve) the intersection of two parabolas, and the other the intersection of a hyperbola and parabola.
9) Up to the 19^{th} century axioms were considered as basic self-evident truths about the concepts (involve).
10) Details (concern) the discovery of incommensurable quantities are lacking.

11) Though not (concern) with a universal method in philosophy, Fermat sought a general method for working with curves.
12) (Guide) by the methods of geometers Descartes carefully formulated the rules that could direct him in his search for truth.
13) Laws are simple (guide) threads, the main threads of experimental knowledge we draw from nature.
14) The only numbers (accept) by the Greeks were the natural numbers.
15) These devices (accept) a low-energy signal modify it.

II. Vocabulary

I. Translate the sentences into Russian.

1. Mathematics has changed drastically *since* that time.
2. *Since* each such term can represent a simple sound, the theorem says that each musical sound is merely a combination of simple sounds.
3. Mathematics is known as the most exact of all the sciences *since* the proper use of its methods can provide only one correct answer to a specific problem.
4. *Since* the position of a point in space depends upon three rectangular coordinates, these coordinates are conceived as functions of t.

II. Fill in the gaps with the derivatives of the following words:

solve, develop, compute, science, apply,
express, history, long, algebra, importance.

1. It has not proved feasible to obtain a... of this equation.
2. The control of frictional heat has been one stumbling block in the... of this method.
3. Data from the acquisition system can be fed into a....

4. Educated people must be familiar with all the important... developments of their day.
5. The analysis is dependent on the... of a satisfactory mixture law.
6. Some mathematical... are helpful.
7. This statement is mainly of... interest.
8. The apparatus consists of a tube 5 inches in....
9. To avoid much... manipulation we used a simple shortcut method.
10. Each of these factors is... to the end results.

III. Fill in the prepositions.

1. The lamp radiates light from the arc instead... from the electrode.
2. The research is of great importance... the country's economy.
3. Various solutions... the simple diffusion equation may be employed.
4. The article deals... the modifications at the power stations.

IV. Fill in the gaps with the correct form of the verbs and their derivatives.

1. *differ, different, difference*
   a. The effects of the errors on the results will....
   b. There is a great... between these two theories.
   c. The solution... in the fact that only certain amounts of vibrational energy are allowed.
   d. The... of approach to the experiment resulted in... outcomes.
   e. The method... from the above in that it commences with the shock Mach number.
   f. The same result may be obtained by... pathways.
2. *vary, varied, various, variety, variation*
   a. This equation has many applications in... fields.

b. Molecules are emitted from the comet's nucleus in a... of fashions.
c. Any... in the width between different ring grooves should be corrected.
d. Three general classes of stainless steel have been developed to produce such... properties.
e. These products... in size and value.

3. *devise, develop, work out, elaborate, evolve*
a. Newton... (or...) his own theory of gravitation.
b. In the second phase Kepler... a theory for the longitudes of Mars.
c. This technique was... (or...) originally for metallurgy.
d. A tentative hypothesis was....
e. New methods of energy conversion have been....
f. Experiments must be... to test this suggestion.
g. These petroleum resources are already under....
h. A variety of new experimental tests of gravitation theory has been....
i. Maths ranks among the highest cultural... of man.

V. Choose the proper word. Consult your dictionary.

speed — velocity — rate

1. Since the... of light is extremely great, we cannot measure it by ordinary means.
2. We know the... of a particle to be continuously changing if this particle has non-uniform motion.
3. A measure of... of motion equal to the distance moved per unit time is called....
4. The loud noises caused at the ground by an airplane flying faster than the... of sound will have to be brought under control before supersonic transports can come into service.
5. If a body is subject to no external force whatever, the center of mass will move in a straight line with constant... and the angular momentum will be constant in both direction and magnitude.

6. It is clear that the... of a machine is an essential factor in the consideration of the overloading of wings, and hence it is natural to expect the overloading to be a maximum when the... is greatest.
7. The minimum relative... required for two bodies to fly free of their mutual gravitational attraction is called the gravitational escape....
8. The... of a falling body is proportional to the time.
9. In raising a weight with a lever, we lose in... what we gain in force.
10. Mathematicians created a new term to designate the study of calculating the... of change of slope and curvature. We refer to the study which yields such... as differential geometry.

VI. Use the word **such** in different combinations:

1. Input to the computer is provided with... things... punched cards or punched papertape.
2. Storage is provided by a device..... a rotating magnetic drum or by magnetic cores.
3. It is easy to realize when electricity flows in... a circuit — only if both the first and the second switches are closed.
4. Let's choose the coefficient..., that the product changes sign.
5. The plan of Euclid's *Elements* is as follows. It begins with a list of definitions of... notions... point and line. Next appear various statements some of which are labelled axioms and other postulates. Using... axioms and postulates... a basis for further reasoning Euclid constructs the whole system of geometry.

III. Reading Comprehension

Supply the English equivalents.

Cauchy, Augustin Louis (1789–1857)

French mathematician who стремился ввести более строгий подход к анализу. In his *Cours d'analyse (A Course of Analysis)* he ввел современное понятие предела и продолжал использовать его для определения важных понятий of continuity, convergence and differentiability. In group theory Cauchy доказал in 1845 the fundamental theorem с тех пор известная как теорема Коши that every group делимая by a prime p содержит a subgroup of order p. He also внес вклад в the calculus of variations, probability theory and the study of differential equations.

Unit 3

I. Grammar

I. Fill in the auxiliary verbs: is, are, was, were, will be, have been, has been.

1. For a long time the subject matter of algebra... written out in common language.
2. Any development toward a more compact way of displaying complex relationships..... regarded as a fundamental advance.
3. Such advance in the field of algebra... made by French mathematicians.
4. New algebraic structures..... created in the past twenty years.
5. The domain of algebra..... lately profoundly expanded.
6. Such problems... usually solved in algebra.
7. In Egypt computations... handled mostly by the priests.
8. This method... widely used in science.
9. The solution to this equation... never... found.

II. Ask questions about the statements:

1. A line segment is to be regarded as made up of points. (What...?)
2. The new role of indivisibles was adopted during the Renaissance period. (When...?)

3. The theory of measure will be extended to space of higher dimensions. (Where...?)
4. Many contemporary mechanical problems cannot possibly be solved. (Why...?)
5. Numbers or the written figures called "numerals" have a long history. (What...?)
6. Number names were evidently the first words used when people began to talk. (What...?)
7. Mathematicians speak only the formalized language of maths. (Who...?)

III. Fill in: can, must, is/are to.

1. This proof... be relied on.
2. Such results... be wondered at.
3. From this point of view Quantum Mechanics... be judged highly successful.
4. The principles of Quantum Mechanics... never fail.
5. Both theories... to be reconciled.
6. The centre of the system... to be assumed as immovable.

IV. Choose the right form.

1. We can't understand/to understand what is going on inside a star.
2. The most precise description of nature must be/to be in terms of probabilities.
3. Both experiments are proved/to prove the initial assumption.
4. They wonder whether these elements will ever detect/be detected.
5. One can conclude/be concluded that a body should contract in the direction of its motion.

V. Find a mistake and correct it.

1. An electron must to have a wavelength associated with it.
2. Can scientific laws discredit by the discovery of exceptions?
3. The equation is be solved by other means.

4. The group concept will not recognize as explicitly as were some of its axioms.
5. To investigating the structure of a group more profoundly it is necessary to introduce addition as a second operation between group elements.

VI. Open the brackets and put the verbs in Active or Passive.

1. There will (give) a formal definition of the group.
2. This definition is to (consider) as a formal operation.
3. These ideas can (illustrate) by the following alternative definitions.
4. They will (reason) in terms of words rather than simply in terms of numbers.
5. Can the computer (respond) to man's questions?

VII. Give the three forms of the following verbs:

mean	—	write	—	read	—	tell
understand	—	raise	—	rise	—	show.

VIII. Infinitive or ing-form?

1. (Construct) continuum mechanics we need various curvilinear coordinate systems.
2. (Test) the validity of the arguments, one must use diagrams.
3. Logic is the study of how (draw) conclusions validly.
4. This is the simplest model (describe) the dynamics of a pitch.
5. Their work is considered the major breakthrough in (found) the mathematical theory of probability.
6. (Answer) this question we must point out the specialization of general problems in the theory of additive functions.

IX. Choose the right sentence.

1. a) In this book we will be concerned mainly with the logical foundations.

b) In this book we will concern mainly with the logical foundations.
c) In this book we are concern mainly with the logical foundations.

2. a) The model developed can briefly describe as follows.
b) The model developed can briefly to be described as follows.
c) The model developed can briefly be described as follows.

X. Match A and B to make a question.

A	B
Do	a) the mathematical concept of motion satisfy our conception of the physical phenomenon of motion?
Does	b) new symbols often appear in maths?
Who	c) was the meaning of geometry extended to the ordinary space of solids?
What	d) the theory be developed?
Will	e) considered geometry as a logical system?

XI. Fill in **some**, **any** or **no**.

1. The denominator of a common fraction may be... number.
2. Have there been... new discoveries about the universe in the past years?
3. ... scientists believe that we use only 1% of our brain's full potential.
4. When... part of the brain is damaged, people lose the ability to do certain things.
5. But even a rudimentary understanding of memory isn't... better.
6. ... new hypotheses have been recently put forward.
7. ... suggest that the structure of a nerve pathway changes when data are preserved.
8. There are... new approaches to the problem.
9. The student must always remember that the understanding of... subject in maths presupposes clear and definite

knowledge of what precedes. That is the reason why there is... royal road to mathematics.

10. These machines can in... way be distinguished from each other.
11. That solution was by... means the limit of what could be achieved.
12. One may ask today whether a geometry is based on a set of consistent postulates, whether these postulates are independent of one another, or whether this geometry serves better than another geometry for a given application. But the question of whether a geometry is "true" has... place in pure science.

XII. Fill in the articles if necessary.

1. Mathematics is closely related to... art and... music.
2. Let me give you... advice.
3. ... Knowledge about the universe has been accumulated by man since the dawn of our civilization.
4. By... modern maths we mean... maths of the past century.
5. Model designing is... art in... science.
6. It is doubtful if any detectable amount of this element occurs in... nature.
7. These particles would be recognized as examples of a new form of... matter.
8. An exact solution by... computer is preferable in this case.
9. It is... good practice with scientists not to take anything for granted.

XIII. Fill in the gaps with: little, a little, much, many, few, a few, a great deal of, a lot of, any, some, a piece of, great.

1. ... mathematicians assert that there is great beauty in maths.
2. Maths created by the Greeks shows... ingenuity and sophistication.
3. It is a fine..... poetry.

4. I have... news for you.
5. ..... of information about processes in the upper atmosphere is communicated by satellites.
6. There is... evidence in favour of the steady-state theory.
7. Not... is known about the outline of the continent.
8. ..... examples can be supplied here to illustrate the case.
9. Are there... proofs of this theory?
10. ... progress toward an understanding of the origin of life has been achieved.
11. ... volume of research has been carried out.
12. There is not... evidence for the existence of different worlds.
13. The water level is..... below the level of the spray jet.
14. ... if any relationships can be detected here.

II. Vocabulary

I. Fill in the gaps with the derivatives of the following words: relate, mean, divide, repeat.

1. Mathematical biophysics stands in the same... to experimental biology as mathematical physics to experimental physics.
2. What is the... of this term?
3. ... of 20 by 5 yields 4.
4. The atoms are bound in a... three-dimensional array.

II. Fill in the gaps with prepositions.

1. We find that the period of revolution is equal... 273 days.
2. The rate of flow in weight units is the volume of flow multiplied... the density of the fluid.
3. M should be divided... i.
4. F is raised... the third power.
5. Arrange the system... such a way that electrons flow through a wire.
6. Aeronautics is the art and science relating... the flight of aircraft.

III. Give the mathematical expressions of the following operations:

a) a root of two;
b) 10 to the ninth power;
c) proportional to the inverse sixth power of the distance Earth–Moon;
d) four-thirds power of Z;
e) the volume to the $2/3$ power;
f) this number is proportional to the four-thirds power of Z;
g) the distance x squared;
h) tbe square root of 2;
i) the cube root of 87;
j) the square root of -4 is x.

IV. Give several names for the figure **0**.

V. Fill in the verbs **(a)rise** or **raise**. Consult your dictionary.

1. Paradoxes..., it seems, from failure to persue a generalization far enough.
2. A question... as to the method of tackling the problem.
3. Cable television has... a number of issues that remain to be solved.
4. Unemployment... by 5% last year.
5. Computarisation... standards of service hundred fold.
6. In large cities air polution has... above an accepted level.
7. The plans for a new nuclear station have... angry protests from the local residents.
8. The problem defies a solution unless the imposed restrictions are....
9. An air-cushion vehicle... a few feet above the surface.
10. When Nikolas Lobatchevsky was seven years old his father died leaving his family in extreme poverty. Nikolas and his three brothers were... by their mother.
11. This organization... funds for charity.
12. An industrial robot is designed to... heavy sheets of metal from a conveyor.

VI. Fill in the gaps with the following expressions: except for, except that, except for the fact that, all except a few, all except one, except.

1. ..... some notes in the book, no proof was found.
2. The filter eliminates..... colour.
3. ....., diamonds are non-conductors of electricity.
4. The assembly resembles a squirrel-cage..... the disks are tilted with respect to each other at an angle of eight degrees.
5. The law holds for all cases... one.
6. The problem in an arithmetical progression Gauss solved was an ordinary one ..... for a boy of ten to find it instantaneously by himself was not so ordinary.
7. We have already seen that the longest distance joining the two points is the other arc of the same great circle, ... in the case when the points are ends of a diameter, when shortest and longest are equal.

VII. Fill in the gaps with: in a like (or similar) manner, similarly, much like (much the same as).

1. The asthenosphere behaves very..... a true fluid.
2. For fast waves the situation is... to that in gas dynamics.
3. Gases behave approximately.....
4. ..... it is sometimes useful to consider alternatives.
5. The characters of the language are the basic, indivisible configurations in terms of which the language is written. ..., for an automatic programming language the characters that can be utilized must be listed and agreed upon.

III. Reading Comprehension

Put the words in brackets in the proper form, supplying the missing prepositions.

Descartes, René du Perron (1596–1650)

French mathematician and philosopher who in his La Géométrie (1637) (to introduce)... mathematics the fundamental principles and techniques... coordinate geometry. He (to begin)... a solution... the problem of the four-line locus, (to go on) to show how to draw tangents... curves and... the final part (to deal) with the solution of equations of degree (high) ... two, (to describe) also the rule (to know) as 'Descartes's rule of signs'. In the area... notations it... Descartes... (to introduce) the system... indices (x^2, x^3 etc.) and who (to begin) to employ the first letters of the alphabet to refer... (to know) quantities and the ... letters to represent unknowns. The adjective Cartesian (to derive) from the name.

Unit 4

I. Grammar

I. Fill in the Modal Verbs: can, may, must.

1. The problem... be divided into two groups.
2. A third category... include what is known as Diophantine equations.
3. P. Fermat... be awarded the honour of being the originator of number theory as a systematic science.
4. We... assume that n is odd.
5. Such representations... under certain conditions be useful for factoring.
6. It... be supported that the early Greeks were not very much interested in numeration.
7. This notion... not be precisely defined.

II. Open the brackets and put the verbs in the Active or Passive Voice.

1. The final outcome may (describe) as an analysis of the structure of fields.
2. The generic concept of structure may (explain) quite simply.
3. This may (consider) still simpler or less sophisticated.
4. The mixed structure may (appear) in elementary cases.
5. A considerable diversity can (observe) among the great types of structures.

6. One cannot (hope) to have a complete list of such types of structures.
7. Such a number x cannot (find) in our extended system of real numbers.

III. Fill in the auxiliary verbs: didn't, have, has, are, will, was, is.

1. Thus he... reach his desired conclusion.
2. The new role of indivisibles... adopted through the work of Galileo's disciple.
3. Up to this point we... stressed the similarity between the ancient method of exhaustion and the modern formulation of the calculus.
4. Very often a mathematician... faced not only with one thing that is changing.
5. To understand how they... related to one another, he graphs them together on a set of coordinate frames.
6. It... make clear the different roles of dependent and independent variables.
7. No corpuscular theory based on Newtonian Mechanics... produced formulae for the specific heat of solids.
8. The general physical laws in themselves... suffice to determine the deformation of a body subject to given loading.
9. The theory... been widely developed in this field for the case of ideal gases.

IV. Correct a mistake in each sentence.

1. We may now to be tempted to use this figure as an estimate of μ.
2. We may be said that we estimate the "average" I. Q. of the entire group as 108.
3. We didn't took a sample of 15 of the individuals.
4. What are meant by the term "population"?
5. These rules must usable in practice.
6. The enumerator doesn't must decide whether a doubtful case belongs to a population.

V. Ask questions about the statements.

1. Ancient Athens of Aristotle's time provided a great variety of view points and thinkers. (What...?)
2. The aim of the calculus of probabilities is to give a mathematical theory to random phenomena. (What...?)
3. The new approach began with the analysis of the state of affairs. (How...?)
4. Zeno devised a good number of puzzles which have philosophical interest. (general question).

VI. Match A and B to make a question.

A	B
When	a) this type of phenomenon been frequently repeated during the current century?
What	b) has probability theory advanced significantly in the last one hundred years?
Why	c) we draw a sample of 5 of these numbers?
Can	d) will the experiment last?
How long	e) was meant by a stochastic process?
Has	f) did modern mathematics reach full momentum?

VII. Give the three forms of the verbs: leave, mean, read, see, make.

VIII. Past Simple or Present Perfect?

1. Modern maths (reach) full momentum in the 20^{th} century.
2. During the war military management (call) on scientists to assist in solving problems.
3. As we (imply) the optimum solution either maximizes or minimizes some linear combination of the variables.
4. Galileo (offer) a totally new concept of scientific goals.

IX. Present Simple or Present Perfect?

1. Like the axioms of Euclid, Newton's formulas (serve) as a logical basis for other valuable laws in mechanics.
2. There are two ways in which mathematics (become) so effective.
3. Medicine (model) itself on mathematics ever since its creation.

4. We (owe) the word "algebra" to an Arab mathematician.
5. Nearly all mathematicians of distinguished rank (treat) this subject.
6. The most prominent mathematicians (try) their skill on Fermat's last theorem ever since its announcement three hundred years ago.
7. Fermat's problem (remain) remarkably active throughout its history, and results and research on it still (appear) frequently in mathematical journals.
8. According to the steady-state theory the universe always (exist) and its expansion (compensate) for by the continuous creation of matter in such a way that the average density (remain) constant.

X. Supply ordinal or cardinal numerals for the following Russian equivalents.

1. ($2^{a.s}$) and better known story is also told of the source of the problem.
2. (Одна) of the (трех) famous problems of antiquity was to find a geometrical construction for the edge of a cube.
3. It is difficult to memorize at (одним взглядом) a string of (8) digits: 20, 9, 11, 12, 16, 15, 13, 19.
4. Each galaxy contains (мириады) of stars.
5. Opium contains about (2 дюжины) different alkaloids.
6. The great Swiss mathematician L. Euler — "Analysis Incarnate" as Euler's contemporaries called him lived a long and prolific life — nearly 80 years (1707–1783). His scientific heritage constitutes about (тысяча) works, (550) of which were published in his lifetime.
7. (100) years ago it was difficult to imagine what progress maths would make in ($20^{o.m}$) century.
8. It appears quite likely that terrestrial planets could have formed from planetesimals. If they did, the formation was virtually complete about (100 миллионов) years after it began.
9. The age of the universe is estimated about (пять, умноженное на десять в девятой степени) years and it is

thought to contain (десять в 41ой степени) kilograms of matter.

10. Jupiter has (одну тысячную) the mass of the Sun.

XI. Pronounce the following common fractions:

1) $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{1}{10}$, $\frac{2}{5}$, $\frac{1}{12}$, $\frac{1}{16}$, $\frac{3}{4}$, $\frac{5}{6}$;
2) 7/256, 31/144, 19/56;
and decimals:
26.23; 3.142; 0.153.

II. Vocabulary

I. Fill in the gaps with prepositions.

1. The numbers are written... front... symbols.
2. The numerator is placed... the right of a dot called a decimal point.
3. Common fractions have been used... a longer time than have decimal fractions.
4. ... fact, decimals are easier to write and to print than are common fractions. It is also easier to compute... them.
5. ... these reasons decimals have come to be widely used in business, science and statistics.

II. Use the proper verb or one of its derivatives: to cut, to share, to split, to divide, to separate.

1. The line... the circle at two points.
2. A beam of white light on passing through a prism is... into its component colours.
3. Not all scientists... this opinion.
4. Constituents having different densities... under the influence of gravity.
5. Evidently, North America and Gondwana Land were together 1.15 billion years ago, but... apart shortly thereafter.
6. In the metric system all units are exactly... by 10 and 100.

7. Mathematics has several....
8. Kinematics is often treated as a... field of classical mechanics.
9. Dynamics is... into two branches: statics and kinetics.

III. Fill in typical expressions from your active vocabulary: in fact, so on, that is, to avoid, in order to, for example, to be closely related to.

1. Mathematicians employ the language of science..... ambiguity.
2. A sharp dividing line between "pure" and "applied" maths cannot,....., be drawn.
3. A more severe restriction of the tools..... with a compass alone limits the number of possible constructions.
4. ..... for the switching machine to work properly, the operations of the system must be synchronized.
5. Many mathematicians assert that the subject of maths is..... music.
6. Mathematical creations have design, symmetry, harmony, inner beauty and....., ... characteristics of art, in the long run.
7. Euclid's geometry is..... many other geometries.

IV. Supply different meanings of the word **figure**. Consult your dictionary.

1. In our study of Geometry we separate all geometric... into two groups: plane... and space... or solids.
2. The illustration of the model is shown in... 2.
3. Similar... have many geometric properties in common.
4. The latest unemployment... are discouraging.
5. Are you good.....?
6. When Gauss was 3 years old his great power..... became evident.
7. When the schoolboys were given a problem in an arithmetical progression and finished their calculations the... written by Gauss was the only one correct.

8. It would be difficult to carry out an 8... calculation without a computer.
9. How can you..... the volume of a cylinder?
10. The event was attended by many public....

V. Supply different expressions with **do** and **make**.

VI. Fill in the gaps with typical exressions based on **do** and **make**. Consult your dictionary.

1. This argument (не имеет смысла) since these series will never be used.
2. It (безразлично) whether type 400 or 399 is employed.
3. The data obtained (не имеют ничего общего) the preliminary assumptions.
4. Dirac's theory (не дала прогнозов) about the mass or size of the magnetic monopoles.
5. The Institute is equipped (чтобы произвести) research on foamed plastics.
6. It is necessary (провести) an experiment under the specified conditions.
7. 18 years ago a serious (усилие было сделано) to calculate the probability of a major reactor accident.
8. Can you (понять) the idea of the article?
9. The most likely a conjecture (выдвинутая) by the scientists is that the very centre of the Milky Way harbours a black hole.
10. Provision has been (приняты) for supplying more highly developed systems.
11. (Придумайте) a solution to the following problem.
12. Attempts (делаются) to modify the manufacturing process.
13. More heat was required to (компенсировать) the heat lost under compression.
14. The body cannot (обойтись без) glucose.
15. A crucial (решение) has been (принято) to dismantle the space station "Mir" this year.

16. All necessary arrangements for carrying out the experiment have been (сделаны).
17. A good engineer will (сделает все возможное) to minimize friction.
18. Once the new heliocentric picture of the Universe was suggested it could be assumed that the old Ptolemaic system of the universe would be (упразднена). In actual fact, it was not so simple. It took years for the new theory to win general recognition.
19. Considerable (успехи) have recently been (достигнуты) in the area of preventing water contamination.
20. Today the objective of the chemist is to aid in the interpretation of the universe: he has (достиг большого прогресса) toward meeting this objective.

Key words: *to make progress; to make advances in; to make efforts; to do one's best; to make a decision, an attempt; to have nothing to do with; to make provision, arrangements; to do an experiment; to make for; to make out; to do without; to make sense; to make no difference; to make predictions; to do research; to make up; to make a conjecture; to do away with.*

VII. Give synonyms to the expression: to perform an operation. Give examples.

III. Reading Comprehension

Put the words in brackets in the proper form, supplying the missing prepositions.

Descartes's Rule of Signs

A rule for (to find) the maximum number... positive roots... a polynomial equation. It (to depend)... the number of variations... sign... the polinomial; i.e.... the number of times the sign (to change) when the polynomial (to write)... descending order.

Thus $x^5+x^4-2x^3+x^2-1=0$ (to have) three variations... sign. Descartes's rule (to state) that the number... positive roots cannot (to be great) than the number... variations... sign (although it may (to be little). In the case above, it cannot (to exceed) three. The rule can also (to apply) for negative roots... (to replace) x by $-x$. Thus, in the example the equation (to become)

$$-x^5+x^4+2x^3+x^2-1=0$$

for which there (to be) two variations... sign.

Unit 5

I. Grammar

I. Fill in **a**, **the**, or nothing.

1. Maths is... clever servant for... science.
2. ... knowledge of the mathematical formulas doesn't represent knowledge about all... situations encompassed by... formulas.
3. Most mathematicians are not insensitive to... art and... music.
4. ... natural question is: which way is... best?
5. For... long time geometry was intimately tied to physical space.
6. In... 20^{th} century... study of... abstract spaces began.
7. They call the extracted statement... "rule", ... "law", occasionally... "principle".
8. The three basic functions of... computer — are all done by devices that have two stable states.
9. No signal can travel faster than... speed of... light.
10. Ford has produced... new four-door saloon car.

II. Choose the right variant.

1. a) She is going to do three-year degree course at Sussex University.
   b) She is going to do a three-year degree course at Sussex University.
   c) She is going to do three-years degree course at Sussex University.
2. a) A gravity is a force that holds together the hundred billion stars of the Milky Way.
   b) Gravity is a force that holds together the hundred billion stars of the Milky Way.
   c) The gravity is a force that holds together the hundred billion stars of the Milky Way.
3. a) Computer can adapt to the problem of translating languages.
   b) Computer can to be adapted to the problem of translating languages.
   c) Computer can be adapted to the problem of translating languages.
4. a) Man's technical progress is reflecting in the tools he has invented.
   b) Man's technical progress is reflected in the tools he has invented.
   c) Man's technical progress reflects in the tools he has invented.

III. Fill in Active and Passive forms.

1. The matter can (describe) in simple terms.
2. In this equation the brackets (denote) "set abstraction".
3. Today matter universally (regard) to be composed of molecules.
4. Matter commonly (find) in the form of materials.
5. Molecules in their turn will (regard) as composed of atoms.
6. The context makes it clear how many derivatives (assume) to exist.
7. The stress may (determine) from the strain alone.

IV. Fill in an Infinitive or an ing-form.

1. (Give) a brief introduction to the basic concepts of decision theory, let us define a decision function.
2. (Get) some light on the problem how many digits there are in the period of a repeating decimal Gauss calculated the digital representations of all the fractions $1/n$ for $n = 1$ to 1000.
3. Industrial as well as military demands began (draw) many established mathematicians away from academic life.
4. Facilities are not available for (perform) each activity in the most effective way.
5. The problem is (combine) activities and resources in such a way as (maximise) overall effectiveness.
6. A systematic procedure for (solve) the problem was made.
7. What made Kepler (believe) that way?

V. Give the three forms of the verbs: do, hold, build, give, break, fly.

VI. Fill in **is/are**.

1. Cybernetics... said to be concerned with the design of electrical analogs.
2. The concepts... said to have nothing to do with the controversy between the schools.

VII. Give the Degrees of Comparison of the Adjectives: good, bad, far (2 variants), late (2 variants), little, much.

VIII. Fill in the gaps with the correct form of the Adjectives.

1. Iron is (хуже) than copper as a conductor.
2. This model fitted the data (лучше всего).
3. The origin of this phenomenon is now (лучше) understood.
4. The device should be put to (лучше) use.
5. This product is (лучше всего) suited to our operation.
6. Of the three methods this one is the (наименее) known.

7. Pluto is the (наименее) known member of the Solar system.
8. The two (самых) widespread elements in the universe are hydrogen and helium.
9. The Earth is 8 times (более) massive than the Moon.
10. For (более малых) values of the coefficients of friction the angles lie between these extremes.
11. Interplanetory space is (далеко) from empty.
12. (Последние) achievements in science and technology give an opportunity for (дальнейших) investigations in the field of molecular physics.
13. (Последнее, но не менее важное), man's internal electrostatic processes rival in ingenuity any that man has been able to devise.
14. This isotope is called deuterium and its ions are called deuterons: these (последние) move with higher energy.
15. In the (последние несколько десятилетий) the big-bang theory and the steady-state theory have become popular. The (последняя) though being the main rival to the big-bang theory has (меньше) experimental support.
16. His (последние) years were full of honour, but Gauss was not as happy as he had earned the right to be. As powerful of mind and as prolifically inventive as he had ever been, Gauss was not eager for rest when the first symptoms of his (последней) illness appeared some months before his death.
17. During the (прошлого) century geometry was (далее) extended to include the study of abstract spaces.
18. R. Descartes and P. Fermat came to develop Analytic Geometry almost simultaneously. The (первый из названных) R. Descartes was a philosopher who devoted himself to profound thinking about the structure of the universe, the (второй из названных) P. Fermat lived an ordinary life as a lawyer and civil servant, but in his spare time he was busy creating and offering to the world his famous theorems.

19. We'll dwell upon the principal characteristics of the system setting aside the details for (последующего) study.

II. Vocabulary

I. Provide related nouns: behave, press, produce, high, move, consider, separate.

1. Many aspects of ionic... in biochemical systems are still not fully understood.
2. Other methods have received much....
3. These steels cause many problems during....
4. The liquid maintains a nearly uniform concentration throughout the... of the column.
5. The...of the Earth's equatorial surface is 1.000 miles an hour.
6. Both processes require physical... of the liquid phase from the solid phase.
7. The metering system is kept under....

II. Fill in the gaps with prepositions.

1. Argon makes... almost 1% of the air.
2. At time $t = 0$, the mass is... rest.
3. The box was made... plywood.
4. The body is moving... a constant speed.
5. The conductors are separated... thin sheets.
6. We are concerned... computer design problems.
7. The data show direct relationship... CO content and PH.
8. The liquid is... equilibrium with the vapour.
9. Lead nitrate is often used to make nitrogen dioxide... the action of heating.

III. Put in the English equivalent for the Russian *после того, как*.

1. ... a given compound has been identified, the analysis is repeated.

2. Nowhere in the junction may carrier densities increase or decrease... the dynamic equilibrium is established.

IV. Use the proper verb or one of its derivatives. Consult your dictionary: to estimate, to evaluate, to appreciate, to value, to appraise, to assess.

1. We... that the work may take 2 weeks.
2. It is difficult to... the Greeks' contributions to mathematics.
3. The lower limit is... at 0.002 mg.
4. We... the efforts of scientists in exploring space.
5. The losses of gas can be... at about 2.7 kg.
6. In order to... Copernicus's theory, its revolutionary advance in science one should take into consideration an unbearable pressure of medieval dogmas which dominated at that time.
7. The scientists... the document as authentic.
8. The company ordered software to the... of $700.
9. Young people have a different set of... from their parents.
10. Find the... of x.
11. According to official government... a decline in the... of the rouble will slow down.
12. An initial... of the magnitude of this contamination was erroneous.
13. In my..., this problem defies solution.
14. A correct... can be formed only if a sample is large enough.

V. Use the proper verb: to produce, to cause, to effect, to manufacture. Consult your dictionary.

1. The x-rays can... chemical changes in the environment of the chromosomes.
2. The ionization was... by the charged particle.
3. Bimolecular processes may... reactions at such low temperatures.
4. Viscosity... tangential stress at the body surface.
5. Nuclear tests... alarm in the scientific community.
6. This heat is used to... a chemical reaction.

7. Each week the plant... thousands of such units.
8. Great minds of Greece such as Pythagoras, Euclid, Archimedes etc., ... an amazing amount of first-rate mathematics.
9. Aside from its adverse effect on hydrodynamic performance, cavitation is often undesirable because of the noise and physical damage which it....
10. The ancient geometers invented higher curves to... the solution of the famous construction problems.
11. The research program has been... by a cooperative effort.
12. The acid is... commercially.
13. A sound is a pressure disturbance; a sonic boom, like other explosive sounds is... by an abrupt change in pressure. An airplane in subsonic flight... weak changes in pressure. Because these disturbances travel at the speed of sound, they move faster than the airplane and stay in front of it. In other words "the airplane sends a message" ahead warning the air to get out of the way. The air does just that parting in smooth curving streamline to pass around the airplane's surfaces. But a supersonic jet gets ahead of its own pressure disturbances. The air has no advance notice that the jet is coming: it must therefore get out of the way abruptly... a shock wave.
14. People lack confidence to... change in society

III. Reading Comprehension

Put the words in brackets in the proper form, supplying the missing prepositions.

Dynamics

A field of classical mechanics (to concern)... the study... the motion... material bodies... the influence... forces. Newton's laws ... motion (to form) the basis... this study. Dynamics can (to divide)... kinetics, in which the relationships... force and motion (to

consider) i.e. the effects... forces (to study), and kinematics, in which motion (to describe) without regard... its cause, i.e.... (to consider) the forces (to involve). Kinematics... however often (to treat) as a separate field... classical mechanics. Dynamics and kinetics, then, (to concern)... essentially the same subject matter and may (to consider) synonymous. Statics (to deal)... bodies... equilibrium... the action... forces.

Unit 6

I. Grammar

I. Give the plural form of the following nouns: a series, datum, momentum, equilibrium, vacuum, spectrum, nucleus, medium, continuum, axis, crisis, basis, analysis, nebula, hypothesis, index, vertex, radius, modulus, genius, automaton.

II. Give the three forms of the irregular verbs: lie, lay, find, begin, make, tell, do, hold, give, throw, keep, sweep.

III. Find a mistake.

1. The scope of Galileo's interests and activities were unbelievably broad even for a great intellect of the Age of Geniuses.
2. The elements in terms of which a motion is described are: Position in Space and Time.
3. It often happens that the same special problem find application in the most diversed and unrelated branches of mathematics.
4. Newton was the first creating the law of universal gravitation.
5. One of the great contribution of mathematics to physics is Relativity.
6. A gravity is a force that holds together the hundred billion stars of the Milky Way.
7. Gravity makes the Earth to rotate around the Sun.

8. Mathematical deduction produces knowledges of the physical world.
9. It was until the early 1600's that the long-established beliefs were challenged.
10. Have we to pay tribute to Cantor's contribution to the development of Mathematical Logic?
11. Offsetting Aristotle's hypothesis he determined that all bodies fall at even rates if the air resistance will be discounted.
12. In his experiments Galileo noticed that light bodies were falling more slowlier.
13. Let a body to fall from a height of 300 meters.
14. Stevin and Galileo lay the foundations of applied mechanics.
15. Scientists need an imagination, an insight, a curiosity, a persistence to make great discoveries in science.
16. It were the natural numbers that were the only numbers accepted by the Greeks.

IV. Open the brackets and put the verbs in the Active or Passive Voice.

1. Zeno of Alea might (to call) the forerunner of the concept of mathematical infinity.
2. Experience with computer has shown that the data manipulated by programmes can (to represent) virtually anything.
3. To-day topology may roughly (to define) as the mathematical study of continuity though it still reflects its geometrical origin.
4. We may (to want) to know how we can (to represent) inside a computer the fact that a particular action may (to have) multiple effects besides those intended when the action was made.
5. A. I. researches still do not have enough evidence to decide whether machines can (to make) as intelligent as human beings.
6. Any discussions of artificial intelligence raise the question of how the study of thinking machines should or could (to influence) our phylosophical and psychological concepts.

7. The techniques for processing images can (to apply) not only in scientific research and medicine but also in fields such as criminology and military intelligence.
8. Scientists hope that gravitation may (to provide) a key to understanding processes in a microcosm at the quantum level.
9. It is at the junction of quantum and gravitational ideas that scientists can (to expect) to make the most sensational discoveries.
10. When we are finding Hook's law our spring may (to be twisting), the load may (to paint) different colours, the load may even (to be evaporating) but ignore those distractions. Or our spring may (to be growing) hotter, then we find the stretch changing less simply.

V. Open the brackets, using the correct forms of the verbs **to have to, to be to.**

1. Nowadays geometry... (to be defined) in an entirely new way.
2. In 1872 Cantor published a paper that included a very general solution to his problem of number continuum together with the seeds of what... later (to become) the theory of transfinite sets.
3. A man supplied with cybernetics devices — the products of man's reason — thinks deeper, wider than a man who... (to resort) only to his own intellect.
4. Recently a new theory of gravitation has been advanced. To solve the question which theory is correct — the new theory or Einstein's theory of relativity — there... (to be) more experiments.
5. For such new theories to be viable they... (to meet) criteria that are steadily becoming more rigorous.
6. In modern atomic physics, where nature provides us with velocities close to that of light, Galileo's transformation fails and it... (to replace) by the Lorentz transformation.

7. The problem is so important that it is not easy even to assess the revolution in physics, if the gravitational waves... (to discover).
8. Plank... (to find) some theoretical justification for his radiation formula.
9. The deep significance of certain problems for the advance of mathematical science and the important role which they play in the work of the individual investigator... not (to deny).

VI. Put questions to the following sentences, paying attention to the verb **to have to.**

1. The early Greeks had to give special attention to geometric constructions.
   (Why...) (tag question)
2. This principle has to be replaced. (Why...) (tag question)

VII. Ask questions about the statements.

1. Einstein's theory of relativity is being challenged. (general question) (Whose...)
2. Three astronomers from the university of Arizona have recently found that the Sun is not a perfect sphere as Einstein assumed it was. (What...)
3. One of Galileo's early discoveries was the remarkable property of a pendulum: that (for small amplitude) the time of swing is independent of amplitude. (What...)
4. Galileo had to yield to demands of Church. (Why...)
5. That inconsistent theory has to be revised. (What...) (Why...)
6. Quantum mechanics must be judged highly successful. (How...)
7. Galileo had died a year before Newton was born. (When...) (tag question)

VIII. Open the brackets and use the Continuous-Aspect forms of the verbs given in brackets.

1. Scientists (to set forth) ideal schemes for science, but there is no one scientific method.
2. Hooke, Halley, Huygens and many others (all to seek) to reach a unified theory for celestial and earthly motion.
3. Nowadays scientists (to follow) Galileo and Newton in their scheme of scientific method: they collect information, extract rules, frame hypotheses, deduce consequences, test deductions, verify the results.
4. The planetary laws (to verify) in to-day's cosmic flights.
5. It (to assert) widely a hundred years ago that science had finally abandoned its early materialistic taint swinging strongly towards religion and misticism.
6. The knowledge of nature (to codify) by ancient scientists in simple laws.
7. Kepler found simple curves — ellipses — along which the planets (to move), sweeping out equal areas in equal time.
8. The universal law of gravitation (to claim) more and more attention from scientists.
9. How far scientists' theoretical thinking (to develop) at a given time in the future depends on the state of knowledge and interest.
10. Scientific laws (to view) now as algorithms.
11. Computation (to establish) a new approach to many problems.
12. The velocity at which the universe (to expand) (to decrease).
13. Currently the length of the day (to increase) by approximately two milliseconds per century and the moon (to spiral) away from the earth at about three centimeters per year.
14. Nowadays incurable diseases (to attack) by scientists on a large scale.
15. These experiments (to carry out) now by two groups of scientists simultaneously.
16. The information obtained (to check up).

IX. Translate the sentences paying attention to the -ing forms of the verbs. What parts of speech are the -ing forms used below?

1. In specifying gravitation on the new geometrical view Einstein did not prove "Newton's Law of Gravitation" wrong but offered a refining modification though this involved a radical change in viewpoint.
2. When two bodies collide they keep on moving for some time due to inertia.
3. Electromechanics covers topics regarding the nature of the mechanical and electrical properties of the interacting medium.
4. After carefully considering the parallel axiom, Gauss gave a criterion for determining the truth of Euclidean geometry: measuring the angles of a triangle must decide which geometry fits the physical world in the particular case.
5. The rotation of the universe can serve as one more observable phenomenon confirming the correctness of the general theory of relativity with the already known expansion of the universe, the deflection of star light near the Sun etc.
6. What can we find out about space? Where is its fixed framework and how fast are we moving through it? Nowadays we find the Copernican view comfortable and picture the spinning Earth moving around the Sun with an orbital speed of about 70 000 miles/hour. The whole solar system is moving towards the constallation Hercules at some 100 000 miles/hour, we must be carrying along a huge epicycloid through space without knowing it.
7. The general attraction is responsible for keeping the Earth and other planets on their courses around the Sun.
8. Nuclear reaction must be going in the stars to make them shine.

The Sequence of Tenses

X. Explain the use of tense forms in the following sentences.

1. In ancient times men did not think that the brain was the centre of mental activity.
2. Aristotle, the philosopher in ancient Greece thought that the mind was based in the heart.
3. It was not until the 18^{th} century that man realized that the whole of the brain was involved in the workings of the mind.
4. Fermat made extensive marginal notes in his copy of Diophantus' *Arithmetic*. Fermat wrote that it is impossible for a cube to be the sum of two cubes, a forth power to be the sum of two fourth powers or in general for any number — that is a power greater than the second to be the sum of two like powers, Fermat commented that he had discovered a truly marvelous demonstration of that proposition that the margin was too narrow to contain.

XI. Change into Indirect Speech.

1. I. Newton said: "If I saw a little farther than others it is because I stood on the shoulders of giants".
2. H. Poincare remarked: "Later generations will regard Cantor's work as a desease from which one has recovered".
3. In the early morning hours of May 30, 1832, before the duel of honour, the French mathematical prodigy Evariste Galois, who was then 20 years old wrote to his friend Auguste Chevalier: "I have made some new discoveries in analysis. The first concerns the theory of equations, the others integral functions. In the theory of equations, I have investigated the conditions for the solvability of equations by radicals; this has given me the occasion to deepen this theory and describe all the transformations possible on an equation even though it is not solvable by radicals. All of this will be found here in three memoirs... Make a public request of Jacobi or Gauss to give their opinions not as to

the truth but as to the importance of these theorems. After that, I hope some men will find it profitable to sort out this mess".

II. Vocabulary

I. Fill in the gaps with the derivatives of the following words: to create, to invent, to behave, to owe, to apply, to disturb, to verify, to confirm, to be valid, to predict, to contribute.

1. Fermat was the... and codiscoverer of coordinate geometry.
2. The... of non-Euclidean geometry brought into clear light a distinction between a mathematical space and physical space.
3. The human brain is so complex that the exact... of its... is essentially impossible.
4. There was a gap of 18 hundred years between Archimedes and Simon Stevin (1548–1620) the next major... to the knowledge of hydrostatics and the statics of solids.
5. Archimedes was renowned for his mechanical....
6. The ingenuity of the mechanical devices... by Archimedes is astonishing even by modern standards.
7. ... to computer work, eight such stars have been located.
8. A wave is a... that propagates through a medium.
9. There exist experimental... and... of General Relativity theory's....
10. One can claim for scientific Laws a universal....
11. Such devices may have extensive... in computers.
12. Dirac's theory made no... about the mass or size of the magnetic monopoles.

II. Insert the missing words from the active vocabulary.

1. Galileo, ... Aristotle approached the problem as a mathematician and emphasized and fixed on matter moving in space and time as the fundamental....

2. Our inability to... absolute motion is not a result of experiments.
3. Lorentz's transformation is always... as it recognizes the relative character not only of space geometry but also of time.
4. Even if Quantum Mechanics is no more than a set of rules, it is still in conflict with the... of the world that many people consider obvious or natural.
5. The premise... that inductive inference is a... mode of reasoning.
6. Church managed to stop Galileo who... Copernicus's picture of the world. But did he... in earnest?
7. The base 10... its origin... the fact that man has a total of 10 ... on both hands.
8. It is..... the tools of cybernetics that we have got power to increase our mental capabilities.
9. Mathematicians faced the problem of finding the correct physical principle to... ... the controversy of the use of infinite processes.
10. The relativity of motion was... by Galileo.

Key words: *to account for, unlike, valid (2), a phenomenon, to hold, to detect, due to, to owe to, the view, to support, to yield, a digit, to establish.*

III. Insert the pronouns: whenever, whatever, whichever etc.

1. ... tried to solve Fermat's Last theorem, he failed.
2. The body is in neutral equilibrium if it comes to rest... it may be, once the torque is removed.
3. This principle is valid. There can be no doubt... about it.
4. ... one refers to computation, he can not do without the Hindu-Arabic system of numeration.
5. ... construction problem the Greek geometers sought to solve, it defied solution.

IV. Use the correct forms of the verbs: **to lie, to lay.**

1. Let us consider the physical conditions that (to underlie) the Sun's magnetism.
2. The nature of energy (to lie) at the heart of the mistery of our existence.
3. Archimedes (to lay) a foundation for two branches of mechanics — statics and hydrostatics.
4. The coordinates of the points that... in the curve satisfy the equation.
5. The practical value of geometry... in the fact that we can abstract and illustrate physical objects by drawings and models.
6. The requirements for quicker aids to computation... at the root of the development of multiplication tables, tables of reciprocals and the like.
7. The beauty of a theorem... in its simplicity and generality.
8. Galileo's greatest contribution to mechanics and mankind probably... in his personality.
9. The attention paid to rigour and precision in mathematics points to the requirements ... -ing mathematical research.

V. Translate the sentences, paying attention to the emphatic structures.

1. Hooke, Wren, Halley and many others were seeking to reach a unified theory for celestial and earthly motion. Each succeeded in grasping some parts of the solution, *but it was Newton who* gave the complete solution in one great theory making "not a leap but a flight".
2. *It was not until the mid of the* 17^{th} *century* that the time was ripe for the creation of the synthesis of geometry and algebra.
3. *Galileo was the first to apply* the experimental method of investigation in science.

VI. Fill in the missing prepositions.

1. With the telescope Galileo extended the application... geometry... infinite space and... many millions... heavenly bodies.

2. Archimedes was interested... and concerned... both pure and applied science.
3. The principles underlying water- and steam driven devices were explained... his treatises... pneumatics and hydrostatics.
4. The classical Greeks believed that reality could be best understood... terms... geometric properties.
5. If the interior of the Sun is rotating as rapidly as the three astronomers... Arizona say it is, it makes an important contribution... the way Mercury is orbiting the Sun.
6. It is common knowledge that Newton was inspired to invent the Law... Universal gravitation... the sight... a falling apple.
7. In his treatise "... Plane Equilibrium" Archimedes established 25 theorems... mechanics... the basis... three simple postulates. In his treatise "... Floating Bodies" he established 19 propositions... the 2 fundamental postulates. This treatise is the first recorded application... mathematics... hydrostatics.
8. Modern electronic digital computers have many attributes ... common.
9. Men can still move great weights... using a few simple devices.
10. Certain general principles or "laws of nature" make... the science of mechanics. The principles of mechanics apply... all bodies... the universe.
11. Trusses are strong because triangles hold their shape firmly ... bending, pulling or pressing.
12. ... the influence... gravity all objects fall... the same acceleration.
13. The Greek thinkers tried to make a scheme that could account... facts.
14. Various changes... the forces must be taken... account.
15. Modern physics owes its beginning... Galileo Galilei.
16. This molecular concept of matter provided the basis... which the behaviour... gases could be studied.

17. "The great crisis... foundations" (1900–1930) occured... the revelation... contradictions... Cantor's intuitive set theory. The mathematicians began to doubt whether it could serve as a secure foundation... maths.
18. Galileo introduced the concept... inertia, investigated the laws... free fall, ... a body's motion ... an inclined plane and... the motion... an object thrown... an angle... the horizontal; he used a pendulum... the measurement of time.
19. The honour... creating the differential and integral calculus belongs... Newton.
20. ... the first time... the history... mankind, Galileo looked ... the sky... a telescope, discovered Jupiter's satellites, sunspots and the rotation... the Sun, investigated the structure... the Moon's surface and proved that the Milky Way consists... an enormous number... stars.
21. Galileo concentrated these studies... such concepts as space, time, weight, velocity, acceleration, inertia, force and momentum.

VII. Insert the words from the active vocabulary.

1. Mathematical language is designed and ingeniously... by the prominent mathematicians.
2. Newton... the first... have the idea of gravity as a universal force.
3. One of the greatest... of mathematics to physics is Relativity which is both mathematics and physics; you need good knowledge of both mathematics and physics to understand it.
4. Mass increases with velocity, but appreciable increases require velocities near... of light.
5. It is the main concern and objective of the physicist to... the... of postulates and theorems.
6. Observation, reasoning and experiment..... what we call the scientific method.
7. The geometric properties of the motion of rigid bodies... the subject matter of kinematics.

8. The possible existence of gravitational waves, ... to electromagnetic ones but possessing unusual properties, was first... by Einstein's general theory of relativity at the beginning of the century. But their rather fractional energy and very weak absorption by substances..... the fact that the existence of gravitational waves is up to this day a subject of very heated discussion.
9. We... to Evangelista Torrichelli the... of barometer.
10. Newton born a year after Galileo died... the first great mechanical theory which dominated scientific thought for two centuries.
11. ... the axioms of Euclid Newton's formulars serve as a logical... for other valuable laws in mechanics and physics.

Keys: *to predict, to invent, to devise, to verify, valid, to create, to account for, to owe, similar, a base, like, to be the first to do smth., that, to contribute, to constitute, to make up.*

III. Reading Comprehension

Supply the English equivalents.

Mechanics

The study of the (поведения) of systems (под действием) of forces, i.e. the study of (движения и равновесия). Classical or Newtonian mechanics (занимается) with systems that can be adequately (описаны) by Newton's (законами движения). When (скорости приближаются) (к скорости света) then the principles of relativity (должны быть приняты во внимание). Such systems (являются предметом) of relativistic mechanics; equations (сводятся к уравнениям) of classical mechanics (для скоростей, которые намного меньше скорости света). (Поведение систем) of extremely small particles — atoms, molecules, (ядер), etc. — (не может быть описано) by Newton's laws alone but (требует)

the principles of quantum mechanics primarily that certain (величины) such as energy (могут меняться) only in discrete steps, (но не непрерывно). These systems can be relativistic (по природе). When (имеется большое число частиц) in a system, (уравнения движения) are treated on a statistical basis rather than by (при рассмотрении) individual particles.

Units 7, 8, 9

I. Grammar

I. Find a mistake.

1. Of the two hypotheses the later holds much favour.
2. The ancient Hindus are credited with discovering of the decimal system of numeration we use today.
3. Farer investigations revealed a certain regularity in the process.
4. The result of the latest experiment is even worser than the previous one.
5. No one attempt to solve this problem was successful.
6. The theorem is named by the Greek mathematician Pythagoras.
7. This method is the most good.
8. It were the Greeks who proposed a lot of theoretical problems to be solved by later generations of mathematicians.
9. Under this law a moving body is at rest as far as its own inertia is concerned, as long as its motion will continue at the same speed and in the same direction.
10. Bodies weigh more little when they are in a liquid than when they are in air.
11. The rise of geometry different from Euclid's was a real surprise and neither mathematicians nor philosophers didn't know what to make of it.

II. Give the plural form of the nouns: calculus, focus, criterion, ox, sheep, thesis, species, means, phenomenon, deer, fish, hypothesis, aircraft, phasis, maximum, photo.

III. Give the Degrees of Comparison: common, little, late, familiar, far.

IV. Supply other words in which a change in stress changes the part of speech:
'record — re'cord; 'increase — in'crease.

V. Open the brackets using the correct form of the verbs given in brackets.

1. Lagrange credited Galileo with (to be) the originator of the modern method of scientific investigation.
2. The rings of Uranus (to discover) in 1977 by accident.
3. The standartization of algebraic notation (to make) during the XVI–XVII centuries.
4. No science ever (to bear) on a specific day.
5. In recent years the growth of statistics (to make) itself felt practically in every phase of human activity.
6. Indeed, it is an understatement to say that statistical methods (to be successful) in numerous problems.
7. Before the 19^{th} century no one (to attempt) to define addition and multiplication in any other way than by a direct appeal to intuition.
8. With this axiomatization it seemed that the definition of foundations of mathematics (to attain). But in fact at the very moment when the axioms of arithmetic clearly (to formulate), arithmetic itself (to dethrone) from its role of primodial science in the eyes of many mathematicians in favour of the most recent of mathematical theories, namely, the theory of sets.
9. The word geometry (to derive) from the Greek words for "earth measure".
10. The ancient Greeks (to give) credit for posing famous unsolved construction problems that (to challenge) mathematicians and amateurs alike even today.

11. Newton (to assume) that a large body such as the Moon would move uniformly in the straight line in the absence of an external force. He (to seek) the force that (to prevent) the Moon from doing so.
12. Today it is a common place that many fine things the old masters (to think) they (to prove) — were not proved at all.
13. While Jacobi (to make) diligently a mathematician of himself Abel already well (to start) on the very road which was to lead Jacobi to fame.
14. When the space rigidity (to be) disturbed, the rotating body tends to turn so that points on its rim (to move) in the same direction as the disturbing force.
15. After all that (to say), is it likely that Fermat (to decieve) himself?
16. In September 1798 Gauss (to go) to the University of Helmstedt, where there (to be) a good mathematical library. There he (to find) that his fame (to precede) him.
17. The ideas that (to overwhelm) Gauss since his seventeenth year (to catch) now and (to reduce) to order.
18. The existence of superclusters long (to conjecture).
19. The past 20 years (to witness) an amazing increase in the number of molecules detected.
20. This process (to go) on for 3 billion years.
21. They were under the impression that no such experiment previously (to carry out).
22. While geometry is one of the oldest branches of mathematics, it (to find) today new areas of application in fields such as exploration and rocket design.
23. Progress now (to make) on the task of causing computer to "speak".
24. Several attempts (to make) to create descriptive models.
25. Even in antiquity solutions already (to find) for equations of the first degree and for quadratic equations.
26. The heavenly movement (to turn) out to be more complicated than Copernicus (to propose).

27. Jupiter's satellites (to discover) nine years before Kepler (to announce) his harmonic laws.
28. It is common knowledge that the greatest mathematicians and philosophers from Greek times on (to plague) with problems involving infinite quantities.
29. The classical approach even when applied by such genii as Copernicus, Kepler, Galileo and Newton (to require) more than one hundred years to produce the laws of motion and gravitation.
30. Since 1781 when the planet Uranus (to discover), astronomers diligently (to search) the heavens for further members of the Sun's family between the orbit of Mars and Jupiter.
31. At the age of 12 Gauss (to look) already with suspicion at the foundations of Euclidean geometry.

VI. Ask questions about the statements.

1. New geometries find invaluable application in the modern development of analysis. (Where ...)
2. Some very general geometries came into being. (What ...)
3. During the last century geometry was still further extended to include the study of abstract spaces. (tag question)
4. Newton gave a method for finding approximations to the roots of numerical equations. (Who ...) (tag question)
5. Galileo rejected the traditional physics of his time chiefly because of its tendency to postulate universal laws without paying close attention to the actual world. (Why ...)
6. Galileo said that the particular motion arising in heavy bodies from the rotation of the earth is circular. (Who ...) (What ...) (general question)
7. What Galileo had set out to prove had nothing to do with the Moon. (What ...) (tag question)
8. Through several centuries there has been a lively interaction between mathematics and mechanics. (How long ...)

VII. Read the sentences, specify the ing-forms, state their functions and translate the sentences into Russian.

1. The need for careful and rigorous *reasoning* in proofs is not at once intuitively apparent to a non-mathematician.
2. Can a common language render the subtle art of scientific *reasoning, designing* hypotheses and *developing* mathematical theories?
3. *While proving* a theorem a mathematician can rely on logic, common sense and the power of deduction.
4. It should be emphasized that though the Greeks failed to find the solution *satisfying* their criterion, they made great mathematical discoveries on the way, for in mathematics there is no futile search.
5. *In looking* back over the past century one is struck by the way in which mathematics has undergone a process of maturation.
6. That certain methods may lead to contradictions when used indiscriminately does not mean that they should be abandoned: such a situation only points to the need *for determining* the areas in which the methods are used.
7. P. Fermat must be awarded the honour of *being* the founding father of number theory as a systematic science.
8. Diophantus showed great ingenuity *in devising* elegant methods of *solving* problems.
9. The programme sets up a hierarchy of abstractions *viewing* the program first in broad outline and then *attending* to one part at a time *while ignoring* the internal details of other parts.
10. *Encoding* is governed by a single, basic fact: the computer can store only numbers.
11. *Executing* a computer programme is much like *performing* an experiment.
12. Newton told his friend that the sight of an apple *falling* from a tree started him *thinking* in the right direction.
13. *Gaining* a complete *understanding of* how the Earth formed will require *learning* how the Sun condensed from a cloud

of gas and dirt and how a small proportion of the matter in the cloud escaped *falling* into the Sun and instead came to make up planets. There exists still another approach which seems more *promising*.

14. In the *Principia* Newton credited Galileo *with having relied* on the law of inertia.
15. What we need is not so much a return to the age of unrestricted scientific inquiry, but *the beginning of* an era where government, business and universities work together.
16. Scientists often describe events *by constructing* a mathematical model.
17. Cantor was not alone *in studying* the properties of the continuum in rigorous detail.
18. Galois's desparate state during *the writing of* these letters was fully justified in view of the subsequent events.
19. The true romance of E. Galois is a *fascinating* story in its own right, and it bears *telling* on the 150 anniversary of his death.
20. The four Jovian planets may be called moons for they are dark in themselves and receive their light from the sun: it is obvious from *their being eclipsed* when they enter into the cone of Jupiter's shadow.
21. The boy's *having carried out* the calculations so easily greatly surprized the teacher.
22. Lobatchevsky's *having been appointed* Rector of Kazan University in 1827 resulted in many great innovations there.
23. *Having thoroughly understood* complex numbers and their geometrical representation as points on the plane of analytical geometry, Gauss proposed himself the problem of investigating what are today called analytic functions of such numbers.
24. *Having been heated* to a sufficient temperature any body becomes a source of light.
25. Archimedes's *having failed* to invent the decimal system or its equivalent puzzled and discouraged Gauss.

VIII. Explain the use of the Continuous Tense and the Perfect Continuous Tense. Make up your own examples.

1. *It is becoming* possible to determine what each hypothesis predicts about such properties as the initial temperature of the earth.
2. For three hundred years the most eminent mathematicians *have been solving* Fermat's Last theorem, so far in vain.
3. New applications of the theory *are being explored* in many fields.
4. Mathematics *has been supplying* a language and methods for science.
5. Currently the length of the day *is increasing* by approximately two milliseconds per century and the moon *is spiraling* away from the earth at about three centimeters per year.
6. Since 1781 when the planet Uranus was discovered astronomers *had* diligently *been searching* the heavens for further members of the Sun's family between the orbit of Mars and Jupiter.
7. The higher arithmetic presents us with an inexhaustible store of interesting truths — of truths, too, which are not isolated, but stand in a close internal connexion, and between which, as our knowledge increases, we *are* continually *discovering* new and sometimes wholly unexpected ties.
8. Long before the decimal numeration system was translated into Arabic and then introduced into Europe the ancient Hindus *had been employing it* widely.

IX. Open the brackets, paying attention to the use of the Present and the Future Indefinite. Make up your own examples.

1. Particles or even worlds of matter (to keep) flying through empty space forever *until* something (to compel) them to change their motion.
2. This law states a fact which can upset many calculations *unless* it (to take into account).
3. On the plane two geodesies intersect in exactly one point *unless* they (to be) parallel.

4. A moving body is "at rest" as far as its own inertia is concerned *as long as* its motion (to continue) at the same speed and in the same direction.
5. *If* two roads on the earth (to intersect) at a certain angle, the lines representing these roads on the map (to intersect) at a different angle.
6. *If* the string (to become) slack the tension is supposed to vanish and no work is done *until* the string again (to become) tight.
7. The change of velocity is not constant *unless* the change (to be constant) both in magnitude and direction.
8. The results of the experiment (to be published) *as soon as* they (to be obtained).
9. *Before* we (to proceed) any further, we (to consider) a synthesis example.
10. Some time (to pass) *before* direct investigations in this field (to be) really feasible.
11. *If* a spark (to have) enough energy, an explosion (to be set off).
12. The advantage of this method (to become) even greater *when* fixture costs (to be) also (considered).
13. *If* two functions (to be) continuous, their aim, product and quotient are continuous *provided* the denominator (to be) not zero.
14. The fuel material is cooled *when* it (to pass) down through the steam generator.
15. *If* the density (to be) high enough for a given rate of expansion, the universe (to recollapse).
16. Maxwell was one of the most promising and honoured molecularists. His device of the "sorting demon" (to be remembered) *as long as* the kinetic theory of gases (to be studied).
17. He found that *as long as* the exceptional points (to be distributed) in a carefully specified way on the x-axis, there can be infinitely many of them.
18. Galileo pointed out that *if* completed infinite sets (to be) admissible in mathematics, there must be as many even integers as there are even and odd integers together.

19. The computer enables the user to see text displayed on a screen, so that words can be revised and reviewed *before* they (to be) ever committed to paper.
20. A car continues in motion *unless* a force (the brakes or the friction of the road surface or an uphill slope) (to stop) the car.
21. In the simplest version of the model the molecule is assumed to travel in a straight line *until* it (to collide) with another molecule; it then recoils in a random direction. All straight line steps are assumed to be of equal length. It turns out that *if* a large number of molecules (to be following) random walks, the average change in the concentration of molecules with time can in fact be described by a differential equation called diffusion equation.
22. The relative velocity of two bodies in orbit around the Sun will tend to be great *unless* the orbits (to be) similar in size, shape and orientation.
23. In some modifications of the theory it is predicted that the universe will eventually stop expanding and begin to contract under the influence of gravity *until* once again it (to be compressed) into a superdense state.
24. Approximations necessarily introduce errors. *If* there (to be) many successive numerical operations, the errors can accumulate and make nonsense of the final result. Only *if* a careful error analysis (to be undertaken) can the final answer be stated with confidence and such error analysis is one of the most complex problems faced in many fields.
25. *As* the star (to collapse) its gravitational field (to become) increasingly intense.

X. Insert **used to** or the forms of the verb **to use**. Translate the sentences.

1. The Greeks imposed severe instructions upon the instruments... for the constructions.
2. The ancient people... consider the earth to be flat.
3. Galileo... a pendulum for the measurement of time.

4. If the set of basic assumptions... is regarded as a "group" every geometry can be considered as a theory of invariants (properties that remain constant) relative to the group.
5. Since the radiation takes many light years to reach the earth from distant space, such observations give an idea of conditions existing nearer the time of the universe's origin and they show that the universe... be more dense and was expanding faster.

II. Vocabulary

I. Use the demonstrative pronouns that, those to avoid repetition.

1. A number of groups of astronomers had set out to observe the passage of the star SA 0158687 behind Uranus. The event was to study the structure of atmosphere of Uranus. Among the more successful observations were... made by J. Elliot and his associates.
2. To correct the defects in Euclid's *Elements* many axiom systems were developed and suggested. Among them are... of Pasch, Peano, Veblen, Hilbert and others.
3. The return of science to some sort of modern mysticism would be essentially a slip in man's hard-won progress from one of his most ancient bad habits — ... of ascribing to the supernatural whatever he did not yet understand.

II. Fill in the gaps with the words from the active vocabulary: number, numeral, digit, numeration, numerical.

1. Transfinite... are as legitimate as rational numbers (Cantor).
2. The figure is to the geometer what the... example is to the algebraist.
3. The first requirement in computation is a system of... i. e. a way to write....
4. The concept of... did not appear of a sudden.

5. Binary system is of recent origin and extremely important in cybernetics. It needs only a sequence of two..., 0 and 1 to represent... of any size.
6. The advantages of our present... system, based on place value, with a choice of a certain... as a base are numerous and well-known.
7. It has taken thousands of years for people to learn how to use numbers or the written figures which we call....

III. Translate the sentences, paying attention to the different meanings of the word **to develop**.

1. It is possible to describe the *development* of the Hindu-Arabic system.
2. To *develop* a rigorous and elegant proof the mathematician builds a structure of logic and form which to his eye is as beautiful as the finest poem.
3. Arithmetic, algebra, the study of functions, the calculus, differential equations and various other subjects which follow the calculus in logical order are all *developments* of the real number system.
4. Much of the scientific knowledge is predicted by deductive reasoning: new theorems are proved constantly, even in such old subjects as algebra and geometry and the current *developments* are as important as the older results.
5. Mathematics and art are mutually indebted in the area of perspective and symmetry which express relations only now fully explained by the mathematical theory of groups, *a development* of the last centuries.
6. Statistical methods have been decisive in *developing* sciences and have become a way of approaching problems in all fields.
7. The introduction of the complex number has led to many important *developments* in mathematics.

IV. Fill in the words and their derivatives from the active vocabulary.

1. Mathematics consists of many....
2. The... introduction of new concepts which more and more depart from forms of experience finds its parallel in geometry.
3. The only... country which uses an archaic monetary system is Britain.
4. The time which is devoted to the... of mathematical expressions into common language is wasted for a mathematician.
5. We are to..... with geometric constructions under the conditions specified and the famous unsolved problems in mathematics.
6. The ancient Greeks..... with posing famous unsolved construction problems that challenge mathematicians and amatures alike even today.
7. There is..... that mathematical investigations will never cease to challenge him who is capable of exploring its mysteries.
8. The definition is useful where other useful definitions may fail to... the needed effect.
9. ... to Lobatchevsky and Bolyai Gauss had made a similar discovery but lacked courage to publish the results so amazing.
10. We must give..... also to other mathematicians which contributed much to the creation of non-Euclidean geometry.
11. A gas... of molecules which attract each other..... with the well-known force of gravity. In addition, the molecules are... to the Newtonian laws of motion.
12. Though Petty made no observations as striking as Graunt's he is especially noteworthy, because his..... was broad.
13. In some problems failure to obtain fundamental laws through the classical methods of deduction from axioms is... paradoxically enough to too much information.
14. Without mathematics it is impossible to gain any deep... into the... of space, time and matter.

15. The early geometers... with measurements of line segments, angles and other figures in a plane.
16. ... we have deductive reasoning — we have mathematics.
17. We... ancient Greece as a cradle of western science.
18. One can not overestimate the... of Fermat's famous theorems on the development of modern mathematics.

Key words: *insight, gradual, wherever, point of view, the influence, to honour, the essence, divisions, to give due credit, prior to, European, translation, to become familiar, there is little doubt, to furnish, to be credited with, to be subject to, in accordance with, to be due to, to consist, to deal.*

V. Fill in the missing prepositions. Translate the sentences.

1. Galileo arrived... his conclusion about strength of materials largely because of his observations... the works of nature, since he had no apparatus... making physical tasks... actual specimens or models.
2. ... several nights Galileo's observations showed that there were not three objects attendant... Jupiter but four and from their motion he correctly deduced that they travel... orbit... the planet.
3. According... the big bang theory the universe began as a singular point of infinite density some ten to twenty billion years ago and pulsed... being... a vast explosion that continues... this day.
4. Equations of the form $ax + b = 0$ are referred... as linear equations... one unknown.
5. The architecture of a ring system resulted... the interplay of a number of forces. These include gravitational forces due... moons outside the rings and the moonlets embedded... them, electromagnetic forces due... the planet's rotating magnetic field and even the gentle forces exerted... the delute gaseous medium in which the rings rotate.
6. The speed of tidal waves can be computed... multiplying the earth's surface gravitational acceleration... the ocean depth and taking the square root... this quantity.

7. Newton's three principles of motion are stated relating the effects... force, mass and motion... respect... a body.
8. Newton devised a powerful method... the mathematical investigation... nature, the honour... creating the differential and integral calculus belongs... him. This exerted an enormous influence... the entire development of physics and facilitated the introduction... mathematical methods ... research.
9. All efforts to carry out compass-and-straightedge construction resulted... failure.
10. ... this law a moving body is "at rest" as far as its own inertia is concerned, as long as its motion continues at the same speed and in the same direction.
11. The first substance is... equilibrium... the second.

VI. Fill in the words from the active vocabulary.

1. It is no... to say that Lobatchevsky may be called the Copernicus of Geometry having in... what Lobatchevsky did in the creation of non-Euclidean geometry.
2. Fluid dynamics..... with the study of the motion of fluids (liquids or gases).
3. While Galileo's most important... to the science of Mechanics... from his studies of motion, he was also the first to study what we of the present generation often call Resistance of Materials or Mechanics of Materials.
4. The controversy over the use of infinite processes... in the formation of various schools of thought concerning the foundations of mathematics.
5. ... the meaning of geometry was extended to the ordinary space of solids.
6. Scientific language is designed and... with the definite....
7. Cantor's theory met... on the part of the conservatively-minded scientists.
8. The history of Fermat's Last theorem... an excellent illustration of the real nature of mathematical inquiry.
9. The... Hindu-Arabic system..... the Roman system which is still used.....

10. It goes..... that irrational number can not be constructed by Euclidean methods.
11. One may not know that the concept of a rigorous mathematical proof was first... by Thales of Miletus.
12. Newton's second law tells how a force... a change of motion, at a... of change called an.... Change of motion is... to the... force and..... in the... of straight line in which that force is....
13. These factors should be.....

Key words: *to result in, to result from, gradually, eventually, superior, to meet resistance, to take into account, to a limited extent, it is no exaggaration, to be concerned with, contribution, in view, to devise, to provide, to replace, ingenuity, it goes without saying, to introduce, to compel, a rate, an acceleration, to be proportional, impressed (2), to take place, the direction.*

VII. Translate the sentences paying attention to the words **effect** and **affect.**

1. Aristotle's conception had a negative *effect* on the development of science.
2. On returning home from France Abel was told by the doctors that his lungs had been *affected* by tuberculosis.
3. Cholera spread quickly. One of the worst *affected* areas was Kazan.
4. The change of climate may *affect* the health of people.
5. The new system will soon be put into *effect.*
6. There are theories *to the effect that* the Moon was once much closer to the Earth.
7. *The effect* of the environment on animals is being studied by the scientists.
8. The device changes resistance *under the effect* of light.
9. This body undergoes acceleration *under the effect* of the impressed force.
10. The factors *affecting* the process are hard to separate out.

11. The negative opinion of the outstanding scientists of his theory did not *affect* Cantor's decision to prove its validity.

VIII. Explain the functions of the word **one** in the following sentences. Translate into Russian.

1. There are controlled systems to which energy must be supplied in *one* and only *one* direction.
2. *One* must not forget that credit for developing Analytic Geometry belongs to P. Fermat and R. Descartes.
3. *One* can understand the titanic efforts made by Galileo in his endeavour to support Copernicus's picture of the universe.
4. This excites *one* or another of the natural modes of vibration.
5. The example illustrates three advantages that algebraic programs have over purely numerical *ones*.
6. Deprit and his colleagues searched for a method more compatible with mechanized execution. *The one* they invented requires transformations that would have exceeded the abilities even of Dalauney, but the algorithm is easy to program and can be executed quickly with a computer. The development of new algorithms is *one* of the most active areas of investigation in computer algebra.
7. Neighbouring particles move randomly in these directions with respect to *one another*, and collisions are inevitable.

III. Reading Comprehension

Supply the English equivalents and put the words in brackets in the proper form.

Newtonian Mechanics (1)

In 1987 the world science societies (to mark) (трехсотлетнюю) anniversary of the publication of Newton's book *Principia*. In powerful (разработке) of physical argument his book is unequalled

(во всей истории науки). Mathematically it could be (to compare)... Euclid's *Elements.* In its physical (проницательности) and its (воздействие)... (научные идеи) it (можно было бы сравнить только с) Darwin's *Origin of Species.* It immediately (to become) the Bible of the new sciences.

Newton's (вклад)... (мировую науку) was a decisive one in (to find) the mathematical method... (to convert) physical principles into (количественно) calculable results (to confirm) by (наблюдением) and (наоборот), to arrive... the physical principles... (таких наблюдений).

The instrument... which he did this (to be) the infinitesimal calculus which he (to use) (для решения жизненно важных вопросов физики) and (to teach) others to do the same.

Units 10, 11, 12

I. Grammar

I. Give the three forms of the verbs: to choose, to draw, to show, to shine, to teach, to speak, to hold.

II. a) Give the negative prefixes. Think of other examples.

real	practical	natural	Euclidean
possible	mortal	formal	legal
reliable	popular	mobile	logical
dispensible	regular	able	
responsible	correct	active	
necessary	rational		

b) Give examples with prefixes.
re — to revolve, en — to enable, bi — binomial, mis — misconception, inter — interaction, over — to overload, co — to cooperate, counter — to counterbalance

III. Find a mistake.

1. Every body remains in a state of rest or of uniform motion unless it will be compelled by impressed forces to change that state.
2. These points lay exterior to the curve.
3. When energy penetrates atoms and makes them to react, the quantized "energy chunks" produce the reaction.

4. If figures do not have either size or shape in common, they may have the same area, or may have endless another possible relationships.
5. Topology is one of mathematical sciences which has emerged in the second part of the 19^{th} century.
6. Topology studies that properties of geometric figures which can be described in terms of continuity.
7. A straight line is the most little distance between two points.
8. An electron or an atom can be made go fast or slow.
9. Theoretical sciences do not explain phenomena, they only classify and correlate it.
10. The ancient Hindus are credited with the discovering of the decimal system of numeration we use today.
11. Galileo had to yield to Church and give up his ideas, hadn't he?
12. All one need to do is to apply the above rule.

IV. Read the sentences, find the Infinitives, state their forms and translate the sentences into Russian.

1. They must be working at the problem now.
2. To prove that a certain object exists meant for the ancient Greeks to construct it.
3. Here are some data to be referred to later.
4. The problem is known to have been solved.
5. The scientists seem to have thought that water and air could be transformed to each other.
6. They are reported to have been working at the problem since March.

V. a) Fill in **should, ought to**.

1. A study of plasticity... be bound up with the introduction of additional parameters characteristic of the known physical phenomena.
2. It... be noted that a "curve" in its mathematical sense includes a straight line.
3. To solve this problem we... apply Newton's laws of inertia.

4. According to classical theory, in empty space light... be propagated in a straight line.

b) Explain the use of the verb **need** in the following sentences.

1. She needn't dwell long on the problem in question.
2. You needn't go into detail. Just outline the problem.
3. Need we perform this operation?

c) In what respect do the following sentences differ from the sentences given above?

1. Much needs to be done to satisfy these requirements.
2. These observations need further consideration.
3. This relationship does not need clarification.
4. All one needs to do is to apply the above rule.
5. We are aware of the need to protect the ecological balance.
6. There is no need to mount the pendulum.

Modals with Perfect Infinitive

VI. Translate the sentences. Explain the use of may, must, needn't, can, should with Perfect Infinitive.

1. The discovery of the irrationals *can* hardly *have been made* by Pythagoras himself, but it *can have been made* by some Pythagorean.
2. Pythagoras *may have been* the first to give a satisfactory proof to the Pythagorian theorem.
3. The eminence of the number 10 is not due to special mathematical properties of this number. It is not due to whatever mystical significance it *might have had* in the past. It is due to the simple fact that human beings have 10 fingers.
4. The universe *must have been* more dense and *must have been expanding* faster ages ago.
5. It appears that the earth's axial rotation *must have been* faster in remote times, the moon nearer, and the month shorter.

6. You *may have noticed* that the rational numbers include both positive and negative integers.
7. In 1832 Jacobi's father died. Up till this he *need not have worked* for a living.
8. The great French mathematician Fourier reproached both Abel and Jacobi for "wasting" their time on elliptic functions while there were still problems in heat conduction to be solved. In his reply to Fourier Jacobi said that a philosopher like him *should have known* that the sole end of science was the honour of the human mind and that under that title a question about numbers was worth as much as a question about the system of the world.
9. Lobatchevsky's first public communication on the subject to the Physical Mathematical Society of Kazan was made in 1826. He *might have been speaking* in the middle of the Sahara Desert for all the echo he got.
10. By himself Büttner *could* probably *not have done* much for the young genius.
11. An astrologer in the year 1801 *might have read* in the stars that a new galaxy of mathematical genius was about to blaze forth the greatest century of mathematical history.
12. Sometimes indifference to the leading fashions of the moment has cost the British school dearly. But in the long run the take-it-or-leave-it attitude of this school has added more new fields to mathematics than an exact imitation of the Continental masters *could* ever *have done*.

VII. Open the brackets using Modal verbs with Perfect Infinitive.

1. The flatness of the Earth's surface (to seem) self-evident to anyone who looked out across an ocean or a prairie.
2. It is now understood, of course, how such a basic misconception (to come about).
3. Newton did see the apple fall but what was it that inspired him to link the applet's descend to the moon in orbit and arrive at the law of universal gravitation? It (to be) a diagram in the *Dialogue*.

4. Everyone realizes that the simplicity of Newton's great discovery is only apparent. The actual events (to be) much more complex.
5. In the book (the *Dialogue*) is a demonstration that hardly (to fail) to interest Newton.
6. There are only two basic ways a terrestrial planet (to form).
7. It appears quite likely, however, that the terrestrial planets (to form) from planetesimals.
8. In 1799 Gauss was awarded his doctor's degree by the University of Helmstedt for the dissertation: *A New Proof that Every Rational Integral Function of One Variable Can Be Resolved into Real Factors of the First or Second Degree.* There is only one thing wrong with this landmark in algebra. The first two words in the title would imply that Gauss had merely added a new proof to others already known. He (to omit) *nova.* His was the first proof.
9. The word *imaginary* is the great algebraic calamity. But it is too well established for mathematicians to do away with it. It never (to use).

VIII. Ask questions about the statements.

1. The early people used to think the earth was flat. (Who...) (What...) (tag question)
2. Topology emerged as a field of serious study in the 19^{th} century. (What...) (When...) (tag question)
3. Great pains were taken to detect the exact day on which successive new moons appeared. (What...) (For what purpose...)
4. Astronomy didn't absorb the whole of Gauss's energies in his middle thirties. (tag question)
5. The story of Newton and the falling apple aroused Gauss's indignation. (What...)
6. Some of Gauss's works had to wait for highly gifted interpreters before mathematicians in general could understand them. (general question)

7. Maxwell regards an electric charge as the establishments of a peculiar state of strain among the atoms of the charged bodies and in the medium between them. (How...)
8. We cannot tell whether electricity is some peculiar kind of substance or some modification of motion of ordinary matter. (What...)

IX. Fill in the forms of the Gerund. Translate the sentences into Russian.

1. Therefore particles (or even worlds) of matter will keep (to fly) through space forever, without (to drive) by any force, until something compels them to change the motion.
2. The problem of (to square) the circle proved to be unsolvable.
3. The Green Peace activists insist on (to take) urgent measures to reduce air pollution.
4. The mystery of the origin of the universe is far from (to be) solved.
5. The Greeks had several ways of (to write) their numbers.
6. Since it is a question of (to prove) the relative consistency of an axiom system, we naturally think of (to construct) a model.
7. The evolution of our universe in many ways resembles the evolution of a collapsing star. If our universe has a little volume, we cannot expect it to go on (to expand) forever. Eventually it will stop (to expand) and begin (to contract).
8. Innumerable experiments performed by Newton resulted in his (to invent) a reflecting telescope.
9. After (to invent) his reflecting telescope, Newton could perform a series of experiments with light.
10. Newton's later works were aimed at (to examine) the problems of the Sun and (to justify) the method of treatment which he had first adopted for the problem of the Earth and the Moon.
11. On (to be appointed) professor at Cambridge Newton continued (to work) on the problem of gravitation.

12. Newton gathered together all his earlier calculations and succeeded in (to complete) his whole theory in 1673.
13. Galileo's (to persecute) by Church darkened the last years of his life.
14. Archimedes's (to overlook) the decimal system of numeration or its equivalent was in Gauss's opinion the greatest calamity in the history of science.
15. The theorem may be stated in somewhat different form, in which it is capable of (to prove) in a simple manner.

X. Fill in the forms of the Participle. Translate the sentences.

1. (To dispose) of quadratic (second degree) reciprocity it was natural for Gauss to consider the general question of bynomial congruences of any degree.
2. (To be) unable to deduce the postulate himself from his other assumptions and (to wish) to use it in the proofs of many of his theorems, Euclid honestly set it out with his other postulates.
3. (To invent) his first telescope Galileo made a series of discoveries.
4. Bodies which do not suffer strain when (to act) on by forces are rigid bodies.
5. When (to calculate) the weight of a body we have to multiply its specific gravity by its volume.
6. (To set) once in motion, a ball will travel with a uniform speed and in a straight line for an indefinite period of time.
7. A straight line (to regard) as (to have) a definite magnitude and direction but no definite location in space is called a vector.
8. (To measure) with unreliable instruments, the data were incorrect.
9. (To invent) simultaneously, though independently, by Newton and Leibnitz, the calculus gave rise to bitter arguments as to the priority of the invention.

XI. Gerund, Participle or Verbal Noun?

1. The horizon indicator or gyro vertical indicates the horizon without the pilot's (to have to) look at the ground.
2. Kepler found simple curves — ellipses — along which the planets are moving (to sweep out) equal areas in equal time.
3. The surface of the earth can be looked upon as (to divide) into two predominant levels.
4. In (to use) the first principle, it should be noticed that the (to impress) forces are (to apply) at the centre of gravity.
5. At 16 Abel began (to read) privately and thoroughly (to digest) the great works of his predecessors (to include) some of those of Newton, Euler and Lagrange.
6. Fermat, after (to dispose) of his part in the calculus and analytical geometry and (to live) a life of hard work all the while to earn his living, he still was free to devote his (to remain) energy to his favourite amusements — pure mathematics, and to accomplish his greatest work — the foundations of the theory of numbers.
7. The only events worth (to mention) in Fermat's material career are installation at Tolouse at the age of 30 a commissioner of requests and his promotion to a King's councillorship in the local parliament.
8. Gauss resolved to follow his great predecessors' example and leave after him only (to finish) works of art to which nothing could be (to add) and from which nothing could be (to take) away without (to disfigure) the whole. The work itself must be complete with no trace (to remain) of the labour by which it had been achieved.
9. (To work) with his ideal before him Gauss preferred to polish one masterpiece several times rather than to publish the broad outlines of many as he might easily have done.
10. A circle is a closed curve (to lie) in a plane and so constructed that all its points are equally distant from a (to fix) point in the plane.
11. (To ask) how he had made discoveries in astronomy (to surpass) those of all his predecessors, Newton replied: "By always (to think) about them".

12. Maxwell's demon is an imaginary creature, who according to Maxwell could separate a gas at uniform temperature into a hot region and a cooler region by (to open) and (to close) a shutter to select the molecules with higher kinetic energy.
13. The infinitesimal calculus when (to deal) with the rate of change of a variable function is called differential calculus.
14. The most important outstanding problems in the development of the theory concern (to understand) and classification of generalized catastrophies and the more subtle catastrophies that arise when symmetry conditions are imposed.
15. The method has the potential for (to describe) the evolution of formal aspects of nature.
16. Herivel showed conclusively that Newton took the law of inertia from (to write) of René Descartes.
17. The final section of I. Newton's *Principia* develops the law of universal gravitation and shows how it explains (to fall) of objects to the earth, (to orbit) of the moon, the motions of the planets and the phenomenon of tides.
18. In the *Principia* Newton credited Galileo with (to rely) on the law of inertia.
19. (To warm) to 0° ice begins to melt.
20. (To make) some theoretical studies of the passage of charged particles through matter and (to obtain) experimental results which led him to the idea of nuclear isotropy Niels Bohr directed his efforts towards the implications for atomic structure of Rutherford's nuclear model of the atom.

XII. Change the forms of the Participle in the functions of the adverbial modifier for the corresponding forms of the Gerund using prepositions in, on, after.

(While) constructing	—	in constructing
Having constructed	—	on/after constructing
Having been constructed	—	on being constructed

1. *(While) making* his experiments Faraday discovered the interaction between electricity and magnetism.
2. *Having invented* a reflecting telescope Newton could perform experiments with light.
3. *Having been invented* simultaneously though independently by Newton and Leibnitz the differential calculus became a subject of bitter argument between the supporters and the opponents of the two scientists.
4. *Having realized* the structure and mechanics of the Universe Newton laid down the Law of Universal Gravitation.
5. *Having gathered* together all his earlier calculations Newton completed his whole theory in 1673.
6. *Having been heated* to a sufficient temperature any body becomes a source of light.
7. *(While) proving* a theorem a mathematician can rely on logic, common sense and the power of deduction.

The Subjunctive Mood. Conditionals. Type II

I. Open the brackets, putting the verb in the required form.

1. In the physical world man never (to get) anywhere if he (not to encounter) resistance on the way.
2. If the Moon, Triton, Pluto and Mercury (to be) all lumped together, you (to have) a body which (to be) nearly twice as massive as Mars.
3. If there (to be) no slight but repeated gravitational tug between the two satellites (Io and Europa) that keeps their orbits elliptical, tidal forces from Jupiter (to drag) Io into a perfectly circular orbit in a few million years, and tidal heating then (to cease).
4. Pluto orbits the Sun in a period of just less than 250 years. It moves some 25 times slower than an asteroid in the main belt. All things being equal, it (to collide) with other planetesimals 25 times less often than if it (to be) in the main belt. Simplistically, it (to take) 25 times longer to

grow by accretion. This implies that if asteroid growth (to take) 150 million years in the main belt, it (to require) the age of the Solar System to complete at Pluto's distance.

5. The Sun is composed of a hot plasma, with the temperature at its centre about 15 million °C. That enormous temperature leads to an equally high pressure, which enables the material in the core of the Sun to support the huge weight of its outer layers. But if the pressure of a plasma (not to depend) upon the temperature, so that at 15 million °C the pressure (to be) the same as at the surface of the Sun, where the temperature is a mere 6000°C, then the pressure at the centre (to be) insufficient to support the outer layers, and the Sun (to collapse).
6. In the case of Vega, if the biggest dust grain (to be) 2 mm in diameter, the amount of dust in the ring (to be) one-hundredth the mass of the Earth, and if the biggest dust grain (to be) the size of an asteroid (say 200 km), there (can) be a hundred times the mass of the Earth in the dust ring.
7. If it (not to be) for the radio there (to be) little point in sending satellites into space.
8. (to be) there no oxygen in the earth's atmosphere, life (to be) impossible.
9. But for Newton's gravitational theory, people (to think) of the world as two-dimensional.

Conditionals. Type III

II. Open the brackets putting the verb in the required form.

1. Many discoveries jotted down in his diary suffice to establish Gauss's priority in fields — elliptic functions for instance — where some of his contemporaries refused to believe he had preceded them. Things were buried for years or decades in his diary that (to make) half a dozen great reputations if they (to publish) promptly.

2. Again, a later entry shows that Gauss had recognized the double periodicity in the general case. This discovery of itself if he (to publish) it, (to make) him famous. But he never published it.
3. The year 1811 (may) (to be) a landmark in mathematics comparable to 1801 — the year in which the *Disquisitions* appeared if Gauss (to make) public a discovery he confined to Bessel.
4. Unless the scientists (to develop) atomic clocks, we (not to have) so accurate a standard of time.
5. For many years Gauss, aided by his friend Weber, sought a satisfactory theory for all electromagnetic phenomena. Failing to find one that he considered satisfactory, he abandoned his attempt. If he (to find) Clerk Maxwell's equation of the electromagnetic field, he (may) (to be satisfied).
6. Like Gauss, Jacobi (can make) easily a high reputation in philology, ... maths (to attract) him more strongly.
7. These examples may suggest that the whole subject is trivial. But if it (to be), Gauss (not to attach) the extraordinary importance to it that he did. His prediction of its (analysis situs) fundamental character has been fulfilled in our own generation.
8. If the column (to be) smaller, but of the same relative proportions, it (not to fail).
9. ...to give an exact mathematical definition of what "continuous" means (to require) pages of definitions and subtle distinction which (to puzzle and astonish) the inventors of the calculus including Newton and Leibnitz. If all these subtleties which modern students demand (to present) themselves to the originators, the calculus never (to get) itself invented.
10. When this memoir of Abel's was published in 1818, Galois was a boy of 16, already well started on his career of fundamental discovery. Galois later came to know and admire the work of Abel; it is probable that Abel never heard the name of Galois, although when Abel visited Paris he and his brilliant successor (can) (to be) only a few miles

apart. But for the stupidity of Galois's teachers and the loftiness of some of Abel's mathematical "superiors", it is quite possible that he and Abel (may) (to meet).

III. Explain the use of Conditionals (Mixed Cases).

1. *If it had been* necessary for man to depend solely on experimentation and inductive reasoning to organize, widen and specify his mathematical knowledge, progress *would be* indeed very slow.
2. Gauss remarked that he could not understand how Archimedes failed to invent the decimal system of numeration or its equivalent which in his opinion was in Archimedes's hands. This oversight Gauss regarded as the greatest calamity in the history of science. "To what height *would* science now *be raised if* Archimedes *had made* that discovery!" — he exclaimed.

IV. Analyze different functions of **would** in the following sentences.

1. The results of Newton's discoveries concerning gravity were so advanced for his time that editors wouldn't publish them for more than ten years.
2. The scientist was sure that the theory *would* account for the phenomenon in question.
3. Large gyroscopes are no longer used to stabilize ships because they *would have to be* enormous to control the big ships of today.
4. On returning to their starting point the two rays *would merge* into one beam again.
5. Newton would return to the idea of gravity time and again.
6. Today some *would* transfer the theorem from algebra to analysis.
7. The University was his life and he loved it. On the slightest provocation Lobatchevsky *would take off* his collar and coat and *go* to work.

8. Galileo assumed that the law of motion for a small sphere rolling down a groove in an inclined plane *would be* similar to that of a freely falling body.
9. Many people *wouldn't* believe this phenomenon until they looked through the telescope and actually saw the moons circling around Jupiter.

V. Make up sentences according to the pattern.

Example: The smoother the surface, the less the friction.

1. (fast) the particle is moving, (steep) the slope of the tangent line.
2. (far) an object falls, (fast) it moves.
3. (small) the particle,(fast) the decay of its orbit.
4. Aristotle thought (heavy) an object was, (much) of this force it possessed.

II. Vocabulary

I. Translate the sentences paying attention to the different meanings of the word **even** and its derivatives.

1. Provided that the layer of glue is spread *evenly* the plastic no longer is perceived as being transparent.
2. *Even* in antiquity solutions had already been found for the first degree and quadratic equations.
3. 4, 6, 8, 10 are *even* numbers.
4. The measurements were rather approximate due to the *unevenness* of surface.

II. Fill in the words and their derivatives from the active vocabulary.

1. Efforts were made to... the vortex hazard.
2. ... in the quality of work in a machine tools is observed.
3. Lubricants... friction.
4. There are always two opposing... or actions which... each other.

5. A rocket moving 7 miles per second will... the Earth's gravity and never return.
6. No other system so far... can give such an effect.
7. The telescope has... a possible explanation for the ultraviolet clouds.
8. Intensity and concentration are... to each other.
9. If we mix two colloids of... sign, the particles of one will attract the particles of the other.
10. The proposed impact probably..... between 2.7 and 2.0 billion years ago.
11. Fermat was a mathematician of the first rank and an arithmetician without a... in history.
12. At high field strengths the current... to infinity.
13. Masses which have equal inertia have also equal weights, ... they are weighed in a vacuum at the same point on the earth.
14. Most of the world's water, 97% is ... in the oceans.
15. He found an excellent... between the observed and computed magnetic profiles.
16. To every organism... an abstract topological space.
17. Flares are about 20 times more frequent than sunspots, but their duration is... much shorter.
18. Though Fermat and Descartes founded Analytic Geometry, they did not advance the subject far enough and did not... it purely analytically either.
19. L. Euler developed the subject matter of both plane and solid Analytic Geometry far... its elementary stages.
20. These characteristics are optimum for the... of a rapidly changing signal.
21. Electrons... the bulk of ordinary matter.
22. A full-flow filter is now... in the hydraulic system.

Key words: *to elaborate (2), to transmit, to correspond, to constitute, to contain, to incorporate, to overcome, beyond, to lessen, to reduce, opposite, to counteract, proportional to, to provide (2), a superior, to take place, to tend.*

III. Fill in the missing prepositions, if necessary.

1. The yearly motion of a star, resulting... the Earth's motion grows smaller as the distance of a star increases.
2. The design of the keyboard depends... its intended use.
3. The definition is based... the assumed properties of the real numbers.
4. ... these conditions the transformation of heat energy into other forms of energy takes place.
5. These meteorites that were actually seen to fall established... question that extraterrestrial rocks were arriving from space.
6. Owing... the experiments Galileo found that heavy objects do not fall faster than light ones.
7. The Galois group is named... the great French mathematician Evariste Galois who lost his life in a duel at the age of 20.
8. The element consists... equal numbers of protons and electrons.
9. The chief advantage of the new device lies... its versatility.
10. The operation consists... heating the material to 50°C.
11. Most of the comet mass is contained... the solid nucleus.
12. In 1851 L. Foucault, a French physicist demonstrated the earth's rotation... showing that a pendulum continued to swing... the same direction while the earth turned around.
13. ... many years a gyroscope was merely a scientific toy.
14. There are two gyroscopic principles that apply... every rotating body.
15. This behaviour makes the gyroscope useful... giving stability to many mechanisms.
16. It explains how the earth... the conflicting attraction of other heavenly bodies wobbles slowly... its axis, producing ... other effects what is called the precession of the equinoxes.
17. A transmission system links the master gyrocompass... the repeaters.
18. Gyroscopes are also used... such purposes as steering, position finding and course recording.

19. A gyroscopic recorder aboard a speeding railway car is sensitive... extremely small changes... position.

IV. Fill in the words and their derivatives from the active vocabulary. Translate the sentences.

1. Stabilizing fins, controlled by a gyroscope... the... of a vessel to roll and pitch in heavy seas.
2. Nerve impulses are... from one cell to another.
3. Every... is made in machinery to make the surfaces... and smooth.
4. M... mobility; the volume is... by S.
5. After the given compound has been..., the analysis is repeated.
6. Here are some figures to be... to later.
7. It... needs saying that Einstein's theory of relativity had a tremendous... on the development of science.
8. There is..... that the rate can be accelerated.
9. The Moon is the only... body that is not self-luminous.
10. The measures of length used by most early people were... to a considerable... from a human body.
11. Few objects in the... have been treated with such unmerited neglect as the Great Nebula in Andromeda. ... its enormous extent and conspicuous brightness it has... all inquiry.
12. The factors...-ing the process are... to separate out.
13. These points lie... to the curve.
14. A definition of a new term cannot be accepted if it... undefined terms.
15. ..... Aristotle's model is..., it collapsed when tested by experiment.
16. ... had Cantor declared his theory when severe attacks followed on the part of the mathematical establishment.
17. When... on board a ship a gyroscope will... rolling and pitching.

Key words: *to designate, the heavens, heavenly, to transmit, to resist, notwithstanding, to derive, hardly (2), an extent,*

little doubt, hard (2), as far as smth is concerned, to identify, to counteract, a tendency, an effect, to refer to, to record, to affect, exterior, to comprise, to install, an effort.

V. Complete the sentences.

1. The directional gyro tells...
2. The gyro vertical indicates...
3. The rate gyro — also called the turn-and-bank indicator — tells the pilot...
4. Gyroscopic instruments are used also in bomb sights, ...

III. Reading Comprehension

Supply the English equivalents and put the words in brackets in the proper form.

Newtonian Mechanics (2)

The calculus as (to develop) by Newton, could (to use) and was used by him for (to solve) a great (разнообразия) of mechanical and hydrodynamic problems. It immediately (to become) the mathematical instrument... all understanding... variables and motion, and (следовательно)... all mechanical engineering and (to remain) almost the exclusive... until well... the present century. In his *Principia* Newton (to do) far more than (установил) (законы движения планет). His (целью) was to demonstrate how (всемирное тяготение) could (лежать в основе)... the system of the world. He (to destroy) all (предыдущие философские концепции) and (установил) his own not only the correct but also (наиболее точный способ)... (объяснения явлений). In a word, Newton (установил) once and for all, the dynamic (точку зрения)... the universe (вместо) the static... and (показал) that the universe (to regulate)... (простыми математическими законами).

Units 13, 14, 15

I. Grammar

I. Give the three forms of the verbs: to lead, to strike, to wake, to sit, to fly, to seek, to send, to write.

II. a) Form nouns using the following suffixes:

-tion — definition...
-sion — transmission...
-ment — development...
-ness — usefulness...
-ance — resistance...
-ence — dependence...
-th — strength...
-ty — quality...
-ship — relationship...

b) Form verbs using suffixes: -ify, -ize, -ate.

code — codify
specific —
simple —
analysis — analyze
summary —
investigation — investigate
formula —

c) Form adjectives using the following suffixes:

-able — available...	-al — analytical...
-ive — intuitive...	-ic — harmonic...
-ful — useful...	-y — noisy...
-less — meaningless...	-ible — flexible...
-ous — conspicuous...	

III. Ask questions about the statements.

1. The ancient Greeks considered Geometry as a logical system. (Who...) (general question)
2. Galois's scientific inheritance contains only 60 pages. (What...) (How many...)
3. In the early 19^{th} century algebra was considered simply as symbolized arithmetic. (How...)
4. The earliest glimmerings of the modern view of algebra appeared about 1830 in England. (Where...) (When...)
5. Arithmetic originated with the question *how many*. (With what...)
6. Fermat's conjecture generated a tremendous interest among mathematicians. (Whose...)
7. We needn't dwell on this problem. (tag question)
8. We do not doubt that different civilizations have used various bases for number system. (tag question)
9. The Greeks had to use all 24 letters of their alphabet, not having hit the brilliant idea of positional notation for their numbers. (tag question)

IV. Find a mistake.

1. No one does not know when counting first began.
2. The other galaxies are moving away from each another.
3. Galileo had to overthrow medieval thinking to establish modern views in science, hadn't he?
4. As early as 1633 Galileo founded that the Earth rotated.
5. Not until near the end of the 16^{th} century did anyone tried to test the truth of Aristotle's statement.
6. It was at that time that the demand raised to bring theory and experiment into better agreement.

Complex Subject.
(The Nominative with the Infinitive)

V. Read the sentences, find **Complex Subject**. Translate the sentences into Russian.

1. The Earth seems to be flat.
2. The three famous construction problems of antiquity proved to be unsolvable.
3. Each ion is taken to be spherical.
4. The molecule in bacteria is perceived to be circular.
5. For nearly two thousand years all heavy objects were believed to fall faster than the light ones.
6. This method is unlikely to yield the result desired.
7. Electrons and other particles are shown to have wave properties.
8. More than half of the objects identified on the basis of their radio position usually turn out to be quasars.
9. The molecule is said to have 6 degrees of freedom.
10. Newton appeared to have regarded his mathematics principally as an instrument for scientific exploration and put his main effort on the latter.
11. The word *million* seems not to have been used before the thirteenth century.
12. Gauss never claimed in anything he himself printed to have anticipated others when they caught up with him. But the record stands.
13. Opposition seemed to have strengthened Cantor's determination to prove the validity of his theory.
14. Descartes seems to have been unaware of the importance of his discovery.
15. The nebula is assumed to have been rotating.
16. Although, the Bavarian astronomer Simon Mayer appears to have found the four satellites of Jupiter a month before Galileo made his discoveries, he did not recognize their significance and did not communicate his findings to Kepler and other scholars of the period until after Galileo's announcement was published.

17. The rings of Uranus happened to have been discovered by accident.
18. Few objects in the heavens appeared to have been treated with such unmerited neglect as the Great Nebula in Andromeda.
19. Galileo's *Dialogue* proved to have been pivotal for Newton's discovery of the law of universal gravitation.

VI. Use Complex Subject instead of the sub-ordinate clause.

1. It is known that mathematics is the most exact of all the sciences.
2. It was shown that electrons and other particles have wave properties.
3. It is agreed that this formulation is correct.
4. It is thought that the largest fraction of carbon dioxide is dissolved in the ocean.
5. It is assumed that these organizms do not produce desease.
6. It is known that light carries energy.
7. It cannot be inferred that the absorption will be different as well.
8. It is conjectured that the very centre of the Milky Way harbours a black hole.
9. It seemed that the two theories (the theory of elliptic functions and the theory of functions of a complex variable) had been designed by fate to complement and supplement one another.
10. It appears that Fermat had known a proof before 1683.
11. For the next two centuries it was assumed that the disk was a continuous sheet of matter.
12. It was proposed that the appendages were attached to Saturn and that they consisted of several moons in orbit only around the back of Saturn so that they never cast a shadow of the planet.
13. It was found that the rings rotate about Saturn at a rate different from that of the atmosphere of the planet.

14. It was proposed that the rings of Saturn consist of many narrow ringlets, each one thin enough to sustain the slight imbalance of forces across its radial width.
15. It was conjectured that a terrestrial planet had been built up by the accumulation of smaller bodies (planetesimals) that had earlier condensed from the gas and dust.
16. It is assumed that random fluctuations or errors are scattered symmetrically about the true value of the quantity.

VII. Use the sub-ordinate clause instead of Complex Subject.

1. Light is proved to travel in a straight line.
2. The property appears to have been mentioned frequently in the past.
3. The nucleus which had previously been thought to consist of protons and electrons was now seen to be better expressed in terms of protons and neutrons held together by strong forces which Yukawa in 1935 attributed to a hypothetical intermediate particle, the meson.
4. Of these particles, the neutron proved to be the most effective in producing nuclear transformation.
5. The scientists seem to have thought that air and water could be transformed into each other.
6. In passing it may be noted that the particular discovery has proved to be the germ of the newer quantum theory in its mathematical aspect, that of "wave mechanics" elaborated since 1926.
7. Euclid's part in his *Elements* appears to have been principally that of a coordinator and logical arranger of the scattered results of his predecessors and contemporaries.
8. Euclid in some sense was believed to have discovered an absolute truth or a necessary mode of human perception in his system of geometry.
9. Abel is closer to Gauss in his insistence upon rigour than Jacobi was by nature — not that Jacobi's work lacked rigour, for it did not, but its inspiration appears to have been formalistic rather than rigoristic.

10. Jacobi seems to have been the first regular mathematical instructor in an university to train students in research by lecturing on his own latest discoveries and letting the students see the creation of a new subject taking place before them.

11. The history of elliptic functions is quite involved and although of considerable interest to specialists, is not likely to appeal to the general reader.

12. It does not seem to have occurred to Jacobi, as it did to Abel, that the general quintic might be unsolvable algebraically.

13. The concepts of modern algebra have been found to be extremely useful in other branches of mathematics.

14. I. Newton and the German mathematician, physicist and phylosopher G. Leibnitz seemed to have discovered the differential calculus at about the same time.

15. Air leaking into the pump from any source is likely to cause faulty performance.

16. The difference in variance is believed to be statistically significant.

17. The oldest wheel is believed to date back 55 centuries.

18. The process appears to have considerable promise.

19. The organic accumulations are interpreted to be ancient reefs.

20. Combining the roller and the sledge is believed to have been the next step.

21. The method was thought to give the most accurate result.

Complex Object.
(The Objective with the Infinitive)

VIII. Translate the sentences paying attention to Complex Object constructions. Explain the absence of the particle **to** in some cases.

1. The force that causes bodies to fall to earth is called gravity.
2. Heat and cold make all parts of the structure expand and contract.
3. Some forces tend to make an object's centre of gravity move along some line.
4. Any such force tends to make a body rotate upon some axis.
5. Galileo stated that if a body is moving freely in any direction, something must happen to stop it or to make it change direction.
6. Particles (or even worlds) of matter will keep flying through empty space forever without being driven by any force, until something compels them to change their motion.
7. Galileo devised a simple thermometer and inspired his pupil Evangelista Torrichelli to invent the barometer.
8. When energy penetrates atoms and makes them react, the quantized "energy chunks" produce the reaction.
9. Galileo believed the three stars to belong to the number of the fixed stars.
10. A collision at a low relative velocity does allow the bodies to coalesce.
11. Topology cannot solve equations. What it provides is a mathematical vocabulary — adjectives and nouns — that allow a set of solutions to be discussed in a general way without actually being specified.
12. When the computer program is executed it causes the numbers and symbols to be modified in the way specified by the scientific laws. It thereby allows the consequences of the laws to be deduced.

13. Computation thus extends the realm of experimental science, it allows experiments to be performed in a hypothetic universe.
14. While making out his weekly pay-roll and coming to the end of his long computation Gerhard Gauss was startled to hear his little boy say: "Father, the reckoning is wrong".
15. While Galileo was viewing the constellations of the heavens through a telescope he noticed three little stars shine brightly near the planet Jupiter. From their motion he correctly deduced that they travel in orbit around the planet.
16. In only some 20 years, for example, gaseous drag can cause a micrometer-size particle to move from the outer edge of the bright ring of Jupiter to the inner edge.
17. The presence of friction causes the displacement of a spring to lag in phase behind the applied force.
18. The new methods free the statistician to attack more complicated problems, exploiting a wider array of statistical tools.
19. A number of groups of astronomers had set out to observe the star SAO 158687 pass behind Uranus on March 10, 1977.
20. Gravity caused some of the compressed masses to contract along one of the three spatial axes.
21. Tidal friction in shallow waters has controlled the evolution of the earth-moon system for aeons. It is causing the length of the day to increase and the moon to recede from the earth.
22. The longest oscillation period, which is determined by the time it takes seismic waves to travel through the earth, is about 55 minutes.
23. The carbon dioxide and water vapor in the atmosphere of Venus act as a highly efficient glass in the greenhouse, allowing the energy of the sun's visible light to enter and be deposited throughout the lower atmosphere, perhaps down to and including the surface.
24. We observe the volume of a given mass of a gas decrease as the temperature decreases.

25. The young man's inhuman memory enabled him to do without a table of logarithms when he was hard pressed or too lazy to reach for one.
26. From the first Jacobi gave evidence of the universal mind which the Rector of the Gymnasium declared him to be on his leaving the school in 1821.
27. No mathematician would dispute the claim of the theory of functions of a complex variable to have been one of the major fields in the nineteenth century mathematics.

IX. Explain the cases of inversion in the following sentences. Make up your own examples.

1. Had he been footloose poverty would never have bothered him. He could have earned enough for his own modest needs somehow or other at any time.
2. Not only does a computer control processes and movements outside itself, but it can also control itself.
3. N. Lobatchevsky was one of three men who did consciously develop non-Euclidean geometry.
4. Little did this eighteenth century scholar realize that in setting out to defend Euclid's work he was laying the foundation of the first non-Euclidean geometry.
5. Not until near the end of the 16^{th} century did anyone try to test the truth of Aristotle's statement.
6. No sooner had Galileo published his announcement than S. Mayer claimed priority.
7. Not until Einstein's theory came out were those of Newton even partially replaced.
8. Not till long after his death was it known how much of the nineteenth century mathematics Gauss had forseen and anticipated before the year 1800.
9. Were it not for friction the streetcar and railroad wheels would spin around without advancing.
10. Hardly had Cantor announced his theory when severe attacks followed from diverse quarters.

X. Translate the sentences paying attention to different functions of the verb **to do**.

1. Instead of constructing geometry to fit the Earth as human beings now know it, Euclid apparently proceeded on the assumption that the Earth is flat. If Euclid *did not*, his predecessors *did*, and by the time the theory of *space*, or geometry, reached him the bald assumptions which he embodied in his postulates had already taken on the aspects of necessary truths, revealed to mankind by a higher intelligence as the essence of all material things. It took over 2000 years to knock the eternal truth out of geometry, and Lobatchevsky *did* it.
2. Euclid's aim was to give a connected, reasoned account of elementary geometry such that every statement in the whole long book could be referred back to the postulates. Euclid *did not* attain this ideal or anything even distantly approaching it although it was assumed for centuries that he *did*.
3. Astronomy *did not* absorb the whole of Gauss' prodigious energies in his middle thirties.
4. In any case Newton asked himself why the Moon didn't move away from the Earth or fall to it as the apple *did*.
5. Neither of Lobatchevsky's parallels meets the line to which both are parallel, nor *does* any straight line drawn through the fixed point and lying within the angle formed by the two parallels.
6. A collision at a low relative velocity *does* allow the bodies to coalesce.
7. *Doing* his experiments Galileo had in view a new goal for scientific activity. The new goal was that of obtaining quantitative description of scientific phenomena independently of any physical explanation.
8. Röntgen's discovery of x-rays enabled J. J. Thomson to complete his understanding of the generators of x-rays — the cathode rays of electrons. He found that not only *did* electrons striking matter generate x-rays, but that x-rays strik-

ing any kind of matter generated electrons.

9. Not until 1905, when Einstein published his general theory of relativity *did* it become evident that the Universe is expanding.
10. Not until Clark Maxwell summarized in a brief but informative form the whole of electromagnetic theory *did* Faraday's qualitative intuitions turn into precise and quantitative mathematical equations.

XI. Open the brackets, putting the verbs in the required form.

1. This theorem (first to prove) by the Great Euler in 1749, after he (to struggle) off and on for 7 years to find a proof.
2. As all traces of the steps by which the goal (to attain) (to oblitarate), it was not easy for the followers of Gauss to rediscover the road he (to travel).
3. The work of this prince of mathematical amateurs (to have) an irresistible appeal to amateurs of mathematics in all civilized countries during the past three centuries.
4. For some time a young man in his eighteenth year (to hesitate) according to the tradition — whether to devote his superb talents to mathematics or to philology.
5. By sixteen Gauss (to catch) his first glimpse of a geometry other than Euclid's.
6. Until the modern invention of pneumatic rubber tyres and ball and roller bearings there (to be) few improvements in the wheel itself since Roman days.
7. Before entering the Caroline College at the age of 15, Gauss (to make) great headway in the classical languages.
8. The study of algebra of real numbers and the recent recognition of the fundamental importance of the basic principles (to lead) to the development of what is now called modern algebra.
9. The next step (to be) the change of the roller into a wheel. The wood between the grooves of the roller (to cut) away to make an axle, and wooden pegs (to drive) into the runners on each side of the axle.

10. It was not until 1633 that Galileo (to find) that the Earth (to rotate).
11. The velocity at which the Universe (to expand) (to decrease).
12. The nebula is assumed (to rotate).
13. At present computation (to establish) a new approach to many problems. It (to make) possible the study of phenomena far more complex than the ones that (can) previously (to consider) and it (to change) the direction and emphasis of many fields of science. Scientific laws (now to view) as algorithms.
14. Physical systems (to view) as computational systems processing information much the way computers do.
15. Before Newton (to publish) the *Principia* in 1687 he (not to read) anything of Galileo except an English translation of the *Dialogue.*
16. What Galois (to write) in the last desperate hours before the duel (to keep) generations of mathematicians busy for hundreds of years.
17. The advantages of computerized typing and editing (now to extend) to all the living languages of the world.
18. So far computers (largely to limit) to the processing of worlds in the English language. That is not surprizing. Most computers (to develop) in English speaking countries.
19. New aspects of natural phenomena (to make) accessible to investigation.
20. Many statistical methods in common use today (to develop) between 1800 and 1930 when computation (to be) slow and expensive. In the past few years there (to be) a surge in the development of new statistical theories and methods that (to take) advantage of the high speed digital computer.
21. The period from 1895 to 1916 might (to call) the first phase of the revolution in physics, the so-called heroic, or in a different aspect, the amateur stage of modern physics. In it new worlds (to explore), new ideas (to create), mainly with

the technical and intellectual means of the old nineteenth-century science.

II. Vocabulary

I. Fill in the gaps with the words: to differ, different, difference, various, to vary.

1. The... in variance is believed to be statistically significant.
2. The largest coded number... by only one bit from the smallest.
3. These circuits... according to their purpose and functions.
4. The chemical characteristics of the original substances are ... from those of the new substances formed.
5. The products of the reaction may have a... distribution than the original substances.
6. It is difficult to tell the... between these two patterns.
7. Two homeomorphic figures are considered to be equal (from topological point of view) not... from each other.
8. The safety factor... between 1.3 and 2.
9. The time will... with... samples.
10. The distribution of molecules... from one sample to another.
11. The means of transmission... from broad band microwave radio circuits down to standard telephone message channels.
12. These motors come in... sizes.
13. L. Euler contributed to... fields of science.
14. Archemedes did invent... machines, but his primary activity was maths.
15. Arithmetic, algebra, the study of functions, the calculus, differential equations, and... other subjects which follow the calculus in logical order are all developments of the real number system.
16. Terminal velocity... according to the object and the fluid medium.

II. Observe the use of **as** in the following sentences. Translate them into Russian.

1. *As* in wing theory, these components require an increase in blade angle.
2. *As* we might expect this difference is relatively large.
3. The molecule *as* a whole is non-polar.
4. The Greek philosophers thought of gravity *as* a force within an object that propelled it downward.
5. This species will be treated *as though* it were a well-defined molecule.
6. We subtract the two reactions *as if* they were algebraic equations.
7. The absorption should be reduced *as* much *as* possible.
8. *As* an approximation C may be neglected in comparison with A.
9. We take *as* a starting point the following equation.
10. The pressure is seen to rise *as* hydrogen dissolves.
11. *As* new information becomes available the magnitude of geothermal energy resources is beginning to be appreciated.
12. Newton took an interest in the enigma: what are the forces that keep the moon in its regular orbit *as* it turns around the Earth?

III. Observe the use of **for** in the following sentences. Translate into Russian.

1. *For* years many of these techniques have been used.
2. The gas was studied as a possibility *for* refrigeration system.
3. A thermometer is an instrument *for* meusuring temperature.
4. All his serious scientific work was done by the time he was 42. *For* the rest of his life he studied religion.
5. The stages are cascaded *for* the purpose of maximizing the power gain of each stage.
6. Downward they thought of as a single direction in space, *for* they had little idea that the earth was round.

7. As *for* the above theorem, it is no longer useful *for* our aim.
8. If it were not *for* the help of Halley, Newton would not have published his great work.
9. It was formerly believed that all heavy bodies fell faster than the light ones. How this mistaken idea arose is easy to understand, *for* if a stone and a feather are both dropped, the stone will hit the ground sooner than the feather.
10. *For* all we know the decimal system of numeration was first translated into Arabic and then introduced into Europe by travelling merchants.

IV. Fill in the words and their derivatives from the active vocabulary. Some words may be used several times.

1. The... of the updated equipment took a few days.
2. The black hole could have started with a large star that burnt out its nuclear fuel and then collapsed. If the star was big enough the implosion would have been so violent that all the atoms would have been crushed out of.... The... star would have been squeezed into an immeasurably small size, its gravity and density would have increased enormously.
3. The Solar system has been in... for five billion years.
4. There... a theory supporting the idea of terrestrial planets having been formed by the accumulation of planetesimals. The Solar system could have... from a local concentration of nebula's gas and dust that collapsed into a planet by self-gravitation.
5. Gauss was one of the first to give a consistent... of complex numbers and to interpret them as the points of a plane.
6. Mathematics was still for many years to be of such modest..., that a gifted man could reasonably hope to do good work in... pure... applied maths.
7. Fermat was a born.... He was also..... his science and mathematics were..., an amateur.
8. The creators of the calculus...-ing Fermat..... geometric and physical intuition to get them ahead.

9. Fermat was the first to... the matter of analytic geometry to space of three dimensions.
10. A given whole number can be built up in one way only — ..... rearrangements of factors — by multiplying together primes.
11. The disk of interstellar gas occupies a small volume compared with the volume of the Galaxy.....
12. These rays... to the surface of the earth.
13. Alpha particles do not... deeply into living tissue.
14. Newton appears to have regarded his mathematics principally as an instrument for scientific exploration and put his main... on the latter. Fermat, ... was more strongly attracted to pure maths although he also did notable work in the... of maths... science, particularly optics.
15. The solution finally came of itself in a flash. But to... that it would have blazed out of itself like a new star without the "wasted" hours is to miss the point....
16. Everything on Earth... to fall or to... a lower position unless it is... up by something beneath it.
17. Through experiments with balls on an inclined plane Galileo proved that falling bodies constantly... more speed as they fall.
18. Terminal velocity varies..... the object and the fluid medium.
19. We derive... properties which follow as consequences of the... basic principles.
20. He... this phenomenon for the first time.

Key words: *to penetrate (2), to assume, entire(ly), according to, on the other hand, to apply to, to encounter, to imagine, to tend, to hold up, to seek, to acquire, to install, to exist, account, to originate, to include, both... and, as far as smth is concerned, extent, various, to rely on, as a whole, apart from, effort.*

V. Fill in the missing prepositions.

1. ... these conditions neighbouring particles can acquire large individual charges.

2. Though Gauss made some brilliant discoveries... mathematics prior... his contemporaries he had no intention... publishing the results.
3. The results of the experiments vary... one investigator ... another.
4. The experiments in this field are far... being ended.
5. There is little doubt that the data obtained may be relied....
6. Resistance... the fluid exerts a force... the falling body opposite... the force of gravity.
7. ... the same case... a feather, the amount... surface area is very great... proportion... its weight.
8. ... a certain point... its fall the object reaches its greatest speed and ceases to accelerate.
9. Thus resistance has a greater effect... a feather than it does... a bit... lead... its small surface area.
10. ... that point it falls... the ground... an even rate... speed.
11. ... nearly 2000 years this idea went unchallenged.
12. ... that time the Italian scientist Galileo Galilei began his experiments... falling bodies.
13. The wave-particle theory applies... matter as well as... photons.
14. Gauss objected... a wide-spread belief that Fermat had found a solution... the equation left... the margin... a book.
15. As many other great mathematicians Gauss was greatly interested... both linguistics and physical sciences.
16. A physicist may use modern algebra... designing an electronic computer.
17. Newton set forth the theory of gravitation... publishing his famous *Principia*.
18. Environmental groups insist... taking urgent measures... reducing pollution of the river.
19. A little visualization will show that this definition accords... common notions as required.
20. This method... representing surfaces has great advantages ... the Cartesian when applied... the study... curvature and

other properties... surfaces which vary rapidly... point... point.

21. Inspired... this work of Gauss Riemann in 1854 produced his classical dissertation... the hypotheses that lie... the foundation of geometry which... its turn began the second great period... differential geometry, that which is today... use... mathematical physics, particularly... the theory... general relativity.
22. ~~The problem is to devise some precise means... describing~~ how a curvature... a surface varies... point... point... the ~~surface, the description must satisfy our intuitive feeling~~... what "more curved" and "less curved" signify.

III. Reading Comprehension

Put the words in brackets in the proper form, supplying the missing prepositions.

Newtonian Mechanics (3)

Though Newton (to use) the calculus in (to arrive)... his results, he was very careful in his *Principia* and (to do) all the work... the form... classical Greek Geometry understand (...) by other mathematicians and astronomers. The immediate practical consequence of its publication (to be) to provide a system... calculation (to enable) the position of the moon and planets (to determine) far more accurately... the basis... a minimum... observations. Three observations, ... instance, (to be) sufficient to fix the position... a celestial ~~body... an indefinite future. The proof... it (to give) soon~~... Newton's time... his friend Halley... his famous comet, whose return ~~he successfully (to predict)... the basis... Newton's theories.~~

Units 16, 17

I. Grammar

I. Find a mistake.

1. ~~The computer enables us to see text displayed on a screen~~, so that words can be reviewed and revised before they will be committed to paper.
2. These forces do not prevent molecular motion within the liquid itself but prevent escaping of molecules from the surface of the liquid.
3. Neither the duplication of the cube nor the trisection of the angle cannot be performed under the conditions specified.
4. The extraction of knowledges from large masses of data is ~~accomplished by mathematics~~.
5. The wave properties make the electrons to show diffraction ~~effect~~.
6. The major difference in point of view between Newton's and Einstein's theory of gravitation lie in their convention concerning geometry of space and time.
7. A straight line is the most little distance between two points.
8. If figures don't have neither shape nor size in common, they may have the same area or in geometric terms they ~~may be equivalent or may have endless another possible~~ relationships (*2 mistakes*).
9. ~~On one hand mechanics have used mathematics to formu~~late the basic laws and apply them to a host of problems (*2 mistakes*).

10. On other hand the needs of mechanics has stimulated the development of mathematical concepts (*2 mistakes*).
11. Not until near the end of the 16^{th} century did anyone tried to test the truth of Aristotle's statement.
12. Cantor did not prove the Continuum Hypothesis and his followers did not do it too.

II. Ask questions about the statements.

1. Cantor did not set out with the aim of establishing a theory of infinite great magnitudes. (general question) (tag question)
2. The nature of the infinite has always been a controversial topic. (What...)
3. In the 19^{th} century mathematical infinity appeared only in its "potential" form. (When...) (What...).
4. Neither Cantor nor his followers proved the Continuum Hypothesis. (Who...) (tag question)
5. These basic principles needn't be the same as our basic principles for addition and multiplication. (tag question)
6. Having found the flaw in his reasoning, Abel had to revise the solution. (Who...) (general question) (tag question)
7. The contradictions or paradoxes focused attention on the foundations of set theory and of mathematics generally. (On what...)
8. What Galileo had set out to prove had nothing to do with the Moon. (What...)

III. Fill in the gaps with **some**, **any**, **no**, **every** and their derivatives.

1. ... was in his mind when the famed apple fell that was different from... that had occured to other people in similar circumstances.
2. ... scientific discovery of importance is followed by innumerable investigations.
3. Fermat published practically....

4. ... scientist has so far succeeded in proving Fermat's Last theorem.
5. How Lobatchevsky found time to his discoveries is... for us to marvel at.
6. When we see a ball which is gradually losing its speed we know that... force resists its motion.
7. In the physical world man would never get... if he did not encounter resistance.
8. The Moon's orbit is... concave towards the Sun.
9. For... kind of particle there is an antiparticle.
10. ... knows the Pythagorian theorem.
11. The ancient Greek geometers were the first to discover that there are... real numbers which are not rational.
12. ... approach has been completely successful in answering the fundamental questions concerning foundations.
13. This method has... to do with the problem in question.
14. ... can claim that there is "a royal road" to mathematics.
15. ... knows when the wheel was invented and who was the inventor.

IV. Translate the sentences paying attention to the verb **to be to**.

1. The work thus well begun was to change the whole aspect of mathematics.
2. Gauss was strongly attracted to phylological studies, but fortunately for science he was presently to find a more compelling attraction in mathematics.
3. While still at the college Gauss had begun those researches in the higher arithmetic which were to make him immortal.
4. Gauss rediscovered the "gem" of arithmetic, known as the law of quadratic reciprocity which he was to be the first to prove.
5. Gauss definitely decided in favour of mathematics. The study of languages was to remain a lifelong hobby.
6. Gauss had already invented the method of "least squares", which today is indispensable in all work where the most

probable value of anything that is measured is to be inferred from a large number of measurements.

7. W. Bolyai's son Johann was to retrace practically the same path that Gauss had followed to the creation of a non-Euclidean geometry, in entire ignorance that his father's old friend had anticipated him.
8. The book is in seven sections. There was to have been an eighth, but it was omitted to keep down the cost of printing.
9. When Legendre grasped what Abel and Jacobi had done he encouraged them most cordially, although he realized that their simpler approach (that of inversion) nullified what was to have been his own masterpiece of forty years' labour.

V. Put the words given in brackets in the correct form.

1. Of the two approaches the (late) is (much) promising.
2. In (late) chapters electrochemical cells will be treated.
3. (Late) but not (little) man's internal electrostatic processes rival in ingenuity any that man has been able to devise.
4. The group velocity is (little) than the speed of light however great the phase velocity may be.
5. This conjecture is (little) plausible.
6. Can you give a (good) approximation to the solution of the equation?
7. Lines (far) apart indicate the weaker regions of the field.
8. (Far) development of the programme can be expected in (near) future.
9. A (good) understanding has been gained of the way in which static electricity is generated.
10. Model II gives (good) fit to the data.
11. (Good) one can hope for is that (soon) or (late) virus deseases will be combated.
12. On a (much) or (little) intuitive basis, early in this century, the great Henry Poincare and others built a fascinating edifice of topological theory.
13. The amount of mercury here may run... (high)... two parts per billion.

14. The double-acting compressor discharges (twice)... (much) fluid per cylinder... the single-acting.
15. The Chinese were aware of the binary system of numbers... (early)... 3000 B. C.
16. Pluto is (little)-known member of the Solar system.
17. These parts show (bad) wear.
18. Iron is (bad) than copper as a conductor.
19. In all that galaxy of talent there was no (bright) star... Niels Henrik Abel.
20. The mechanism has a (simple) structure.
21. The solar corona is (easily) observable at an eclipse.

VI. Open the brackets putting the verbs in the correct form.

1. Mathematics (just to enter) its modern phase with Descartes' publication of *Analytic geometry* in 1677.
2. The three-dimensional curviture of space and a closely related concept, the four-dimensional curviture of space and time (to become) important ideas in astronomy and cosmology because of the key role they play in Einstein's theory of relativity.
3. The line of intersection of a sphere and a plane that (not to pass) through the centre is called a small circle of the sphere.
4. Two solutions to the equations of turbulance (not to add) up to a new solution.
5. When he later (to begin) to read about these ideas he (to find) that they (actually to grow up) of many disciplines simultaneously.
6. For 300 years the preeminent method in building such models (to be) the differential calculus.
7. The most important applications of the theory may be in biology and the social sciences where other mathematical techniques (so far to prove) ineffective.
8. In physics and engineering models (to develop) for the propagation of shock waves, the minimum area of surfaces, nonlinear oscillations, "scattering" and elasticity.

9. The nature of the infinite (always to be) a controversial topic.
10. In modern times problems associated with the infinite (to appear) in the abstract theory of sets, a theory that provides a foundation for virtually all contemporary mathematics.
11. Philosophers and mathematicians (to reject) the concept of completed infinities since the time of Aristotle, primarily because of the logical paradoxes they inevitably seemed to generate.
12. Most of the more than 200 geometrical illusions that (to record) by investigators (to discover) in the second half of the 19^{th} century.
13. In the 100 years that geometric illusions (to study) many different explanations for them (to advance).
14. Illusions (not to result) from the movements of the eye.
15. Descartes (usually to regard) as the founder of Analytic Geometry, though the idea of representing points on a plane by a system of related lines (also earlier to occur) to Fermat in 1625.
16. In order to prove that equations of the 5^{th} or higher degree (can) not in general be solved by radicals, Galois (to have to) show that there (to be) equations of this kind for which the Galois group (to be) not a solvable one.
17. The rings of Saturn (first to observe) in July, 1610.
18. The laws of planetary motion first formulated by Kepler (to specify) that the orbit of a body around the Sun is an ellipse. The velocity at any point in such an orbit (to determine) by the size and shape of the ellipse. It follows that the relative velocity of two bodies in orbit around the Sun (to tend) to be great unless the orbits (to be) similar in size, shape and orientation.
19. In some modifications of the theory it (to predict) that the universe (eventually to stop) expanding and (to begin) to contract under the influence of gravity until once again it (to compess) into a super dense state.
20. Because of their mysterious appearance galaxies (originally to refer) to as extragalactic nebulae.

21. If Einstein (to do) no more than to find an alternative and neater expression for gravitation than Newton, he (to be) the Copernicus of the new era; but he (to do) more; he (to show) that the new method (to give results) in better agreement with experiment.
22. A number of ingenious theories (to advance) to explain how the spokes in Saturn's "B" ring arise.
23. In his letter to Bolyai Gauss wrote that he (to lay) the foundations of a non-Euclidean geometry but (not to want) to publish the results so amazing.

VII. Put the verbs in brackets in the correct form paying attention to the Sequence of Tenses.

1. The Greek philosophers had little idea that the earth (to be) round and that "down" (to mean) toward its centre.
2. The great philosopher Aristotle thought the heavier the object (to be), the more of its force it (to possess).
3. Newton said that if he (to see) further than most men it (to be) by standing on the shoulders of giants.
4. Newton decided that only the attraction of the Moon and the Earth for each other (can) account for the fact.
5. Early in history man found that a heavy load (can) be moved rather easily if a roller (to be put) under it.
6. The French mathematician Poincare condemned the theory of transfinite numbers as an "desease" from which mathematics (some day, to be cured).

VIII. Change Direct into Indirect Speech.

1. Cantor himself was so unprepared for the result that it prompted him to exclaim: "I see it but I don't believe it".
2. In his retort to the great French mathematical physicist Fourier, who had reproached both Abel and Jacobi for "wasting" their time on elliptic functions while there were still problems in heat conduction to be solved, Jacobi said: "It is true that M. Fourier had the opinion that the principal aim of mathematics was public utility and explanation

of natural phenomena; but a philosopher like him should have known that the sole end of science is the honour of the human mind, and that under this title a question about numbers is worth as much as a question about the system of the world".

IX. Fill in the missing articles. Translate into Russian.
In fact Cantor borrowed... paradox cited by Galileo and turned it into... means of comparing... size of infinite sets. He defined two sets as equivalent if one-to-one correspondence can be established between... members of each set. Such... correspondence provides... natural way of comparing size. For example, imagine... bucket filled with black and coloured marbles, and suppose one wants to compare... number of black marbles with... number of coloured marbles. ... simplest way is to remove... marbles from... bucket in pairs of one black and one coloured marble. If every marble can be paired with... marble of... different colour, the two sets are equivalent. Failing that, ... marbles remaining in... bucket are... basis of... comparison.

X. Explain the zero article in the following sentences.

1. Lobatchevsky was appointed Rector of the University of Kazan in 1827.
2. Newton was elected President of the Royal Society in 1703.
3. Fermat was appointed Commissioner of Requests at the age of 30.
4. Newton was made Master of the Mint in 1699.

II. Vocabulary

I. Paraphrase the following sentences.

1. Once he fastened on a problem, he neither heard nor saw anything until the problem was solved.
2. He hated to quarrel but once he started he hated to stop.

3. A problem once grasped was never released till he had conquered it, although several might be in the foreground of his attention simultaneously.
4. Once radio activity was discovered scientific progress was fast — much faster than in any earlier period in the history of science.

II. Fill in the words from the active vocabulary.

1. Here is a unit that proves itself. . . . . .
2. The Assyrians probably. . . . . with the Egyptians in the use of the wheel.
3. The relative velocity of the planetesimals must. . . . . with their growth and with their increasing escape velocity if it is to stay in the optimum range.
4. The Greeks. . . . . the idea for wheels from Egypt and added a few improvements.
5. It has been suggested that size constancy is. . . . . geometrical illusions.
6. . . . . the advantages of Cantor's approach, it troubled some mathematicians because it presumes the. . . of sets or sequences of numbers having infinitely many elements.
7. The German mathematician Richard Dedekind is one of the great. . . in the logical and philosophical analysis of mathematical structure, and the. . . of the concept sometimes known as *Dedekind cut* which. . . that just as any point on a line cuts the line into two continuous, . . . -ing regions, every real number can be regarded as a cut in the sequence of rational numbers, dividing all the rational numbers into two classes which have no element. . . . . .
8. This hypothesis was. . . . . by Einstein.
9. When the press is removed the material. . . its original shape.
10. What. . . atoms together into molecules?
11. It is. . . that such stress can have major consequences.
12. The next generation is certain to discard this model . . . -ing it by a better one.
13. . . . . the ancient Greek geometers all objects were. . . of four basic elements: earth, air, fire and water.

14. From these experiments some general... can be drawn.
15. It was found that the rings rotate about Saturn at a... different from that of the atmosphere of the planet.
16. Newton's experiments with light... him to new facts about colour.

Key words: *to compose, to set forth, to lead, to replace, time and again, obvious, according to, a rate, to keep pace, to keep step, to pick up, in spite of, to be responsible for, the existence, pioneers, non-overlapping, the originator, to hold, in common, to restore, to bind, conclusions.*

III. Fill in the missing prepositions.

1. The assumptions often involved the bell-shaped curve, which is also called the normal or Gaussian distribution... the great German mathematician — Carl Friedrich Gauss.
2. Many other properties of a sample, however, are of interest to the statistician, but are... the reach of exact mathematical analysis.
3. Complex systems such as computers consist... large numbers of simple components. At present a goal is being pursued to find new designs that call... fewer components in the system.
4. The theory of manifolds arose in the 19^{th} century..... a need to understand quantitative relations geometrically.
5. ... order to represent an algebraic expression in a computer program, most systems seek to store the minimum information needed to specify the expression uniquely.
6. They searched... a method more suitable... mechanized execution.
7. In solid geometry, the term angle is applied... figures formed... the line of intersection of two planes, or... the point of intersection of three or more planes.
8. Galileo initially thought the blurry structures he saw were two moons close... Saturn. Soon his opinion changed. The "strange appendages" did not vary... their position... respect... Saturn... one night... the next.

9. ...effect, the fascinating diversity of mankind's written symbols must be made to coexist in the computer.
10. Dynamics is due entirely... the moderns and Galileo is the one who laid its foundations.
11. The word equation usually refers... a conditional equation. The solution of such an equation consists... finding the set of values, which when substituted... the variable or variables, make the two sides of the equation numerically equal.

IV. Translate the sentences paying attention to the word **whether.**

1. There is a wide spread misconception, however, that the curvature of the universe determines whether the universe is finite or infinite in extent.
2. In the above we cannot determine whether a moving particle is acted on by an external force or not.
3. Whether or not a linear system is stable is determined completely by the roots of the characteristic equation.
4. These analyses will show whether the solution is adequate.

V. Fill in the gaps with **either**, **neither**, **either... or**, **neither... nor** and translate the sentences.

1. It was argued, not entirely unreasonably that the surface of the earth must... be indefinite... have an edge.
2. ...Henri Poincare... any other eminent mathematician came forward in support of Cantor's theory of transfinite numbers.
3. A line is said to have length, but... breadth... thickness.
4. Every mathematical problem must be settled... in the form of a direct answer to the question posed... by the proof of the impossibility of its solution.
5. Some of these theories invoke a rain of charged particles from... the planet... the rings themselves as a way of transferring electric charge to micrometer-size particles and lifting them from the surface of larger particles.
6. The ancient Greek mathematicians did not solve the three famous construction problems by compass and straightedge alone and further generations of mathematicians could not solve them....

7. Cantor did not prove the Continuum Hypothesis... did his followers.

III. Reading Comprehension

Put the words in brackets in the proper form, supplying the missing prepositions.

Speed, Time, Distance

Kinematics and Dynamics are the two branches of mechanics (to concern)... the phenomena of motion. Kinematics (to describe) motion... respect... speed, time and distance only, while dynamics (to deal) ... the causes or laws of motion (to involve) the nature of the particle or object whose motion is... study. (To compare)... every other form of motion... which we are familiar the speed of light (to appear) to be an upper limit of velocity. ... a single second light (to cross) a space equal... eight times the circumference of the Earth and in (to travel) from any visible object on the Earth... the eye of an observer on the Earth, light (to occupy) however small, but a real interval of time. We (to see) objects not as they (to be)... the moment we (to notice) them but as they (to be) the smallest fraction of a second before that. From the Moon light (to take) a little more than a second and a quarter in (to reach) us. But light (to occupy) (much) than 8 minutes to reach us from the Sun. The information (to bring)... light... the various members of the Solar system (to belong)... different times and it is clear that events of the greatest importance might (to have happened) and we (not to know) anything about them. If, however, we (to pass)... the limits of the Solar system, we (to understand) (good) how different in time are the events (to present)... us. We may (to assume) that the light of many stars (to occupy) thousands.... years in (to come)... us. That is why we (to use) the so-called astronomical unit (symbol A. U.) or a still (large) unit (to know) as a light-year (symbol Ly), while (to speak)... galaxies. A. U. (to define) as the mean distance... the Earth... the Sun (1.4964×10^{13} cm) while Ly (to define) as the distance (to travel)... light... the course... one year and (to be equal)... 9.463×10^{17} cm.

Keys

Unit 1

Grammar

Ex. VIII. 1. — 2. a branch 3. a circle (2) 4. a point 5. a line segment 6. —

Vocabulary

Ex. VII. 1. changes 2. modify 3. alter 4. change 5. modify 6. varies (2) 7. alters 8. varies

Reading Comprehension

Measurement of a Circle; dealt with difficult problems; in plain geometry; comparable work in solid geometry was displayed in his *On the Sphere and Cylinder*; the first application of mathematics to hydrostatics; the center of gravity of a variety of bodies. In pure mathematics he succeeded in solving cubic equations; providing a notation for the representation.

Unit 2

Grammar

Ex. II. 1. succeeded 2. have shown 3. began 4. has begun 5. has assumed 6. have argued 7. discovered

Vocabulary

Ex. IV. 2. a. various b. variety c. variation d. varied e. vary.

Ex. V. 1. speed 2. velocity 3. rate, velocity 4. speed 5. velocity 6. speed, speed 7. velocity, velocity 8. velocity 9. speed 10. rate, rate

Reading Comprehension

Strove to introduce a more rigorous approach into analysis; he introduced

the modern notion of a limit and went on to use it to define the important concepts; proved; since known as Cauchy's theorem; divisible; contains; contributed to.

Unit 3

Grammar

Ex. XII. 1. —, — 2. — 3. — 4. —, the 5. An, — 6. — 7. — 8. —/a 9. —

Ex. XIII. 1. many 2. great/much/a lot of 3. piece of 4. some 5. a lot of 6. little. 7. not much 8. a few 9. any 10. much 11. great 12. much 13. a little 14. few

Vocabulary

Ex. V. 1. arise 2. arose 3. raised 4. rose 5. raises 6. risen 7. raised 8. raised 9. rose 10. raised 11. raises 12. raise.

Ex. VI. 1. except for 2. all except one 3. all except a few 4. except that 5. except 6. except fot the fact 7. except.

Reading Comprehension

introduced into; of; began with; to; went on; to; in; dealt, higher than; describing; known; of; was; who introduced; of; began; to known; the last; is derived.

Unit 4

Grammar

Ex. VIII. 1. reached 2. called 3. have implied 4. offered.

Ex. IX. 1. serve 2. has become 3. has modelled 4. owe 5. have treated 6. have tried 7. remains, appear 8. has existed, is compensated for, remains.

Vocabulary

Ex. II. 1. cuts 2. separated 3. share 4. separate 5. split 6. divided 7. divisions 8. separate 9. divided.

Reading Comprehension

Finding; of; for; depends on; in; of, on; changes; is written in; has; in; states, of; be greater; of; in; be less: exceed, be applied; by replacing; becomes; are; in.

Unit 5

Grammar

Ex. I. 1. a, — 2. the, the, the 3. —, — 4. a, the 5. a 6. the, the, — 7. a, a, a 8. a 9 the, — 10. a

Vocabulary

Ex. IV. 1. assess/estimate 2. overestimate 3. estimated 4. appreciate 5. assessed 6. evaluate 7. appraise 8. value 9. values 10. value 11. estimates, value 12. appraisal/assessment 13. estimation 14. assessment

Ex. V. 1. cause 2. produced 3. cause 4. causes 5. cause 6. produce 7. manufactures 8. produced 9. produces 10. effect 11. effected 12. manufactured 13. produced, produces, causing 14. effect

Reading Comprehension

Concerned with; of; of; under; of; of; form; of; is divided into; of; are considered; of; are studied; is described; to; without considering; involved; is treated; of; are concerned with, be considered; deals with; in; under; of.

Unit 6

Grammar

Ex. V. 1. is to be defined 2. was to become 3. has to resort 4. will have to be 5. have to meet 6. has to be replaced 7. are to be discovered 8. had to find 9. are not to be denied

Vocabulary

Ex. I. 1. inventor 2. creation 3. prediction, behaviour 4. contributor 5. inventions 6. invented 7. owing 8. disturbance 9. confirmation, verification, validity 10. validity 11. applications 12. predictions

Ex. II 1. unlike, phenomenon 2. to detect 3. valid 4. view 5. holds, valid 6. supported, yield 7. owes... to, digits 8. due to 9. account for 10. established

Ex. IV. 1. underlie 2. lies 3. laid 4. lie 5. lies 6. lay 7. lies 8. lay 9. underlying

Ex. VII. 1. devised 2. was the first to have 3. contributions 4. that 5. verity the validity 6. make up 7. constitute 8. similar, predicted, account for 9. owe, invention 10. created 11. like, base for

Reading Comprehension

Behaviour, under the action; motion and equilibrium; is concerned; described; laws of motion; speeds approach the speed of light; must be

taken into account; are the subject; are reduced to those, for speeds which are very much less than that of light; the behaviour of systems; nuclei; cannot be described; requires; quantities; can change; not continuously; in nature; there are a great number of particles; the equations of motion; by considering.

Units 7, 8, 9

Grammar

Ex. V. 1. being 2. were discovered 3. was being made 4. has ever been born 5. has made 6. have been successful 7. had attempted 8. had been attained 9. were being formulated, was being dethroned 9. is derived 10. are given, challenge 11. assumed, sought, would prevent 12. thought, had proved 13. was making, had started 14. is disturbed, will move 15. has been said, had deceived 16. went, was, found, had preceded 17. had overwhelmed, had been caught and reduced 18. has long been conjectured 19. have witnessed 20. has been going on 21. had been carried out 22. is finding 23. is being made 24. have been made 25. had been found 26. turned out, had proposed 27. had been discovered, announced 28. had been plagued 29. had required 31. was discovered, had been searching 31. was looking

Vocabulary

Ex. II. 1. numbers 2. numerical 3. numeration, numbers 4. number 5. digits, number 6. numeration, number 7. numbers, numerals

Ex. IV. 1. divisions 2. gradual 3. European 4. translation 5. become familiar 6. are credited 7. little doubt 8. furnish 9. prior 10. due credit 11. consists, in accordance, subject to 12. point of view 13. due 14. insight, essence 15. dealt 16. wherever 17. honour 18. influence

Ex. VI. 1. exaggeration, view 2. is concerned 3. contribution, resulted 4. resulted 5. gradually 6. devised, ingenuity 7. resistance 8. provides 9. superior, eventually replaced, to a limited extent 10. without saying 11. introduced 12. compels, a rate, acceleration, proportional, impressed, takes place, direction, impressed 13. taken into account

Reading Comprehension

Marked; the 300^{th}; development; in the whole history of science; compared to; insight; effect, on scientific ideas; could be compared only to; became; contribution into the world's science; finding; for converting; quantitatively; confirmable; observation; conversely; at; from; by, was; used; to study vital questions in physics; taught.

Units 10, 11, 12

Vocabulary

Ex. II. 1. reduce 2. reduction 3. lessen 4. tendencies, counteract 5. overcome 6. elaborated 7. provided 8. proportional 9. opposite 10. took place 11. superior 12. tends 13. provided 14. contained 15. correspondence 16. corresponds 17. correspondingly 18. elaborate 19. beyond 20. transmission 21. constitute 22. incorporated Ex. IV. 1. counteract, tendency 2. transmitted 3. effort, hard 4. designates, is designated 5. identified 6. referred 7. hardly, effect 8. little doubt 9. heavenly 10. derived, extent 11. heavens, notwithstanding, resisted 12. affecting, hard 13. exterior 14. comprises 15. as far as... concerned 16. hardly 17. installed, record

Reading Comprehension

Developed; be used; solving; a great variety; became; for; of; hence; of; remained; one; into; did; establish the laws of motion of the planets; object; universal gravity; lie at the foundation of; destroyed; all previous philosophic conceptions; established; the most accurate way of accounting for the phenomena; established; view of; instead of; one; showed; was regulated; by simple mathematical laws.

Units 13, 14, 15

Grammar

Ex. XI. 1. was proved, had struggled 2. had been attained, had been obliterated, had travelled 3. has had 4. had been hesitating 5. had caught 6. had been 7. had made 8. have led 9. was, has been cut, have been driven 10. found, had been rotating 11. is expanding, is decreasing 12. to have been rotating 13. is establishing, is making, could be considered, is changing, are viewed 14. are viewed 15. had published, had not read 16. wrote, will keep 17. are being extended 18. have been limited, have been developed 19. have been made 20. were developed, was, has been, take 21. be called, were being explored, were being created

Vocabulary

Ex. IV. 1. installation 2. existence, entire 3. existence 4. exists, originated 5. account 6. extent, both... and 7. originator, so far as... concerned 8. including, relied on 9. apply 10. apart from 11. as a whole 12. penetrate 13. penetrate 14. effort, on the other hand, application to 15. imagine, entirely 16. tends, seek, held up 17. acquire 18. according to 19. various, assumed 20. encountered

Reading Comprehension

Used; arriving at; did; in; of; understandable; was; of; enabling; to be determined; on; of; of; for; were; of; for; of; was given; after; by; in; predicted; on; of.

Units 16, 17

Grammar

Ex. VI. 1. had entered 2. have become 3. does not pass 4. do not add up 5. began, found, had grown up 6. has been 7. have proved 8. have been 9. has been 10. have appeared 11. had rejected 12. have been recorded, were discovered 13. have been studied, have been advanced 14. do not result 15. is regarded, had occurred 16. cannot, had to, are, is not 17. were observed 18. specify, is determined, tends, are 19. is predicted, will stop and begin, is compressed 20. were referred 21. had done, would have been, did, showed, gave 22. have been advanced 23. had laid, didn't want

Ex. IX the, a, the; the; a, a; a, the, the; the, the, the; a, a; the, the, the, the

Vocabulary

Ex. II. 1. time and again 2. kept pace 3. keep step 4. picked up 5. responsible for 6. in spite of, the existence 7. pioneers, originator, holds, non-overlapping, in common 8. set forth 9. restores 10. binds 11. obvious 12. replacing 13. according to, composed 14. conclusions 15. rate 16. led

Reading Comprehension

Concerned with; describes; with respect to; deals with; involving; under; compared with; with; appears; in; crosses, to; travelling; to; occupies; see; are; at; notice; were; takes; reaching, occupies; more; brought by; about; belongs to; have happened; don't know; pass beyond; understand better; presented to; assume; occupies; of; coming to; use; larger, known; speaking of; is defined; from; to; is defined; travelled; by; in; of; is equal to.

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Reading Comprehension

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