МЕХАНИКО-МАТЕМАТИЧЕСКИЙ ФАКУЛЬТЕТ
КАФЕДРА АНГЛИЙСКОГО ЯЗЫКА

ПРАКТИЧЕСКОЕ ПОСОБИЕ

для студентов
механико-математического факультета

Выпуск 1

TABLE OF CONTENTS

PRESENT INDEFINITE TENSE

1. "Work" is both an everyday word and a scientific term.
2. Ten is the base of our number system because we have ten fingers.
3. A gas phase is homogeneous since all parts of the gas have identical properties.
4. Our number system uses only the symbols 0, 1, 2 ... 9; it has positional notation and we express any integer with these symbols in various combinations.
5. Many words that we use in our everyday speech have a more exact and often a more limited meaning in the language of science.
6. The sum of the squares on the arms of a right triangle equals the square on the hypotenuse.
7. Pythagoras occupies a prominent place in the history of Greek science.
8. The fact that an increase in pressure causes a lowering of the freezing point temperature for ice does not mean that all solids behave in a similar manner.
9. A body weighs less when it is in liquid than when it is in air.
10. Energy in ordinary usage means strength sufficient to do something, whereas in physics energy is the capacity to do work.
11. Do all people understand what mathematicians mean by the base of a number system?
12. Kepler's second law states that a planet does not move at a constant speed but at a continually varying speed.
13. Liquids have a free surface and do not change much in volume under great changes in pressure.

PAST INDEFINITE TENSE

1. Newton was one of the inventors of calculus.
2. It is probable that at a very early time man was able to differentiate between a large number and a small one, and to fully appreciate the difference between the two.
3. One of the most important achievements of the 19th century was the formulation in a concise form of the doctrine of energy.
4. The Greeks first commenced the study of geometry from Egyptian sources.
5. From the Egyptians the Greeks obtained their first knowledge of geometry, but they soon surpassed their teachers, and to them we owe the foundations of the subject.
6. Euclid collected together all that people knew on the geometry of simple figures and arranged the results in a logical sequence, giving a logical proof to everyone.
7. As man's skill advanced the abacus developed into a compact and useful instrument. It provided a means of representing numbers. The means of writing numbers developed on difference lines at a much later time.
8. Fermat did his work in France, Newton in England, Leibniz in Germany.
9. Fermat's contributions to the calculus were first rate although those of Newton and Leibniz somewhat overshadowed them.
10. Did Fermat actually prove his theorem? He did not leave any proof to it in the margins of a Latin book but a few words.
11. Newton did not know that Leibniz, a German scientist and philosopher, developed the same mathematical method.
12. Ancient Rome did not contribute much to mathematics.

FUTURE INDEFINITE TENSE

1. We shall show that the time of oscillation of the pendulum is approximately constant.
2. In the present chapter we propose to consider the production of motion, and it will be necessary to commence with a few elementary definitions.
3. The student will notice that we assume that it is possible to create forces of equal intensity on different occasions.
4. In practice, we shall find that equal masses have equal weights so that the process of weighing is the simplest practical method of comparing masses.
5. The formula $S_m = 9,8 \frac{m}{sec^2} t^2$ says nothing about why a ball falls or whether balls fell in the past or will continue to fall in the future. It gives the information how a ball falls.
6. In the following chapter we shall consider the motion of a particle which moves in a curve.
7. Pulling a rubber band increases its length. However, if you stop pulling it and release one of its ends, the rubber band will quickly return to its original shape and size.
8. We shall investigate the simple case of the normal acceleration of a particle which moves in a circle with constant speed.
9. We hope that the wave of fresh interest in numerical methods will attract the attention of mathematicians to the problems which need large scale digital computing machinery.
10. In many situations it will be necessary to study physical quantities which depend on more than one independent variable.
11. As an example of how partial differential equations arise in engineering or physical problems, we shall discuss in detail the derivation of the equation governing the flow of heat.
12. We explain how to find a form of particular solution which will prove useful in solving the boundary value problems.

INDEFINITE TENSES (passive voice)

1. Work and energy are very closely related.
2. Generally speaking, the location of the center of gravity of any body is found by means of experiments.
3. The two curves that are drawn are represented by the algebraical equations xy=6, and x+y=5.
4. The changes in energy are governed by the great law of the conservation of Energy, one of the basic principles of science.
5. The associated integers are regarded as making a single object, and laws of combination of these objects are then postulated.
6. Differential equations or systems of differential equations with only one independent variable are called ordinary differential equations.
7. Equations involving more than one independent variable and the partial derivatives of the dependent variables with respect to the independent variables are called partial differential equations.
8. The Principle of the dissipation of Energy was formulated in 1852 by Kelvin.
9. As the calculus was first used by its inventors, it was essentially a process of approximation.
10. In 1672 Leibnitz went to Paris. Here he met Huygens and in his spare time was instructed by him in the latest developments in mathematics and in their application to physical sciences.
11. Many of the scientific principles Lomonosov first stated were appreciated and further developed much later in the 19th or even 20th century.
12. Kinetic energy which disappeared was not destroyed but converted to other less usable forms of energy.
13. "Analytic Geometry" was so thoroughly explored and developed by Descartes and Fermat that the new revolutionary technique was completed and ready, as the XVII century ended, for Newton and Leibnitz.
14. Many mathematical discoveries, and certainly all the methods by which they were obtained, are creative inventions belonging to the realm of art in that the forms they took were designed rather than discovered by a man.
15. Energy will be defined as the capacity of matter for producing an effect.
16. The quantity of heat transferred to effect a change of form will be termed latent heat.
17. The energy which matters has by virtue of its position will be classified as potential energy.
18. How electronic computers will be used in the future will largely depend on our imagination and understanding of them.
19. As heat is transferred from an external source to the liquid, the velocities of the molecules will be increased.
20. The gas will be subjected to a change during which the volume remains constant until final pressure and temperature.
21. If the temperature of the surroundings is reduced to a value slightly less than that of the gas, heat will flow from the gas and work will be done in compressing it.
22. If the spring is allowed to contract to its original position, the work required to stretch the spring will be approximately equal to that performed by the spring as it contracts.

CONTINUOUS TENSES

1. The only case that we shall consider is when the angular velocity is uniform, and the moving point P is describing a circle about the fixed point 0 as center.
2. The principle of the dissipation of energy is the second great principle that governs all changes which are taking place in the universe.
3. The calculus is a method by which we can study quantities that are continually changing.
4. A point is moving with uniform speed when it moves through equal lengths of its path in equal times.
5. From a scientific viewpoint an object can be in equilibrium not only when it is standing motionless but also when it is moving in a straight line at constant speed.
6. When we are standing and holding a heavy weight; when we are writing at a desk in our office; when we are studying or teaching at the Institute - we say that we are working.
7. Owing to the collisions with neighboring molecules, the magnitude of the velocity and the direction are continually changing.
8. If a body is moving with a constant speed V for a time t, this moving body will pass a distance S according to the formula $S = V \times t$.
9. A man sitting in a tram seems motionless to his fellow-passengers; in reality, all are moving rapidly with respect to any man in the street.
10. We shall simply appeal to our physical experience to support the assertion that a person travelling in an automobile is moving at a definite speed at each instant.
11. Latitude and longitude define position on the earth's surface; we are here using the earth as a frame of reference.
12. When we saw a ball which was gradually losing its speed, we knew that some force resisted its motion.
13. The method to be employed came into Archimedes' mind whilst he was having his bath, and he ran through the streets shouting: "Eureka! Eureka!"
14. Archimedes, the greatest Greek mathematician and scientist, died by the hand of a Roman soldier who burst in upon him while he was studying a geometrical diagram drawn in sand.
15. In 1820 a Danish physicist, Hans Christian Oersted, who was working at the University of Copenhagen discovered a most important relationship between electricity and magnetism.
16. Dropping two balls of different sizes, but of the same material, Galileo found owing to the experiment that heavy objects do not fall faster than light ones. Both balls started falling together, were falling together and hit the ground at the same time.
17. I say that in defending mathematics, I shall be defending myself, and that my apology is to some extent egotistical (Hardy).
18. If a student studies English for three hours, he grows tired, however, he will not be performing any work in the sense in which we use that term in physical science.

PASSIVE CONTINUOUS

1. The upward pull upon a body at any instant while it is being lifted is a force acting on it.
2. Consider a body which is being translated (though not necessarily always in the same direction) without any change of orientation.
3. In many instances, work is performed in an engineering apparatus; at the same time heat is being transferred.
4. Progress is now being made on the task of causing computers "to speak".
5. Since heat may be absorbed by or removed from the body while work is being performed by or on the body, it is necessary to consider the signs associated with the Q or W terms in the equation.
6. Whenever the above-mentioned condition exists, the material is undergoing a change of form, that is, a solid is melting to a liquid, as a liquid is being evaporated into a vapor.
7. While heat is being radiated from the surface, it is also being produced by radioactive disintegration within and so it balances the heat lost by radiation.
8. According to the law of conservation of Energy, the energy of the universe can neither be increased nor decreased in amount. It is continually being transformed, producing changes and phenomena, being concentrated here and dissipated there, but always remaining invariable in amount.
9. While these branches of mathematics were being created, a new culture was being fashioned on the basis of the contributions of the 16 and 17 century mathematicians.

PERFECT TENSES (Active)

Present Perfect

1. When a ball starts to roll, we know that either the table is not level or some external force other than gravitation has caused the motion.
2. We do not doubt that different civilizations have used various bases for number systems.
3. Scientists have introduced into science words and terms which we use in common speech.
4. Ever since people began to count they have used different words to represent the first few natural numbers.
5. How the plus and minus signs came into use is a matter of considerable conjecture, and historians of mathematical science have put forward several very interesting theories.
6. Only recently other works of a similar nature have replaced Euclid's “Elements”.
7. Newton gave due credit to his predecessors: “If I have seen a little farther than others, it is because I have stood on the shoulders of giants”.
8. In our century, mathematics has attained such vast proportions that no mathematician claims that he has mastered the whole of it.
9. Mathematics has indeed been a beacon light to the sciences and has continually helped them in reaching the position they occupy in our present civilization.
10. Mathematics has brought life to the dry bones of disconnected facts and, acting as connective tissue, has bound series of detached observations into bodies of science.
11. The problem we have thus far considered have involved situations wherein only a few possibilities could occur.
12. Through electromagnetic theory mathematics has mastered another segment of the physical world.
13. Man has always understood the sound sense of proceeding from the particular to the general, from a group of examples toward a broad theory.
14. The so-called “theory of linear programming” originated from problems of economics, and has developed into a theory in its own right.
15. Although the concept of probability plays an important role in the foundations of science and enters many questions of everyday life, it has been the subject of many controversies.

Past, Future, Perfect

1. Asked how he had obtained the discovery of universal attraction, Newton answered: “I was always thinking about it.”
2. By the time Einstein was fifteen he had found himself.
3. Before Newton went to Cambridge, he had received a good education of the normal type for the time.
4. Numerous capable mathematicians had already made progress in the direction of the calculus by the time it appeared.
5. The use of ”0” in the body of a number was something that no other ancient system had evolved.
6. The book by von Neumann and O. Morgenstern “Theory of games and Economic behavior” presented some vast development of the theorem von Neumann had presented in 1928 at Gottingen.
7. Before Descartes students of mathematics had taken the ready methods of the Arabs and had perfected them into a powerful analytical tool, from which they were obtaining striking scientific results.
8. By Maxwell's time, the physicists of the 19th century had succeeded in formulating mathematically the quantitative aspects of various electrical and magnetic phenomena studied over the preceding centuries.
9. It was essential for man's very existence that he learned to count and when he had accomplished this, that he had some means of recording his results for future experience.
10. Long before the great Greek mathematicians in the distant East mathematical development had proceeded less logically and geometrically. The scholars of India and China had produced no great body of deductive reasoning, but they had become much interested in how numbers worked. As a result, they had assembled a mass of numerical information, which they in turn transmitted to the Arabs.
11. The reader will have seen from the preceding pages that geometry was one of the earlies of the mathematical studies.

Perfect Continuous

1. We have been examining the influence of mathematics itself and of the rational spirit engendered by mathematics on the science of man.
2. Living outdoor lives primitive shepherds and hunters had been watching the motion of the stars, as part of their occupational activities, for thousand and thousand of years, thus laying the foundations of astronomy.
3. Long before the flowering of Greek genius, the peoples of Egypt and Asia Minor had been struggling with the problems that arose in the handling of numbers.

PASSIVE VOICE (Perfect)

1. The facts you have been given above are an attempt to illustrate the phenomenon known as inertia.
2. When two intermediate integrals have been obtained, the final primitive is obtained by resolving the two equations for p and q and effecting a quadrature.
3. Particular examples of spaces satisfying these postulates were first introduced and systematically studied by Hilbert whose name has since been attached quite appropriately to all such spaces.
4. A large number of methods, similar in spirit but differing in various details of procedure, in attainable accuracy, and in complexity have been developed by different writers and in almost bewildering variety.
5. Actually several nearly similar methods have been discovered and published independently, and in many cases no completely adequate means for assessing accumulated error has been devised.
6. In order to make the book more useful for classroom instruction a number of exercises have been inserted to provide the student with the practical experience so indispensable for the mastery of numerical methods. Answers to a number of these exercises have been computed.
7. The king of Syracuse, suspecting that the gold of his crown had been alloyed with some baser metal, gave it to Archimedes to test.
8. Since the days of Archimedes problems concerning levers, friction etc. had scarcely been considered so that the interest Leonardo da Vinci displayed in applied mathematics is noteworthy.

MODAL VERBS (can, must, may)

1. Computers in general can do a number of different things.
2. Modern computers can solve problems so quickly because they are electronic devices.
3. We can imagine the liquid as consisting of separate particles moving about freely.
4. It seems that the earth is fixed, as we cannot feel it moving.
5. By “analytic geometry” you can analyze geometry algebraically and picture algebraic formulas geometrically.
6. To a mathematician a four-dimensional world can exist in terms of his symbols and equations.
7. The computer can perform certain operations upon the information furnished in.
8. Euclid's axiom is that two intersecting straight lines cannot both be parallel to a third line.
9. A computer can store large amounts of information in a small physical volume.
10. To a mathematician a four-dimensional world can exist in terms of his symbols and equations.
11. If all the vectors under consideration have directions parallel to a fixed plane, we can represent geometry by a two-dimensional model, that is, by directed line segments in a plane with common initial point 0.
12. We must admit that the equation $x^2= 2$ has no solution.
13. A teacher must ask his students simple natural questions.
14. The programmer must be familiar with the capabilities and limitations of the computer.
15. We must have some notion of how computers operate before we can discuss their use in everyday operations.
16. We must not forget that Euclidean space cannot account for relativity, but Lobatchevskian space can.
17. A computer is a must in every modern institution.
18. A designer must know how to build a computer so that it can perform routines and subroutines with facility and with as few program steps as possible.
19. We must remind the reader that it is quite impossible to visualize the "Minkowski World" - a four-dimensional geometry of space.
20. In a short book like this we cannot give a detailed discussion of the applications of the theory of Relativity, and so we must conclude this chapter with a brief mention of some of the more important results.
21. The velocities of the bodies in question are the same on first touching the floor; but, since they rebound through different heights, their velocities on leaving the floor must be different.
22. When we attempt to express in mathematical symbols some condition, given in words we must understand thoroughly the condition; and we must be familiar with the forms of mathematical expressions.
23. We have no means of finding out what is the actual magnitude of the force between two bodies during an impact; we only know that it must vary very considerably, being zero at the commencement of the impact and zero at the end, and that it must be large at some instant during which the impact lasts.
24. By Newton's Third Law, the force at each instant must be the same in magnitude for each body, but opposite in direction; hence the impulses of the forces acting on the two bodies must be equal, but in opposite directions.
25. We may neglect the distances between particles.
26. A body may have simultaneously velocities in two or more different directions.
27. It may appear that the computer is a modern magic genie. Not so. Men must do much hard work to make it do things.
28. Trying to help the student effectively the teacher sometimes asks the same questions and indicates the same steps again and again; but he may vary the words and ask the same thing in many different ways.
29. To devise a plan of the solution of a problem is not easy. To carry it out is much easier. The main danger is that the student forgets his plan. This may easily happen if the student receives his plan from the outside and accepts it on the authority of the teacher.
30. The force may also be of the nature of an attraction such as exists between the sun and earth, and which compels the earth to describe a curve about the sun.
31. We may, however, mention that a uniform rod, of small section swings about one end in the same time as a simple pendulum of two-thirds its length.
32. The programmer may compose a routine that takes the least amount of time to run; he may compose a routine which checks the results for accuracy and consistency of information at many points along the way and is longer to run.

MODAL VERBS (Passive)

1. A straight line may be drawn through any two points.
2. Only things which are similar can be added.
3. The size of an angle can be measured by the size of its intersected arc.
4. Many interesting consequences can be deduced from the hypothesis presented above.
5. In Cartesian geometry we mind that every equation can be pictured by a line.
6. Algebra can be used to analyze geometry, and geometry can illustrate the any-numbers of algebra.
7. The input of a computer requires information which is, or can be converted into electrical signals for each bit of information.
8. A programmer must be able to see how the problem can be subdivided into small sequences of steps or calculations that can be considered as a programming unit.
9. If the motion involves rotation as well as translation, additional relations must be added to express the entire motion.
10. In the development of science the name of Descartes must be associated with that of a less famous Frenchman, Pierre de Fermat.
11. Special care must be taken to avoid numerical mistakes, since such mistakes are liable to escape detection.
12. Whenever an explicit solution of a differential equation can be found, it is usually best to use this explicit solution rather than to resort to numerical methods.

VERBS OF OBLIGATION

1. In countless problems, we have to ask the questions: what is the unknown? What is required to prove?
2. Trying to find the solution of a problem, we must distinguish four phases of the work. First, we have to understand the problem; second, we have to see how the various items are connected; third, we carry out our plan; fourth, we look back at the completed solution.
3. When confronted with a problem, the student should understand it. But he should not only understand it, he should also desire its solution.
4. Suppose we are to find the mean of several approximate numbers. What must we do first of all?
5. When we are to solve an equation of the sixth or higher degree, it is well to separate the roots by the ordinary method.
6. “I desired only tranquility and repose.” These are the words of a man who was to deflect mathematics into new channels, and change the course of scientific history - Rene Descartes.
7. The day of the discovery of Archimedes' principle, if we knew which it was, ought to be celebrated as the birthday of mathematical physics.
8. If we can solve, by such a method, a certain kind of problem involving many parameters, then the addition of more parameters, of the same kind ought not to cause an inordinate increase in difficulty.
9. The acceleration of gravity varies slightly with the position on the earth, but for most purposes the local value need not be distinguished from the standard value given above.

VERBS OF OBLIGATION (Passive)

1. When one approximate number is to be subtracted from another, they must both be rounded off to the same place before subtracting.
2. When computations are to be done by hand or with the aid of desk computing machines, the method most commonly used is that which has come to be known as relaxation.
3. It should be clearly understood, that the field of complex numbers contains the field of real numbers.
4. In using the first principle it should be noticed that the impressed forces are to be applied at the center of gravity parallel to their former directions.
5. It must not be forgotten that a teacher wishing to impart the right attitude of mind towards problems to his students should have acquired that attitude himself.
6. As a general rule, the method indicated should be applied only where the form of the differential equation is such that the additional derivatives can be computed without excessive labor.
7. Before such problems could be attacked, or even formulated precisely, the algebra of hypercomplex number systems had to be developed.
8. In higher mathematics functions have to be dealt with, whose analytical form is either totally unknown or else is of such a nature that the function cannot easily be subjected to such operations as may be required.
9. In case an equation of the sixth or seventh degree is to be solved, the roots ought to be separated by the ordinary method.

PASSIVE VOICE
(presenting some difficulties in translating)

A

1. The arrangement of the atoms in a solid molecule is often referred to as a lattice.
2. A body will remain at rest or in a given state of motion if it is not acted upon by the external force.
3. The double and triple integrals can be dealt with in one theorem.
4. Increasing and decreasing sequences of sets are referred to as monotonic sequences.
5. The basic idea of the term "fraction" is "one of the parts into which a whole can be broken or separated", or may be thought of as broken or separated".
6. When a body moves through the air it is acted on by two forces; the force of gravity downwards and a force due to the resistance of the air in a direction opposite to that of the relative motion.
7. The storage in a computer is frequently referred to as "memory" or simply as a store.
8. Electric current can be thought of as a flow of electrons and it can be represented by a mathematical formula.
9. Why is it that this discovery has to be thought about by people all over the world?
10. The determination of the relative order of these various infinitesimals presents important problems some of which will be dealt with later on.
11. In the above way we can determine whether a moving particle is acted on by any external force or not.
12. We have now completed a survey of the functions, which occur in the elementary parts of mathematics usually referred to as the "elementary functions".
13. The brightness of stars has been spoken of as depending upon both their size and their temperature, as well as upon their distance.
14. An integral is, in accordance with tradition, spoken of as a double integral, although it is defined as the single limit of a finite sum and accordingly the sign of integration is here employed only once.
15. Most of the smaller meteors burn themselves out before reaching the surface of the earth. A few survive the ordeal, and many of these have been recovered. They are then referred to as meteorites.
16. Cosmic particles are gradually running into the earth, or being run into by the earth, and so are being swept up by it as it travels through space.
17. To be travelling 18 1/2 miles each second seems like an impossible speed. The speed of an automobile is spoken of as so many miles per hour not per second!
18. Numbers called "irrationals" will be dealt with in more detail later; they are the incorrigibles in a scheme of number representation which, though short of perfection, is still one of the greatest and least appreciated achievements of the human race.
19. Newton showed that a body projected in space, and acted upon by a central force in accordance with his law of gravitation, would describe a conic section, a hyperbola, parabola, or ellipse, the shape of which could be completely determined, given the initial distance of the body from the position of the central force and the direction and velocity of its initial motion.

B

1. Pressure can be caused by the impact of a moving object.
2. The computer can be made to multiply, divide, add or subtract information that is stored in various locations in the memory.
3. Any discovery of importance is followed by innumerable investigations.
4. Some smaller planets are given the word satellites because they follow their planets in their revolution around the sun.
5. As the student already knows much of mathematics is concerned with equations.
6. When one body slides over another, the motion is resisted by a force which is called friction.
7. Electrons can be made to travel at very high speeds.
8. The choice of material was greatly influenced by the author's personal interests.
9. If we look at the names which are assigned to natural numbers, it is quite apparent that the number "ten" plays a very special role.
10. The method described above is the most accurate and should be followed when greatest possible accuracy is desired.

11. For a given mass or a particle of material to vibrate, displacement from its rest position must be opposed by a so-called restoring force.
12. Such procedures have been followed in many investigations of topological spaces.
13. The work of generations of students who worked for the improvement of mathematics was influenced by the finest teacher of antiquity - Euclid.
14. The chapter is devoted to general explanations, connected with the existence-theorem and with the kinds of integrals that are possessed by equations of order higher than the first.
15. We should consider how the mass of a body is measured and how the velocity and acceleration of any particle are affected by the action of forces.
16. Reference has been made to the fact that the vapor pressure of a liquid is affected by changes in temperature and to a small extent, by the changes in the pressure of the air on the liquid.
17. Any mathematician today must be impressed by the apparent permanence of the ideas introduced by Abel and Galois, and the profound difference between their approach to mathematics and that of their predecessors including in some respect, Gauss.

THERE IS

1. There is an infinite number of ways in which a force may vary.
2. There are eight solutions possible to the problem proposed by Decartes to his pupil.
3. There are some cases where exceedingly large vapor pressures exist.
4. There is marked expansion when water changes to the solid.
5. There are many forms of energy such as: electric energy, chemical energy, and so on.
6. In any subject there are words which occur again and again, like the words “point”, “line”, “circle” in elementary geometry.
7. There is no way of proving or disproving this theorem.
8. There is no direct evidence concerning the early activities of this scientist.
9. There is associated with the automobile a definite amount of Kinetic energy.
10. Perhaps long ago there were people on Mars when there was more air and water than at present.
11. Joule demonstrated the most important fact, that there is a definite equivalence between the quantity of energy and the amount of heat it is able to produce.
12. Through a point P not on a line L there passes one and only one line m (in the plane of P and L) that does not meet L no matter how far m and L are extended.
13. There exist three degrees of freedom associated with a monatomic molecule.
14. In philosophy and mathematics there appears no Roman name of major importance.
15. Induction results in adapting our minds to the facts. When we compare our ideas to the observations, there may be agreement and disagreement.
16. Gradually there developed an imperative need for critical thinkers with imagination and daring of another kind, the kind that was able to dispense with and even override intuition and “common sense”.
17. There are books by Euler on hydraulics, on ship construction, on artillery. In 1769-1771 there appeared three tones of a “Dioptrica” with a theory of the passage of rays through a system of lenses. In 1739 appeared his new theory of music, of which it has been said that it was too musical for mathematicians and too mathematical for musicians.
18. If a particle in motion describes a curve with uniform speed, there can be no force in the direction of the tangent to its path. If its speed is not constant, there must in addition be a tangential force.
19. Pythagorean theorem and its extensions tell us that, when we have constructed this arithmetic, it will not prove sufficient for our needs, since there will be many magnitudes which obtrude themselves upon our attention.
20. A computer must have some means of estimating the reliability of every computed result. It is not always possible to have an explicit formula giving the error committed, but usually there exists some means for ascertaining the magnitude of the majority of unavoidable errors.

DEGREES OF COMPARISON

1. The only free path between molecules is much less in a liquid than in a gas.
2. Liquids differ from solid bodies by the greater mobility of their particles.
3. We shall return to a further discussion of the matter when dealing with linear equations of the second order.
4. Let us suppose that we are on top of a mountain and, hence, a little farther away from the center of the earth, our weight will then be slightly less than at sea level.
5. James Joule and William Thomson carried out additional experiments on greatly refined apparatus and found that all gases deviate more or less from Joule's law.
6. A straight line is the least distance between two points.
7. Astronomy is one of the oldest among the sciences.
8. Only the molecules moving with the greatest velocity are able to overcome the intermolecular forces in the liquid and thereby leave the surface.
9. One of the most common descriptions of mathematics is as the “science of number”.
10. Newton's problem was: what shape of body will guarantee the least possible resistance?
11. Light always follows the shortest path, that is a straight line.
12.Of all surfaces bounded by curves of a given length, the circle is the one of largest area.
13. The most astonishing contribution of the Arabs which they obtained from the Hindus was a symbol for nothing.
14. The problem consists in finding the curve for which the associated number attains a maximum or a minimum - that is the largest or the smallest possible value.
15. One might think that the motion along a straight line, is the quickest. The brothers Bernoulli determined the form of the curve which takes the shortest possible time; it is curve called cycloid.

The... The...

1. The greater the force acting on a body, the faster it will move.
2. Generally speaking, the greater the force and the distance moved, the greater the work that has been performed.
3. The nearer to the sun a planet is, the faster it has to move; otherwise the sun may draw it.
4. The other galaxies are moving away from each other, and the farther away they are, the faster they are moving.
5. The nearer the comets approach the sun, and thus the more heated they become, the smaller they get.
6. The fainter the star, the larger the magnitude numerically.
7. Tho higher up a man ascends, the more difficult it is for him to breath.
8. The greater the mass of an object, the greater is the force with which it attracts another body.
9. The more kinds of jobs the computer does, the less efficiently it will be able to do a few jobs.
10. The more complex the decisions to be determined by the computer or the problem to be solved the more questions have to be answered.
11. The kinetic energy of the molecules is proportional to temperature; the higher the temperature, the greater the kinetic energy.

ONE

1. The process of counting is an exact one: whereas measurment can in practice only be carried out with a greater or less degree of approximation and can only ideally be made an exact process.
2. The method of constructing a new space from a given one depends on dividing the given space x into equivalence class, each of which is a point of a newly constructed space.
3. One who undertakes to tell the story of Mathematics during the late XVIII and the XIX centuries is confronted by a great difficulty.
4. One can easily repeat Galileo's experiment by dropping a large stone and a small one at the same time at the same height and by observing their hitting the ground at the same time.
5. One likes to mention important results connected with what one is discussing even if there is no time for a full treatment.
6. The difficulty is one which arises in the case of straightline boundaries and is due to discontinuities or other singularities in the assigned boundary values or initial values.
7. Elementary courses in differential equations present a long list of clever devices by means of which one is able to solve differential equations.
8. In order to solve a new problem, one should first try using methods similar to those that have worked on similar problems. Since we cannot expect that new situations are precisely the same as old ones, any useful learning will have to involve generalization techniques.

THAT

1. The specific gravity of a body is the ratio of the weight of the body to that of an equal volume of water.
2. The proton has a mass about equal to that of the hydrogen atom and carries a unit positive charge.
3. In order to fix the ideas presented we shall consider a familiar experiment, namely, that of a stone falling from a vertical height.
4. Available energy is that which can be used at once for mechanical effects; diffuse energy is that which cannot be so used and for practical purposes inapplicable.
5. The change of velocity is not, in general, the difference in magnitude between the magnitudes of the two velocities, but is that velocity which compounded with the original velocity gives the final velocity.
6. One of the three famous problems of antiquity was "Squaring the Circle" - that is, the construction of a square equal in area to that of a given circle. This is practically equivalent to determining by geometrical means the value of π.
7. It is important to observe that the equations in Monge's method are equivalent to those in Boole's method, so that the problem of obtaining the integral equivalent of one aggregate is effectively the same as that of obtaining the integral equivalent of the other aggregate.
8. Of the two essential properties of the arithmetic continuum, that of connexity, and that denoted by the term perfect, the latter is absolutely indispensable.

INDEFINITE PRONOUNS (some, any, no)

A

1. Some of the theorems in Riemann's geometry that differ from Euclid's are very interesting.
2. Every proof in Euclid called for some new, often ingenious approach.
3. What can be said about the motion of a body if some force is applied to it?
4. Let us concentrate our attention on the relations between the integer or some other group of objects lying in some particular stratum.
5. π is one of the most interesting, as well as famous, of numbers and as it is so important we must say something about it and its history.
6. Some measure of generality must be present in any highclass theorem, but too much tends inevitably to insipidity. Everything is what it is, and not another thing.
7. Nearly everyone knows something about Albert Einstein.
8. The word "fraction" is derived from a Latin word which means "something broken off".
9. By the age of eighteen Descartes resolved to see the world and learn something of life as it is lived in flesh and blood and not in paper and ink. He left school.
10. Lobatchewskian Geometry does not contain the nice flat planes of Euclidean Geometry, but nevertheless it is something entirely logical and consistent.
11. In Descartes' age a man of talent could hope to find something of interest in almost any science that took his fancy.
12. Any one branch or system of mathematics deals with a class of concepts pertinent to it.
13. The proof is made by showing that any supposed one to one correspondence between the positive integers and the set of all numbers between 0 and 1 leads to contradiction.
14. Once you are able to form a picture of "any number", you will discover that the rules of arithmetic are mathematically trivial and mechanical.
15. Galileo recognized that the number of whole numbers is infinite, that is, the number of these whole numbers is greater than any finite number that can be named.
16. If a man is in any sense a real mathematician, then it is a hundred to one that his mathematics will be far better than anything else he can do.

B.

1. No one knows when counting first began.
2. No man has had direct experience with what happens on other planets.
3. No one not even the most gifted mathematician can visualize four-dimensional structures; he must rely on his mind alone.
4. No one knows how the magnetic field creates its effect.
5. Thermodynamics makes no hypotheses about the nature of matter and is purely an experimental science.
6. No effort was spared to make Alexandria a truly magnificent centre of education.
7. Leonardo da Vinci made no very serious contribution to applied mathematics, but the suggestiveness of his studies kept it alive in people's minds.
8. By a "free particle" we mean a particle on which there acts no force but gravity.
9. Fermat published practically nothing.
10. No substantial additions to the development of the theory in question was made until the publication in 1861 of the memoir of Natani.
11. Descartes amused himself with his crudely constructed telescope, but did nothing of striking novelty.
12. We have the line of elementary geometry which we think of as possessing no definite length, but as indicating a certain direction.
13. Descartes did not tell anyone what he found on the 10th of November 1619, but we believe it was nothing less than the application of Algebra to geometry-analytic Geometry.
14. When we take into account the energy, which has been transformed into heat, sound, light and other forms, which modern physics recognizes as forms of energy, we find that there is no real loss of energy in an isolated system which is left to itself.
15. No machine yet invented has had brains enough to reject nonsense fed into it. Despite its inerrant accuracy and attractive appearance, even the most highly polished mechanism is no substitute for brains.

16. The graphic representation of a vector is in the form of an arrow thought of as having a definite length, direction and sense, but no definite position so that it is free to move provided it remains parallel to its original position.
17. How could mathematics, which had always claimed to present the truth about quantity and space, now offer several contradictor geometries? No more than one of these could be the truth.

EITHER, NEITHER, BOTH THE FORMER … THE LATTER

1. In higher mathematics we frequently have to deal with function, whose analytical form is either totally unknown or else is of such a nature that the function cannot easily be subjected to such operations as may be required.
2. Since only smooth and spherically symmetrical molecules are considered, the force which either exerts on the other is directed along the line joining their centers, A, B.
3. It is desired to express either pair of velocities in terms of the other pair, and of any geometrical variable required to complete the specification of the encounter.
4. Let us imagine P moving relative to 0 on either or both sides.
5. Work is both an everyday word and a scientific term.
6. Both Abel and Galois died long before their time, Abel at the age of twenty-seven from tuberculosis, Galois at twenty-one of a pistol shot.
7. The work which this mathematician was carrying at that time (1877 has relations with both that of Lie and that of Frobenius).
8. Both the classical and quantum theories of radiation predict that when homogeneous isotropic radiant energy falls on a perfectly reflecting surface, it exerts on the surface a pressure equal to 1/3 of the energy density.
9. One of the basic principles of quantum mechancs is that there is a limit both to experimental precision with which the position and momentum of a partirle can be simultaneously determined, and to the precision with which these quantities can or should be specified mathematically.
10. Galileo's and Newton's work established the existence of universal, mathematical laws. These laws described both the behavior of a speck of dust and the most distant star. No corner of the universe was outside their range.
11. Galois spent a considerable part of his five productive years in a hopeless fight against stupidities and indifference. Not at first quarrelsome or perverse, he became both.
12. The origins of both the critical approach can be traced definitely to the 1880's. Neither attracted much attention till Hilbert in 1899 published his work on the foundations of Geometry.
13. Neither astronomy nor any other science of the eighteenth century suggested the introduction of -1, which completed trigonometry, as no such scince ever made any use of the finished product.
14. In trying to describe modern computing machines one is faced with the dificulty that the subject has quite a few novel and advanced aspects, which are so interdependent that neither can be properly explained and understood without reference to the others.
15. Abel and Galois lost their lives when sill very young; the former from consumption induced by poverty, the latter in a duel.
16. Leibnitz made the independent discovery of the calculus, as well as he invented a calculating machine, which could divide, multiply and extract roots. For the latter he was elected to the Royal society of London, whereas for the former he obtained in time the acute enmity of all English scientists for sharing Newton's glory.

IT

1. In order that a body may pass from one position A to another position B, it must pass through every intermediate position in its path.
2. The theory of the arithmetic continuum has been criticized on the ground that it is an attempt to find the continuous within the domain of number, whereas number is essentially descrete.
3. When a particle is moving as a part of a rigid body, it is acted on by the external impressed forces and also by the molecular reaction of the other particles.
4. It we consider this particle as separated from the rest of the body and the external impressed forces removed, there is some one force which, under the same initial conditions, would make it move in the same way as before.
5. The description of mathematics as of the "science of numbers" is not valid at the present time; but it has excellent mathematical justification, since there is indeed a science of number, and since it was to this science that the name mathematics was first applied.
6. The reader to whom the subject is new, is advised to read the introduction through once, then return to it later after a study of the first few chapters of the book.
7. We derive our idea of force primarily from muscular effort. It requires an effort to lift a body, or to throw a ball.
8. It is necessary to note that the number zero was originally invented for the sole purpose of indicating an empty space.
9. It is usual to treat dynamics under the heads-statics and kinetics.
10. It is remarkable that although force and distance are both vector quantities, work, which is their product is not a vector quantity.
11. It is a matter of common experience that bodies may be soft like rubber or hard like steel.
12. It is usual to specify the place and time when describing an event in ordinary life.
13. It is a matter of common experience that water expands when freezing.
14. It is the opinion of historians that Zero was introduced by the Hindus or the Babilonians not later than the ninth century A.D.
15. As travel and commerce increased, it became essential to make permanent records of the results obtained on the abacus.
16. It is common practice to consider gases under pressure of one atmosphere.
17. It is a matter of common knowledge that bođies weigh less when immersed in water.
18. It is customary to have one operator present at the machine during computation, and on a some of the more elaborate machines two operators are useful.
19. It has been maintaidned by Poincare that the principle of Mathematical induction is a special characteristic of mathematical reasoning.
20. It is the aim of the general theory to reconstruct the various methods of proceeding to a solution, and to show why the isolated rules that seem so sourceless in practice actually prove effective.
21. It is the purpose of this chapter to enable the reader to apreciate the activities of professional programmers; it is not its purpose to teach him how to code or to give him the experience and detailed knowledge possessed by most professional programmers.

IT (emphatic)

B

1. It was in Alexandria that Greek science progressed for the next thousand years.
2. It is only of recent years that Euclid's "Elements" has been replaced by other books of a similar nature.
3. It is through the Arabs that we obtained our present decimal system of counting and the use of our familiar Arabic System.
4. It was in the 17th and 18th centuries that the foundations of modern mathematics were laid.
5. It was largely on the work of Galileo and Kepler that Newton built up his theory of gravitation.
6. Although Euclid was the author of several works, it is his "Elements" that is the best known. It was a text-book on geometry he wrote for his students, and for the next two thousand years it was the recognised students' book.

7. It was not until the early XIX century that a freer interchange of ideas took place and the bitterness of the controversy between Newton and Leibnitz subsided.
8. It was not until 1604 on the appearance of a new star, that Galileo publicly renounced the Aristotle's axiom of the "incorruptibility of the heavens".
9. It was not until Decartes, in the seventeenth century, invented the methods of analytical geometry and far simpler methods of manipulation, that the investigation of the properties of the curves became an easier task.

RELATIVE PRONOUNS OMITTED

1. The number of questions a man has set himself is ever increasing.
2. Descartes had the privilege of publishing anything he cared to write.
3. There is a definite equivalence between the quantity of energy and the amount of heat it is able to produce.
4. The earliest written mathematical work we possess consists of a papyrus written by an Egyptian priest named Ahmes.
5. A great many of the phenomena we observe in everyday life have a periodic motion.
6. If the wire is very smooth, the constraint is practically the only effect the wire produces on the motion of a bead.
7. It is difficult to give a brief account of the mathematical work Archimedes accomplished - so diverse were his activities.
8. The method consists in introducing litteral coefficients, substituting and finding the value these coefficients must have to satisfy the given equations.
9. The curves are then tangent and it becomes difficult to determine which curve is the continuation of the one we are tracing.
10. It was not until Einstein discovered the connection between gravitation and inertia that the mystery Newton could not understend was solved.
11. Little must be added in the first course in algebra to the knowledge the pupil already possesses of the real positive numbers from his study of arithmetic.
12. Various theories of infinitesimals the new point of view has given rise to will be discussed in the chapter to follow.
13. By translating a problem into mathematical terms, we put ourselves in the position where we can apply all we know about numbers without having to worry whether the unknowns represent quantities of dollars, horses, or cows.
14. The great mechanical ingenuity Newton displayed while a boy at school so impressed his family that it was resolved to send him to Cambridge. There there was scarcely a subject he was not interested in and very few he did not contribute to.
15. The reason the above assumptions give correct results is that the ratio of differentials is by definition the limit of the ratio of increments.
16. The equations we have solved have always contained two variables one of which may be considered independent, the other dependent.
17. We are now in a position to use some of the ideas we have just considered and see how they fit in together and form what is usually called the theory of relativity.
18. As a bullet travels through the air the distance and time it travels are continually increasing; at the instant it strikes a person, however, what is important is its speed, or rate of change of distance compared to time and not the distance and time it travelled.
19. Let the distance travelled by a body from the moment the action of the force F started to the moment the body comes to rest, be S. The motion of the body is one of uniform retardation. The work done in overcoming the resistance is A=FS.

SEQUENCE OF TENSES

1. It was formerly believed that atoms were the smallest constituent particles of matter.
2. In the distant past a man learned that number and form were as useful as language.
3. For nearly two thousand years it was believed that all heavy objects fell faster than light ones.
4. The history of π closes in 1882 when Lindemann showed that it could not be the root of an algebraical equation.
5. We said that two vectors were equal when and only when they were the same in these three respects (direction, sense along that direction and length).
6. The medeival Arabs saw that an advance in pure theory generally had practical uses, and that the solution of a practical difficulty was most clearly expressed if it could be fitted into a broad theoretical pattern.
7. Lobatchewsky made the ridiculous assumption that not one but two lines could be passed through an outside point and both of them be parallel to a third line.
8. For many generations, men did not even suspect that they were moving with the earth.
9. Leibnitz did not know that Newton had dealt with this subject but had not published his results.
10. The great poet Omar Khayyam, who was an astronomer by profession, insisted that sea waves had once spread over the vast territory of Central Asia.
11. Physicists showed that the centre of the earth was neither syrupy nor fluid but was almost as rigid as steel.
12. The king of Syracuse suspected that the gold of his crown had been alloyed with some baser metal and gave it to Archimedes to test.
13. The author wrote that in his book he would be concerned with the further development of the Calculus of Variation.
14. Following Toscanelli Christopher Columbus was sure that the earth was round and that he would reach the Indies by sailing west.
15. The author was not sure whether his theory would account for the phenomena in question.
16. We were quite sure that the method now in use would give the results desired.
17. Galilio assumed that the law of motion for a small sphere rolling down a grave in an inclined plane would be similar to that of a freely falling body.
18. Lobatchewsky set out to discover what would happen if he challenged the truth of the well-known Euclidean axiom.
19. Albert Einstein, when a boy of fifteen, knew what he wanted to do with his life; he made up his mind that he would specialize in abstract sciences.
20. After carefully examining the manuscripts, the author came to the conclusion that it would be very difficult to rewrite this portion of the work so as to connect the old matter with the new.
21. There was a time when people did not believe that a number existed great enough to express the number of grains of sand on a sea shore. Archimedes said, however, that such was not the case, and showing improved methods of notation, he solved the famous “Sand Reckoner” problem.

SUBORDINATE CLAUSE

1. What is large enough for one purpose may not be large enough for another.
2. A direct consequence of the mobility of the particles of a liquid is that the free surface of a liquid at rest is always horisontal.
3. The problem now is to determine what happens to the flow after two initial waves intersect.
4. What we have just proved is that there is no exact square root of 2.
5. Do you really know what the terms “speed” and “acceleration” mean in physics?
6. We do not know what absolute motion is; rest and motion are relative terms.
7. The principle Galileo followed was to measure what is measurable and to render measurable what is not yet so.
8. Whether this question can still be reduced to a finite problem cannot be decided now.
9. Newton's first law states that if a body at rest is acted upon by no forces, it will remain at rest.
10. Experiments can be carried out to ascertain whether the things suggested by the theory are actually true or false.
11. When the limit of a sequence is not known, it may be necessary to determine whether there is a limit.
12. The characteristic of a Vector quantity is that it has direction as well as magnitude, and is thus fitly represented by a straight line; in all cases vector quantities are compounded by the parallelogram law.

WHETHER

1. A computer, whether analog or digital, is a device for solving problems automatically.
2. The inertia of a body is the sum of the inertias of its several parts whether they are combined or separate.
3. The work done in raising a weight or compressing a spring is the same whether done in a second or in an hour.
4. No one knows when counting first began or whether the idea was created from experience or whether experience served as a stimulus to the primitive mind.
5. Any Fourier series, whether convergent or not, may be integrated term by term between any limits.
6. A very important characteristic of storage is whether it is dynamic or static that is, whether it exists in time as a sequence of pulses or in space as the condition of bistable elements.
7. Fermat claimed to have discovered a marvellous proof to what we call his "Last theorem", and whether or not he had, no proof has yet been found.
8. The question one asks is whether all the corpuscles in question are in fact elementary.
9. All gases behave in the same way toward changes in volume, temperature, regardless of whether they are elements, compounds, or, as in the case of air, a mixture of gaseous substances.
10. The physical laws of attraction tell us that the attraction between two masses, whether they be charged or uncharged, varies inversely with the square of the distance between them.