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The Canada School Journal.

VOL. I.

TORONTO, SEPTEMBER, 1877.

No. 4.

GEORGE PAXTON YOUNG, M.A.

Professor Young, besides being himself a teacher of great eminence, holds a high position amongst those who have made our system of education in Ontario what it is—an object of pride to ourselves and a model for other countries to imitate. He was born at Berwick-on-Tweed in 1818, and received his early training in his native place. His education was continued in the Edinburgh High School, and completed, in so far as scholastic instruction is concerned, in Edinburgh University, at which he took the degree of Master of Arts without having given any striking evidence of the possession of that keen intellectual power which has raised him to the front rank of living metaphysicians. During his Edinburgh career he enjoyed the questionable benefit of Professor John Wilson's lectures on Moral Philosophy, and just missed the unquestionable advantage of attending those of Sir William Hamilton on Logic and Mental Philosophy. It is quite possible that the *penchant* he has since manifested for the study of Philosophy might have been developed at an earlier period had Sir William's appointment taken place a few years before it did, but it may well be doubted whether, after all, his position in the philosophical world would have been as thoroughly independent as it is had it been his lot to come in his youth under the influence of one whose impress on the mental character of his disciples has proved so enduring. After leaving the University Mr. Young spent some time as a teacher of Mathematics, a branch of study of which he was very fond, and in which he subsequently became singularly proficient. After the disruption in the Established Church of Scotland in 1843, he entered the ministry of the Free Church, having attended during his theological course the instructive and highly suggestive lectures of Dr. Chalmers. After a brief pastorate in the Martyrs' Church, Paisley, he came to Canada in 1848, and settled in Hamilton, Ontario, as the pastor of Knox Church. His acquaintance with philosophical literature and his devotion to that branch of study led to his appointment to one of the chairs of Knox College, Toronto, the subjects assigned to him as a Professor being Mental and Moral Philosophy and Logic, besides one or two departments of Theology. This position he resigned after a few years, and shortly afterwards accepted that of Inspector of Grammar Schools, which he held for

four years and a half with great benefit to the cause of middle-class education and credit to himself. His reports on the condition of the Grammar Schools of the Province threw a flood of light on their internal condition and management, and made the wrong tendency of the system so apparent that the necessity for remedial legislation was at once admitted. To attempt to account for the existence of the evil thus described would be to give the history of the Provincial Grammar Schools with more of detail than our space will allow. Suffice it to say, that it was due mainly to the want of adequate inspection during the earlier years of their existence, and to unsuitable methods of distributing the Government grant during almost the whole period of distribution. The Grammar School system in this Province, singular to say, came into



(From a photograph by Hunter & Co.)

existence ten years at least before any attempt was made to establish a system of Common Schools. For nearly half a century the schools were allowed to spring up and develop with little State aid and equally little interference in the shape of inspection or supervisory control. In 1858 they became the recipients of Government aid, which was distributed on a plan admirably calculated to increase the number of the schools, but little calculated to enhance their efficiency. In 1865 a change was effected in the mode of distribution, the principal effect of which was to put an additional premium on the study of Latin to at least a nominal extent. The schools became in consequence crowded with pupils who were acquiring neither a good classical nor a good English education. The defects of the training imparted under this system were laid bare in Professor Young's reports of 1866 and 1867, which contained also many valuable suggestions as

to the best method of remedying them. These were subsequently to a great extent embodied in the School Acts of 1871, 1874 and 1877, and in the Regulations drawn up between the two latter years by the Central Committee, which was at that time composed of Professor Young and the High School Inspectors. The principle of "payment by results," which was prominently put forward in the reports above mentioned, was fully recognized in the mode of distributing the grant which came into operation in 1876 in connection with the Intermediate High School Examination. Whatever defects may in the light of experience have been discerned in this scheme, they are in all probability capable of being successfully dealt with, but even at this stage it is safe to say that with all its defects it is by far the most complete and effective system

for aiding the schools on the one hand, and securing their efficiency on the other, that has yet been devised. Important as has been the work done in the interest of the High Schools by the Committee of which Professor Young is chairman, the improvements made in the Public School system on their suggestion are hardly less so. The changes made by the Act of 1877 are quite as radical as those made by that of 1871, and whether their ultimate effect will be as beneficial as has been predicted or not, there can be no doubt as to the amount of anxious care and labour expended on the scheme by the Minister of Education and his advisers.

Professor Young resigned the position of Grammar School Inspector to resume that of a teacher of Philosophy in Knox College, and in 1871 he succeeded the late Dr. Beaven as Professor of Metaphysics and Ethics in University College. The field thus opened up was an extensive, and to him an attractive one. During the years of his pastorate he had begun a course of reading in Philosophy, which has been carried on with so much assiduity that he has few living rivals in the intimacy of his acquaintance with the literature of his subject. But he is far from being merely an erudite scholar. As a teacher he stands in the very foremost rank, his method being as admirably adapted for rendering the subject matter of his lectures intelligible to his students as his manner is for calling forth their enthusiasm, and making what is usually regarded as an unattractive theme one of the most interesting that can be imagined. Under his management the Department of Philosophy has, from being one of the least popular, become one of the most so in the College, while as a mental training it is now second to none of the others. Not the least attractive feature about it is the acuteness with which he analyses, and the intellectual independence and freedom with which he criticizes the systems of other philosophers, while he enunciates his own opinions with equal energy and candour. It only remains to add that, besides his present position as Chairman of the Central Committee, which discharges the double function of an Advisory Board and a Board of Examiners, and his former one of Grammar School Inspector, Professor Young held for a time that of a member of the Council of Public Instruction. In 1871 he was unanimously elected President of the Ontario Teachers' Association, on which occasion he delivered an address which was at once a valuable exposition of, and commentary on the principles of the then recently enacted School law, which made such extensive changes in the old systems of inspection of Common Schools and examination and classification of Common School teachers.

AFFECTION IN THE INSANE.—It was my fortune to have daily a girl under management answering to this description. Her name was Thorne, and she was literally a "thorn in the flesh." When I first entered the room as a visitor, she attracted my attention (an art in which she excelled) by leaving her seat and coming to me laughing and saying: "You teach us?" "You nice lady?" "You won't punish, will you?" When not talking to me she would attract my attention in other ways; holding up her apron, standing, etc.

When I entered as teacher I was informed of her evil propensities, and told that her aim and delight would be to tantalize in every possible way. Sure enough, the prediction was true! Not one moment passed that her untiring energies were not fully occupied in carrying out the devices of her mind! From the first, I decided to ignore her doings, always speaking kindly, and thus to win her good favor, but my silent efforts were futile, and every day her annoyances increased rather than diminished, until I was obliged to resort to forcible resources. One very disturbing habit was to slam down, with a loud noise, the seats as she passed them in the school-room, during marching hour; each time looking at me, laughing. Finally I told her if she slammed another seat I should punish her hands. This was just what she'd been wishing, and the news was received with delight; so, in a few moments, another seat suspended on hinges fell with a crash and a pair of evil eyes, nearly closed, were turned exultantly to me, her face convulsed with laughter.

Immediately I went to her, and with some difficulty led her away from the others, and after a half-hour's severe labor, succeeded in confining her hands. Her strength seemed almost superhuman; and, for a while, I thought she would gain the victory, unless I called for aid. I left her uttering fierce imprecations; and at noon went to ascertain her condition, telling her if ready to mind when spoken to kindly, I would release her for dinner. But she was perfectly relentless, and took her dinner in solitude. There she

remained the greater part of the day, when she promised "to mind."

After that day I found that in order to live with her, not one evil deed should escape my notice. I followed her up closely, and when she persisted in wrong, I threatened another similar confinement; this assertion she doubted, and obliged me to reiterate twice the solitary confinement.

The effect produced by the last was magical. She never gave me cause for like treatment afterward; her entire demeanor toward me was changed. I always spoke and treated her kindly, praising her for every good deed. I liked her in spite of her depravity.

Her demonstrations of affection were so frequent and forcible, that they proved annoying, though gratifying, for they told me she was exhibiting another phase of her nature. She would lie in wait for me, as a tigress for her prey; and when I passed through a room she was in, would seize me with a powerful grasp, and only by force could I extricate myself. Her appreciation of gifts was marked. Coming from lunch one day, I gave her half an apple, and several days after she took it from her pocket shriveled and dry.

When she heard I was going to leave, her grief found vent in floods of tears, though not a word escaped her lips. As I entered the school-room the morning of my departure she was sobbing bitterly, and the moment she saw me she sprang from her seat and ran to another room like a hunted deer. I followed her, wishing to bid her good-bye, but she vanished the instant I approached. She spoke not a word, but sobbed. Thus closed my parting with the poor, ill-starred child. It made an impression on my memory never to be effaced; and who shall say that some time in the dim future we may not "meet beyond the river," her sin-steeped soul "washed whiter than snow?"—*G. in Phrenological Journal.*

—The *New York World* recently gave a lucid and interesting sketch of the history of education in Russia since the time of Peter the Great. According to our contemporary, it may be said, without exaggeration, that in no other country of continental Europe, not even in Germany, are such facilities offered to the poorer classes of the nation for acquiring a superior degree of instruction as in Russia. All the universities have for the last twenty years been full of students. The average number, according to the yearly reports of the university councils, amounts to above 18,000, of which at least two-thirds belong to the poorer classes, who are aided in their studies by the State and by private societies. After such a statement one can have very little hesitation in coming to a conclusion respecting the ultimate fate of the illiterate Turks. It seems from the same article that Canada is not the only country in which a penchant for classics haunts the minds of those in authority. The Russian Minister of Instruction would like to convert the gymnasia into Etons and Rugbys, but the system of practical education established by Peter the Great is wonderfully impervious to change, and its inertia is aided by the wise conservatism of the peers and of educationists.

—We have all sorts of laws, to meet all sorts of misdemeanors and crimes, but one is needed to abate scolding in our schools. It should read something like this: An Act to abate a crying nuisance.—*Whereas*—it is known that scolding is a crime and cruelty; and, *Whereas*—in school it is equally destructive to good feeling, and consequently to good health, and thus a means of shortening life: *Therefore be it enacted*,—That whenever a teacher shall be known to scold more than twice in one day, or more than six times in one week, he shall, on the testimony of six pupils of known good behaviour, be convicted of a misdemeanor, and be fined not more than fifty dollars, nor less than one cent, and confined in the county jail for one month, and be compelled to read aloud to his fellow-prisoners, *Oliver Twist*, *Hamlet*, and *Burton's Anatomy of Melancholy*, Sundays excepted, when he shall be required to do nothing. A law of this kind, thoroughly enforced, would soon tend to abate the nuisance.—*National Teachers' Monthly for May.*

—Teachers who have attempted to make applied knowledge part of the school drill have made themselves unpopular. The introduction of sewing into the Boston schools met with strong opposition. A master who took his class out to a wood-pile and showed them how to measure it, was hooted at. The majority of instructors, either misconceiving the duties of their calling, or overruled by those higher in authority, have taught text-books more than the principles which underlie them; and those having official charge of public education have been the servants rather than the progressive leaders of the people.—*Attleboro' Gazette.*

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The Canada School Journal.

TORONTO, SEPTEMBER, 1877.

THE TRAINING OF TEACHERS.

The following remarks on this subject by Dr. Rand, Superintendent of Public Instruction for the Province of New Brunswick, form part of the address delivered by him on the occasion of the recent opening of the new Normal School building at Fredericton. At a time when so many County Model Schools in this Province are just beginning their existence as training institutions, too much light cannot be thrown on the nature of the work Normal Schools are designed to perform, and the manner and spirit in which the masters should discharge the duties devolving upon them:—

The theory upon which this institution has been established and is to be conducted is that every person has more or less of the talent requisite in the teacher. All are born with the same order of faculties. No sound mind is wholly destitute of reason, judgment, memory, imagination, association. Firmness, decision, the power to stimulate and command, are vouchsafed in some degree to every individual, and each of these powers is susceptible of cultivation. That which is weak, may, by a judicious course of exercise, be developed and made comparatively strong. Whatever may be regarded as the necessary natural endowments of a teacher

must exist to some extent in all persons. By a proper system of special training, these natural endowments will be strengthened and the individual made capable of more acceptable service than would otherwise be at all possible. Some, indeed, there are who can never be made successful in this calling, and the same will hold true in regard to all professions and occupations. Henceforth in this institution only those students who, in the judgment of the faculty of instructors, give satisfactory evidence of possessing at least fair professional ability, will be admitted to examinations for license. It is sometimes claimed that a thorough knowledge of the subjects to be taught is all that is necessary for successful teaching. But observation, reason and experience alike concur in refuting this assumption. That a teacher should thoroughly know the subject he professes to teach, is of course admitted; but the question at issue is to be decided, it should be remembered, by considerations lying on the pupil's side of it. The process of thinking, by which the pupil learns, is essentially his own. The teacher can but stimulate and direct, he cannot supersede it. He cannot do the thinking necessary to gain the desired result for his pupil. The problem which he has to solve, therefore, is how to get his pupil to learn: and it is evident that one acting as teacher may know the subject without knowing the best means of making his pupil know it too. He may be an adept in his subject, but a novice in the art of teaching it—an art which has principles, laws, and processes peculiar to itself. Scholarly attainments are indispensable, but a clear insight into, and a warm sympathy with, child nature; a mastery of the art of questioning; the ability to command, control and influence the young; a knowledge of the history and nature of education; of school organization and management, and of good methods of conducting the complicated operations of the school,—all these and many other things are not less important to him who would teach successfully, than good scholarship. There are immutable principles in education, and there are methods based upon them that must be modified according to the circumstances of time, place and persons, under which they are to be applied; and did the characteristic work of this Normal School stop with the consideration of these, I should have small hope for its large success. The young teacher needs to have the theories of the classroom embodied, as perfectly as possible, in the conduct of actual schools before his very eyes; and to be trained by instruction, practice and criticism to a practical knowledge of principles and methods, and to their judicious application to the details of school work. The lower story of this building is equipped for model and practising schools having a consecutive course of instruction covering the first eight years of school life, and therefore affording a sufficient field for the application of the principles of management and method to the general school work of the Province. For the first time since the introduction of the present school system, and indeed, as far as I am aware, for the first time in any existing Normal School, the student-teachers will have equal facilities for observing and practising in both graded and ungraded, or miscellaneous, schools. This is a matter of great moment to the school districts throughout the Province, since about sixty-six per cent. of our school children are residents of rural districts, in which, from lack of sufficient population, the conditions for graded schools cannot be had. These increased facilities are secured by the use of adjustable school desks, so that such portions of the several grades of pupils in all the departments as the Principal of the Normal Schools may find necessary, may be assembled in their respective school rooms, and for any period, without difficulty or disorder. As my experience and observation of the training of teachers increases, the more sharply do I recognize the great difference between the science of education and the art of education, and, therefore, the absolute necessity of making practising schools a very important part of the course of our student-teachers. Science tells us what a thing is and why it is. It deals, therefore, with the nature of the thing, with its relations to other things, and consequently with the laws of its being. Art derives its rules from this knowledge of the thing, and its laws of action, and says: "Do this or that with the thing in order to accomplish the end you have in view. If you act otherwise with it, you violate the laws of its being." Now the rules of art may be carried out blindly or intelligently. If blindly, the worker is a mere artisan—an operative who follows routine, whose rule is the rule-of-thumb. If intelligently, he is a true artist, who not only knows what he is doing, but why this process is right and that wrong, and who is furnished with resources suitable for guiding normal, and correcting abnormal, action. All the operations of the true artist can be justified by reference to known principles. Art and nature are not really

opposed to each other. Bacon long ago pointed out the true distinction when he said: *Ars est homo additus Nature*—art is nature with the addition of man—art is man's work added to (not put in the place of) nature's work. This assembly hall and the classroom in the second storey, primarily exist to furnish facilities for shewing that all this is as true in respect of the whole field of the teacher's work, as it is in all other callings of life. But it needs the actual conditions and work of the school-room in order to give a correct and working knowledge of principles. These are supplied in this building, as I have stated, by the arrangements for Model schools. In these the principal secures to the student-teachers opportunities for observing the operations there carried on, and whether they illustrate or violate the findings of his discussions of the class-room. But while observation, for those who have eyes to see, is a good thing, and while here and there one is found able to see that at which he steadfastly looks, many more are found unable to appreciate just what all the trouble and worry they have been through in listening to or taking part in discussions of the nature of education, the nature of the child, the science and the art of teaching, and the how and why of management, was about. They cannot see but the children are right enough, always doing the right thing at the right moment, saying just what they ought to say, and very ready to learn. That is about the extent of the benefits of observation to one who has never had charge of a school. And here is where the virtue of practising schools come in. The principal requires students to take charge of these schools for short periods, at a time, and to give specified lessons in presence of himself or his associates, and groups of student teachers. When the exercise is over, opinions of its merits are elicited from those of the students who witnessed it, and then is revealed, as with a sunbeam, the grasp of principles and facility to apply them, or the want of these. Here are real and substantial data from which to carry on the work of training, and it is often very surprising how generally, and in some instances rapidly, a correct knowledge of principles is thus successfully lodged, and professional skill developed. These are, in brief, some of the characteristics of the work for which this institution exists, and for the more successful cultivation of which this building has been erected. Here, we trust, is to be impressed deeply upon the minds and hearts of our teachers, the truth that the object of education is the development of manhood and womanhood in harmony with the attributes with which the all-wise Maker has endowed them. Here, we are confident, our teachers will carefully be taught that they are to do the work assigned to them in our school system, in full view of the great object of which it forms so important a part. It is a great, a noble, a blessed work,—

"No work
Of art, or finest mechanism in things
Material, hath e'er so challenged for
Its right discharge e'en the vast aggregate
Of human skill."

The same subject forms the basis of the following remarks in a recent number of the *Nova Scotia Journal of Education*:—

The idea is sometimes put forward that a young person should teach for a year or two before entering a Normal School. No advice could be less to the point. If a Normal School is what it should be, the sooner the would-be teacher is in it the better. The year or two of bungling is a loss to the teacher and pupil alike. The true method is for the aspirant to study the Science and Art of teaching under the best masters possible, just as the man or woman does who desires to excel in singing, or playing on the piano. The truth is, we are all of us under the influence of the past in this respect. We learned to teach by painful trials in the school-room. A celebrated oculist was complimented on his dexterity—"Before I acquired it," he replied, "I spoiled a bushel of eyes." And so before we attained skill we sacrificed many a pupil. We may not like to confess it, but facts are against the method by which we became teachers. The Normal School proposes to instruct teachers in the Science and Art of teaching. And in the words of Guizot, we would say—"Let no school master be appointed who has not himself been a pupil of the school which instructs in the art of teaching, and who is not certified after a strict examination to have profited by the opportunities he has enjoyed."

There is a single argument, in addition to the many that have been frequently urged why every teacher should be a graduate of a Normal School, that is of great weight—Hundreds of young men and women never can teach and never should try it. They will

learn this fact very soon after they enter the Training Department. If a man has no aptitude for teaching, and it cannot be developed, the sooner he seeks some other occupation the better. The service the Normal School thus does is of the highest benefit to the schools as well as to the individual. Like the lightning rod, they draw off silently a class that would do a great deal of harm if allowed to practise on the community for a year or two, to satisfy themselves of the absence of aptitude to teach.

The deep interest taken in the training of teachers by educationists of the present day in all countries, and not least in our own Province, is a proof of the intrinsic importance of the question. The fact that New Brunswick has just completed a handsome Normal School building, while Nova Scotia has one under construction, is ample evidence of the attention paid by our sister Provinces to this department of educational work. Here we have just ushered into existence a highly elaborate system of training institutions, the operation of which will be watched with no small amount of anxiety. Should the system prove a success, the country will have reason to congratulate itself on the comparatively small sum expended; should it prove a failure, something else must be tried, for trained teachers can no longer be dispensed with.

—We publish this month, in the form of a supplement to the *SCHOOL JOURNAL*, the new Public School programme, accompanied by the official "Hints" on its use, and the authorized lists of Public and High School text-books. It will be worth each teacher's while to preserve the sheet for future reference. It will be observed that in the case of the Public School text-books the publisher's price accompanies the title of each volume. By this simple but wise precaution the Department has put it into the power of each teacher to see that his pupils are not overcharged by those from whom they purchase their school books. It will be noticed, also, that a sample copy of each work published in Canada is filed in the Department, so that purchasers can, if they choose, ascertain whether the books sold them are of the quality stipulated by the Department and agreed to by the publisher. It is to be hoped that in all cases teachers will endeavour to avail themselves of these precautions, with a view to protecting the pupils and their parents from unnecessary loss.

Practical Education.

Queries in relation to methods of teaching, discipline, school management, &c., will be answered in this department. J. HUGHES, Editor.

HOW TO READ.

BY RICHARD LEWIS.

II.

There are three qualifications necessary to constitute a good reader, which because they are physical and not mental may easily be acquired in youth, and, unless there be some organic defect, are not impossible to adult age. These qualifications are: (1), a voice of good quality; (2), flexibility of voice; (3), perfect articulation. The exercises necessary to cultivate the voice are most beneficial to the general health. The voice, and all the vocal organs, never suffer from use but from abuse. Children in play shout and laugh with all the energy they can

command, and the vigorous vocal efforts, although annoying to quiet and sedentary people, expand the lungs, circulate the blood, and give it additional purity and nourishment, as the happy child unconsciously inhales great draughts of pure air in his shouting efforts. Mariners, who have to raise their voices higher than the stormy winds and louder than the roaring of the tempest, have generally expansive chests and voices of the deepest tone and greatest power. There is no fear of energetic speaking and shouting injuring the voice if the exercise be carried on with due regard to the physical organization. Hence the importance of making such exercises a part of the gymnastic training of youth.

These vocal exercises are simple and agreeable, and are of two classes. The first consists of a series of well-arranged breathing practices, which, as they fill and expand the whole breathing apparatus, are best conducted in the open air, and should at all times be made where there is an abundance of pure air. The pupils stand erect, with the shoulders thrown back and the chest fully expanded. The air is then inhaled through the nostrils until the lungs are filled to their fullest extent. Then the breath is sent out in various forms of practice. It is allowed to pass out calmly and without effort. It is expelled with a gentle force. It is driven out with great energy, as if the vocal gymnast would knock a house down with the expulsive action. Again it is slowly poured forth until entirely expelled, or it is sent out in rapid jets like the panting of a steam engine in full blast. The moment the breath is exhausted, the lungs are instantly and rapidly refilled, and thus every cell, the most remote in the lungs, which in our methods of reading and conversing we never use, is brought into full and vigorous play. The certain result of such exercises is to enlarge the lungs and the chest, and students who have faithfully carried out the practice have gained several inches in lung capacity in two or three months. I need scarcely say that such exercises, like all other gymnastics, must be in harmony with the physical organization. Excess in vocal as in limb gymnastics cannot fail to be injurious. But nature, in this as in all other bodily exercises, is a sure guide. Excesses are always followed by pain, while judicious and moderate practice leaves agreeable and healthful sensations.

The breathing exercises are a preparation for the voice exercises. Unless there be some organic defect every human being is created with the elements of a good voice, and if the natural powers were systematically cultivated, good voices in adult age would be the rule and not the exception. The expressiveness of speech which marks the delivery of a good reader or speaker is due to the management of the voice more than to the control of the intellect. It is true that to give the just expression, the voice must act under the guidance of the intellect—the reader must understand what he reads. But often the most intelligent and cultivated reader fails utterly in the expressive delivery of a passage which he thoroughly understands. He has no control over his voice, and he has no conception of the music of speech. This no doubt will be the great difficulty which we shall have to meet in introducing the subject into our public schools. But it is not greater than the difficulty of introducing musical culture into school education, and as we advance in musical culture the difficulties of developing the speaking voice will disappear. Much of the practice for improving and training the voice for singing is similar to the practice for drilling the speaking voice. It has, however, certain marked differences. The singing voice advances by sustained tones and incessant changes of modulation or pitch. The speaking tones must always be sustained; but while each tone of the singing voice is level and unvarying in pitch, each tone of the speaking voice invariably ends by sliding upwards or downwards. Now it is these slides—technically, inflections—which form one of the

essential qualities of good reading; and while acuteness of ear to distinguish such variations is as necessary to the reader as the vocalist, the vocal action is different and demands a different mode of practice.

(To be continued.)

Mathematical Department.

Communications intended for this part of the JOURNAL should be on separate sheets, written on only one side, and properly paged to prevent mistakes. ALFRED BAKER, B.A., EDITOR.

BINOMIAL THEOREM.

(Communicated by J. Morrison, M.D., M.A., Member of the Medical Council, and Examiner in Chemistry in the College of Physicians and Surgeons of Ontario.)

*Lemma. If n be a positive integer

$$\frac{a^n - b^n}{a - b} = a^{n-1} + a^{n-2}b + a^{n-3}b^2 + \dots n \text{ terms.}$$

Hence the limiting value of the fraction $\frac{a^n - b^n}{a - b}$, when $a = b$, is na^{n-1} .

To expand $(1 + x)^n$, n being a positive integer.

$$\text{Assume } (1 + x)^n = 1 + Ax + Bx^2 + Cx^3 + \dots \quad (1)$$

when A, B, \dots involve n , but not x . By putting $x = 0$, we see the first term of the expansion must be 1.

$$\text{Similarly, } (1 + y)^n = 1 + Ay + By^2 + Cy^3 + \dots$$

Subtracting

$$(1 + x)^n - (1 + y)^n = A(x - y) + B(x^2 - y^2) + \dots$$

Since $(1 + x) - (1 + y) = x - y$, we have by division

$$\frac{(1 + x)^n - (1 + y)^n}{(1 + x) - (1 + y)} = A + B \frac{x^2 - y^2}{x - y} + C \frac{x^3 - y^3}{x - y} + \dots$$

Now since this equation is true for all values of x and y , it must be true when $x = y$, and then by the above lemma it becomes

$$n(1 + x)^{n-1} = A + 2Bx + 3Cx^2 + \dots$$

Multiply this by $1 + x$, and we have

$$n(1 + x)^n = A + 2Bx + 3Cx^2 + \dots + Ax + 2Bx^2 + \dots \quad (2)$$

And (1) multiplied by n gives

$$n(1 + x)^n = n + nAx + nBx^2 + \dots \quad (3)$$

And equating the coefficients of corresponding powers of x ,

$$A = n.$$

$$2B + A = nA, \quad \text{or } B = \frac{n-1}{2}A.$$

$$3C + 2B = nB, \quad \text{or } C = \frac{n-2}{3}B.$$

&c.

&c.

In which the law of the equations is evident. Substituting in each of these values that of the preceding coefficient, they become

$$A = n; B = n \cdot \frac{n-1}{2}; C = n \cdot \frac{n-1}{2} \cdot \frac{n-2}{3}; \&c.$$

Substituting these values in (1), we have

$$(1 + x)^n = 1 + nx + \frac{n(n-1)}{1 \cdot 2} x^2 + \dots$$

$$\text{Cor. } (a + x)^n = a^n \left(1 + \frac{x}{a} \right)^n = a^n \left\{ 1 + n \cdot \frac{x}{a} + \frac{n(n-1)}{1 \cdot 2} \left(\frac{x}{a} \right)^2 + \dots \right\}$$

$$= a^n + na^{n-1}x + \frac{n(n-1)}{1 \cdot 2} a^{n-2}x^2 + \dots$$

If the indices be fractional or negative the lemma may be established as follows:

The limit of $\frac{a^p - b^p}{a - b}$, when $a = b$, is $\frac{p}{q} a^{p-1}$.

For let $a = k^q$, $b = l^q$; then $a^{\frac{p}{q}} = k^p$, $b^{\frac{p}{q}} = l^p$,

$$\therefore \frac{a^{\frac{p}{q}} - b^{\frac{p}{q}}}{a - b} = \frac{k^p - l^p}{k^q - l^q} = \frac{k^p - l^p}{(k - l)(k^{q-1} + k^{q-2}l + \dots + l^{q-1})} = \left(\text{when } a = b, \text{ or } k = l \right),$$

$$\frac{pk^{p-1}}{qk^{q-1}} = \frac{p}{q} k^{p-q} = \frac{p}{q} a^{\frac{p}{q}-1}.$$

The limit of $\frac{a^{-n} - b^{-n}}{a - b}$ when $a = b$, is $-na^{-n-1}$.

$$\text{For } \frac{a^{-n} - b^{-n}}{a - b} = \frac{-a^{-n}b^{-n}(a^n - b^n)}{a - b} = \left(\text{when } a = b \right) -$$

$$a^{-2n} \cdot na^{n-1} = -na^{-n-1}.$$

The proof of the Binomial Theorem in the case of fractional and negative indices will now be precisely the same as that given above when the index is positive.

Contributions and Correspondence.

INTERMISSIONS IN SCHOOLS.

It is by no means an easy matter for a teacher, without assistants, in an ungraded or partially graded school, to arrange his timetable in such a way as to afford sufficiently frequent changes of position to his pupils. The schools I speak of are to be found chiefly in rural districts, and amongst these there is a considerable diversity of practice with respect to recesses or intermissions. Some teachers never allow any intermission during the forenoon or afternoon, but permit, as in that case they must needs do, each pupil to leave the room whenever he asks leave to do so. Others—and they form a great majority—have one recess in the middle of the forenoon and another in the middle of the afternoon, of about fifteen minutes each. I propose to give the readers of the *SCHOOL JOURNAL* the benefit of my own experience in the matter, and shall be happy if the result of my doing so is to aid both teachers and pupils in securing the maximum of work done with the minimum of irritation and of injury to health.

While teaching, many years ago, in a country school, at a time when assistants and grading were alike unheard of outside of towns, I resolved to make an experiment and watch carefully the result. I was then young enough to have a vivid recollection of the weary hours I had myself spent at school in a thoroughly aimless and listless way, looking forward to the coming recess, when I should be able to get a breath of fresh air and secure a complete change of position as a means of relaxing my fatigued muscles. I could then, and can still, recollect well the zest with which I and my fellow-pupils entered into our sports during the few minutes placed at our disposal, and the new vigour with which we went to turn to our work after our play was done. After teaching for some time on the old-fashioned system of intermissions at intervals of an hour and a half, I ascertained by careful observation that the last half hour of each interval was for the most part wasted by the wearied pupils in vain efforts to fix their minds on their work, or thoroughly successful efforts to amuse themselves whenever they thought they were unobserved, while to myself it was a period of continuous and most depressing irritation on account of the increased difficulty of keeping order. Shortly before taking charge of the school I had spent a session in the Provincial Normal School, where the class was dismissed at the end of every hour. I knew from experience how hard it was for even an adult student to keep his attention thoroughly fixed on the lecturer towards the close of the day, with hourly intermissions,

and I came to the conclusion that the difficulty I felt in keeping my school in quiet order was due to the length of the intervals between recesses.

Having resolved on a change, I first consulted the pupils on the subject. I explained to them the reason why both they and I felt so listless and irritable after being at work in vitiated air for a length of time, and proposed, with their consent, to have a shorter intermission at the end of each hour, instead of the fifteen minutes at the end of an hour and a half. Not a few objections were made, for I allowed a free discussion of the matter and ample time for consideration; but eventually it was resolved by the pupils that the change should be made, with the proviso that if it did not suit they should have an opportunity of reconsidering their decision. The change was made accordingly, and neither they nor I had any reason to regret it. So completely satisfactory was it to the school that not a single voice was raised in favour of a return to the old system when the matter was again submitted to them. To me it was an inexpressible relief. Of course the additional confusion inseparable from dismissing and re-assembling the pupils was a drawback, but at the worst it was insignificant in comparison with the freedom from irritation and the great increase in the amount of work accomplished. After long and careful observation under the changed conditions, I was driven to the conclusion that pupils should not be debarred for more than three quarters of an hour at a time from enjoying a few minutes' recreation in the fresh air; in the case of very young children the interval may advantageously be made much shorter even than this. It follows that the school should be, as adult classes in colleges are, dismissed hourly; and even though it may take fifteen minutes to cover the period of recess and the time necessary for getting the school again at work, I am satisfied that after a fair trial no teacher would dream of going back to the old fashion of single recesses or none at all. I should be glad to hear from others on a matter of such vital importance to the health of the pupils, the good temper of the teacher, and the work done by all.

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Examination Questions.

Under this head will be published from month to month the papers set at the examination for entrance into the High Schools of Ontario, the Intermediate High School Examination, the examination of candidates for Public School teachers' certificates, and the Junior and Senior Matriculation examinations of the University of Toronto. The Mathematical papers will in all cases be accompanied by analytical solutions of the more difficult problems and hints on the best methods of solving the others.

PAPERS FOR JULY, 1877.

ENGLISH LITERATURE.

Examiner: J. M. BUCHAN, M.A.

SECOND-CLASS TEACHERS AND INTERMEDIATE.

I.

1. Carlyle says that Scott employed great power in procuring the means to gratify an essentially vulgar ambition. To what does this criticism refer? Do you concur in it? Give reasons for your answer.

2. Name the author of each of the following works:—The Ancient Mariner, Rasselas, Woodstock, Thalaba the Destroyer, Child Harold's Pilgrimage, The Bard, Hyperion, the Excursion, and Pamela.

3. Tell the story of the ballad of Alice Brand, quoting any parts of it which you may remember. In what part of the Lady of the Lake does it occur?

4. "The Monarch saw the gambols flag,
And bade let loose a gallant stag,
Whose pride, the holiday to crown,
Two favorite greyhounds should pull down,
That venison free and Bordeaux wine

Might serve the archery to dine.
 But Lufra,—whom from Douglas' side
 Nor bribe nor threat could o'er divide,
 The fleetest hound in all the North,—
 Brave Lufra saw, and darted forth. 10
 She left the royal hounds midway,
 And dashing on the antler'd prey,
 Sunk her sharp muzzle in his flank,
 And deep the flowing life-blood drank.
 The King's stout huntsman saw the sport 15
 By strange intruder broken short,
 Came up, and with his leash unbound,
 In anger struck the noble hound.
 —The Douglas had endured that morn,
 The King's cold look, the nobles' scorn,
 And last, and worst to spirit proud,
 Had borne the pity of the crowd;
 But Lufra had been fondly brod,
 To share his board, to watch his bed,
 And oft would Ellen, Lufra's neck, 25
 In maiden gloe, with garlands deck:
 They were such playmates, that with name
 Of Lufra, Ellen's image came.
 His stifled wrath is brimming high,
 In darkened brow and flashing eye;
 As waves before the bark divide,
 The crowd gave way before his stride;
 Needs but a buffet and no more,
 The groom lies senseless in his gore, 35
 Such blow no other hand could deal,
 Though gannetted in glove of steel."

- (i.) What do you consider to be the fine strokes in this passage?
- (ii.) At what juncture does this incident occur?
- (iii.) Give the name of the monarch, and that of this Douglas. Where is Bordeaux?
- (iv.) Scan l. 5.
- (v.) For what is 'archery' used in l. 6? Give the meaning of 'leash' in l. 17.
- (vi.) Give the grammatical relations of the words in l. 38.
- (vii.) Tell what you know about the Douglas family.

5. State your views as to the points of difference between the men of the Lady of the Lake and the actual men of the time of James V.

6. "Far from the madding crowd's ignoble strife,
 Their sober wishes never learned to stray;
 Along the cool sequestered vale of life
 They kept the noiseless tenor of their way.

Yet ev'n these bones from insult to protect
 Some frail memorial still, erected nigh,
 With uncouth rhymes and shapeless sculpture deck'd,
 Implores the passing tribute of a sigh."

—Gray's *Elegy*, Ll. 78-80.

- (i.) Give the grammatical relation of 'far,' l. 78; and 'still,' l. 78.
- (ii.) Explain the meaning of 'madding,' l. 78; and 'vale of life,' l. 75. For what does the expression 'these bones,' l. 77, stand?
- (iii.) Give the derivation of 'uncouth.' Explain how 'rhyme' came to be spelt with an *h* and a *y*.
- (iv.) Why is the final *d* in 'deck'd' sounded like *t*? Give similar instances.

7. Quote or refer to passages in the *Elegy* and the *Lady of the Lake* that show the points of view from which persons in low station are regarded in these poems. Is the perusal of them likely to inspire respect or disdain for the humble? Would it be correct to infer that the sentiments on this subject expressed in the poems are in each case the sentiments of the authors? Give reasons for your answers.

8. State briefly the leading thoughts of the *Elegy*.

II.

FIRST-CLASS TEACHERS.

SHAKESPEARE.

1. Quote or refer to "examples of excessive personification of nature, extravagance of imagery, and expression overcharged with condensed thought," furnished by this poet, and compare him in these respects with Bacon.

2. MACBETH.—Thou canst not say I did it: never shake
 Thy gory locks at me.

ROSS.—Gentlemen, rise, his highness is not well.
 LADY M.—Sit, worthy friends:—my lord is often thus,
 And hath been from his youth: 'pray you, keep seat;
 The fit is momentary; upon a thought
 He will again be well: If much you note him,
 You shall offend him, and extend his passion;
 Feed, and regard him not.—Are you a man?

MACBETH.—Ay, and a bold one, that dare look on that
 Which might appal the devil.

LADY M.— O proper stuff!
 This is the very painting of your fear;
 This is the air-drawn dagger, which, you said,
 Led you to Duncan. O, these flaws, and starts,
 (Impostors to true fear) would well become
 A woman's story, at a winter's fire,
 Authoriz'd by her grandam. Shame itself!
 Why do you make such faces? When all's done,
 You look but on a stool.

MACBETH.—Prithee, see there! behold! look! lo! how say you?
 Why, what care I? If thou canst nod, speak too.—
 If charnel-houses, and our graves, must send
 Their thousand thousands, back, our monuments
 Shall be the maws of kites.

- (i.) Detail the circumstances which at this particular time pre-disposed Macbeth to be the subject of this illusion.
- (ii.) Of what other illusions of a similar kind is Macbeth represented as being the subject?
- (iii.) Did Shakespeare intend the ghost to be regarded as having a real existence? Give reasons for your answer.
- (iv.) Explain the force of the following expressions in Lady Macbeth's last speech:—

"Very painting of your fear," "flaws," "impostors to true fear," "authoriz'd," "shame itself."

3. Greene, in *A Greatsworth of Wit bought with a Million of Repentance*, says:—

"There is an upstart crow beautified with our feathers, that with his tyger's heart wrapt in a player's hide, supposes he is as well able to bombast out a blank verse as the best of you, and being an absolute Johannes Factotum, is, in his own conceit, the only shake-scene in a country."

Explain the allusions.

BACON.

1. "Crafty men condemn studies; simple men admire them; and wise men use them; for they teach not their own use: that is a wisdom without them, and won by observation. Read not to contradict, nor to believe, but to weigh and consider. Some books are to be tasted, others to be swallowed, and some few to be chewed and digested. Reading maketh a full man, conference a ready man, and writing an exact man. And, therefore, if a man write little, he had need have a great memory; if he confer little, have a present wit; and if he read little, have much cunning to seem to know that he doth not. Histories make men wise, poets witty, the mathematics subtle, natural philosophy deep, morals grave, logic and rhetoric able to contend."

"Prosperity is the blessing of the Old Testament, adversity is the blessing of the New, which carrieth the greater benediction and the clearer evidences of God's favours. Yet even in the Old Testament, if you listen to David's harp, you shall hear as many hearselike airs as carols, and the pencil of the Holy Ghost hath laboured more in describing the afflictions of Job than the felicities of Solomon. Prosperity is not without many fears and distastes; and adversity is not without comforts and hopes. We see in needleworks and embroideries it is more pleasing to have a lively work upon a sad and solemn ground, than to have a dark and melancholy work upon a lightsome ground. Judge therefore of the pleasure of the heart by the pleasure of the eye. Certainly virtue is like precious odours, most fragrant when they are incensed and crushed, for prosperity doth best discover vice, but adversity doth best discover virtue."

(i.) Point out the characteristics of Bacon's style of writing and mode of thinking, which are exemplified in the foregoing extracts.

(ii.) Compare their style with that of the received version of the Scriptures.

(iii.) Name the essays from which the extracts are taken.

2. Pope calls Bacon—

"The wisest, brightest, meanest of mankind."

Discuss his claims to each of these epithets.

ADDISON.

1. Describe briefly, and, as far as you can, account for the literary character of the age of Anne.

2. Sketch after Addison, the portrait of Sir Roger de Coverley.
3. Refer to passages in the *Spectator* which are good examples of Addison's serious and humorous styles.

SCOTT.

1. Contrast the use of the supernatural made by Shakespeare in "Macbeth" with that made by Scott in the "Lady of the Lake."

2. "At Doune, o'er many a spear and glaive,
Two barons proud their banners wave.
I saw the Moray's silver star,
And marked the sable pale of Mar."
"By Alpine's soul, high tidings those!
I love to hear of worthy foes.
When move they on?"—"To-morrow's noon
Will see them here for battle boune."
"Then shall it see a meeting stern!
But, for the place—say, couldst thou learn
Naught of the friendly clans of Earn?
Strengthened by them, we well might bide
The battle on Benledi's side.
Thou couldst not? Well, Clan Alpine's men
Shall man the Trosach's shaggy glen;
Within Loch Katrine's gorge we'll fight
All in our maids' and matrons' sight,
Each for his hearth and household fire,
Father for child, and son for sire,
Lover for maid beloved!—But why—
Is it the breeze affects mine eye?
Or lost thou come, ill-omened tear!
A messenger of doubt or fear?
No! sooner may the Saxon lance
Unfix Benledi from his stance,
Than doubt or terror can pierce through
The unyielding heart of Roderick Dhu!
'Tis stubborn as his trusty targe.—
Each to his post!—all know their charge."
The pibroch sounds, the bands advance,
The broadswords gleam, the banners dance,
Obedient to the Chieftain's glance.
I turn me from the martial rout,
And seek Coir-Uriskin once more.

- (i.) Write notes on the proper names.
 - (ii.) Explain "glaive," "sable," "boune," "stance," "pibroch."
 - (iii.) Point out the fine and the weak parts of the passage quoted.
3. Give a brief account of the life and words of the contemporary poet whose success caused Scott to abandon poetry.

COMPOSITION.

I.

ADMISSION TO HIGH SCHOOLS.

Examiner: J. M. BUCHAN, M.A.

(The Minimum for passing on this paper will be 18.)

Values.

- | | |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | 1. Frame a complex sentence out of the following simple sentences:
I struck a light. I took a survey of my house. I discovered the following things. My house contained a stove. The stove was large. The stove was made of metal. My house contained a supply of bed-clothing. The bed-clothing had been saved from some ship. My house contained some bacon. The bacon had been cured in Toronto. The bacon had been cured by Brown, Jones, and Robinson. The firm of Brown, Jones, and Robinson was well known at that time. |
| 18 | 2. Write a letter to a cousin about family affairs. |
| 18 | 3. Express in some other way the meaning of each of the following sentences:
Believing you to be honest, I trust you.
"Company" means any corporation.
At the approach of spring all nature becomes glad.
Hardness is a property of iron.
This book belongs to John.
The widows of Assur are loud in their wail. |
| 6 | 4. Compose a complex sentence containing the word 'lion' in a principal, and the word 'enraged' in a subordinate clause. |
| 18 | 5. Write a synopsis of the lesson in the Fourth Book on "The Founding of the North American Colonies." |

II.

THIRD-CLASS TEACHERS.

Examiner: GEO. W. ROSS.

Select any one of the following themes:—

1. The Horrors of War.
 2. School Vacations.
 3. How to get on in the World.
- Value of Paper, 75 marks.

III.

SECOND-CLASS TEACHERS AND INTERMEDIATE.

Examiner: J. M. BUCHAN, M.A.

Candidates may select any one of the following topics:—

- The education that is given outside of the school-room.
The great North-West.
"All the world's a stage,
And all the men and women merely players."

IV.

FIRST-CLASS TEACHERS.

Examiner: GEO. W. ROSS.

Write on one of the following themes:—

1. Our School System.
2. The Pleasures of a Poetic Taste.
3. Our Country.

DICTATION AND READING.

I.

THIRD-CLASS TEACHERS.

Examiner: G. W. ROSS.

5th Book, pages 869—870. From "To go through the grammar," to "Those works are the best."

II.

SECOND-CLASS TEACHERS AND INTERMEDIATE.

DICTATION.

Page 244, 5th Reader. From "O Faith!" to the end of selection.

READING.

See page 334, 5th Reader, from the top of the page to "Foot-print."

SPELLING AND FOURTH BOOK.

ADMISSION TO HIGH SCHOOLS.

Examiner: J. M. BUCHAN, M.A.

(The Minimum for passing on this paper will be 5.)

Values.

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| 7 | 1. Correct, when necessary, the spelling of the following words:
'Brane,' 'counterpane,' 'counterfeit,' 'dromedary,' 'sopha,' 'northren,' 'callicos,' 'parrallell,' 'tremenduous,' 'ellevater,' 'recioved,' 'believed,' 'beriev-ed,' 'Teusday.' |
| 7 | 2. Distinguish the words in each of the following groups from one another:
'load,' 'lode,' and 'lowed';
'soar,' 'sore,' and 'sower';
'suit,' 'soot,' and 'suet';
'freeze,' 'frees,' and 'frieze';
'fane,' 'feign,' and 'vane';
'scene,' 'seen,' and 'seine';
'to,' 'too,' and 'two.' |
| 10 | 3. "Departed spirits of the mighty dead!
Ye that at Marathon and Leucra bled!
Friends of the world! restore your swords to man;
Fight in his sacred cause, and lead the van!
Yet for Sarmatia's tears of blood atone,
And make her arm puissant as your own!
Oh! once again to Freedom's cause return
The patriot Tell—the Bruce of Bannockburn!" |

10
i.e. 1 for each sub-question.

- (i.) Whence have the "spirits of the mighty dead" departed?
- (ii.) Who bled at Marathon and Leuctra?
- (iii.) Who are called "friends of the world," and why does the poet so call them?
- (iv.) In what sense is the word 'man' used in line 8, and 'return' in line 7?
- (v.) Where is Sarmatia?
- (vi.) What is meant by "Sarmatia's tears of blood"?
- (vii.) Who were Tell and Bruce?
- (viii.) Give the meaning of 'van,' 'atone,' and 'puissant.'
- (ix.) Why is 'Freedom's' printed with a capital F?
- (x.) Point out the silent letters in the first and third lines.

4. Answer the following questions based on Humboldt's account of the earthquake of Caraccas:—

- (i.) Where is Caraccas?
- (ii.) Mention any other cities that have suffered in a similar way from earthquakes.
- (iii.) When does Holy Thursday occur?
- (iv.) "The ground was in a constant state of undulation, and heaved like a fluid under ebullition." Explain the meaning of "undulation" and "ebullition."

' BOOK-KEEPING.

I.

SECOND-CLASS TEACHERS AND INTERMEDIATE.

Examiner: J. J. TILLEY.

1. In making out statements of "Resources and Liabilities" and "Losses and Gains," in which statement would you place each of the following accounts?—Note particularly any that you would place in both statements, with reasons:—

Cash, Mdse., Bank Stock, Expense, Real Estate, Rent, Shipment to A, A's Consignment.

2. Journalize, giving A's, B's and C's entries. (Ruling not required on the paper.)

July 1st. A has this day discounted his note favour of B, (a) giving a cheque on the Bank for \$300, an order on C for \$100, cash for balance. Face of note \$600, discount allowed \$80.

(b) A shipped to B \$1,500 worth of goods, to be sold on account and risk of A. He takes \$800 worth from his storehouse, and buys \$700 worth from C, giving C a cheque on the Bank in full. On sending the goods away, A had them insured at 1½% on four-fifths of their value, paying premium in cash; and, on receiving the goods, B paid freight, &c., per cheque \$80.

(c) B sold to C \$800 worth of goods from A's consignment, receiving in payment C's note at 3 mos. for \$400—note to bear interest at 7% per annum—a sight draft on A for \$200, which A honours, and a cheque on Bank for balance.

(d) A lost a \$10 Bank Bill. Three days after, B having found the Bill, returned it to A, and received \$1.50 for his trouble.

3. Give Day-Book entries for the following:—

- (a) Bank, Dr. \$800
 - To A. B. \$450
 - " Bills Rec. 350
- (b) Bills Payable, Dr. \$400
 - Interest " 50
 - Expense " 100
 - To Bank \$250
 - " A. B. 300
- (c) A. B., Dr. \$900
 - To Mdse. \$250
 - " Expense 50
- (d) Cash, Dr. \$800
 - Bills Payable, Dr. 200
 - To Good Will. \$600
 - " Bills Rec. 400

4. Post all the items in No. 3, and make out a Trial Balance. How far is a Trial Balance a test of correct work? Illustrate your

answer by reference to yours. Discuss the possibility of results as shown by your Trial Balance.

II.

FIRST-CLASS TEACHERS.

1. Give A's and B's Journal entry for each of the following transactions:—(Ruling not required on the paper.)

June 1st. A bought from B 20 shares Ontario Bank Stock—par value \$100 per share—at 107, giving in payment his note at 3 months, with interest at 8% per annum for \$1000, a sight draft on C for \$1000, and a cheque on the Ontario Bank for balance.

June 15th. A has this day discounted his note in favour of B, dated June 1st, at 3 months, for \$1000, bearing interest at 8% per annum, A being allowed discount at the rate of 10% per annum.

June 20th. A sent B \$8000 worth of Mdse. to be sold on joint account; and B, on its arrival, June 24th, added \$1800 worth of Mdse. On the 25th June A received advice and invoice of Mdse. added. A on sending the goods away had them insured at 1½%, paying premium in cash, and B on receipt of goods paid freight, &c., per cheque \$120.

2. What is meant by "Averaging an Account?" When will the balance of the following account become due?

A in account with B		Dr.
Jan. 13.	To Mdse. at 30 days.....	\$300
Feb. 4.	" Sundries	450
Apr. 15.	" Real Estate	750
		Cr.
Feb. 15.	By Sundries	\$750
May 20.	" Cash	800
June 10.	" Merchandise.....	120

3. Give Day-Book entries for the following:—

- (a) Cash, Dr. \$1000
 - Bank, " 4000
 - Bills Rec., " 1000
 - To B's Consignment \$4000
 - " Merchandise 2000
- (b) B's Consignment, Dr. \$8000
 - To Bank \$1800
 - " Cash..... 700
 - " Bills Rec. 500
- (c) Merchandise, Dr. \$2000
 - Expense, " 220
 - To Bank \$1800
 - " Bills Rec..... 400
 - " Interest 20

4. Post the entries in No. 3, and close the accounts. Given Mdse. on hand, valued at \$350—Coal, Wood, &c., for use in business, valued at \$140—our commission, charges, &c., on B's Consignment to date being \$110.

DRAWING.

SECOND-CLASS TEACHERS.

Examiner: JAMES HUGHES.

1. Explain how to draw an ellipse. Apply this form in drawing a circular box, with its lid leaning against it.

2. Draw an arched bridge, and give full explanations of the method of teaching the subject to a class, showing the necessary construction lines (eye opposite the centre of the arch).

3. Draw a Gothic window set in masonry. Give definite instructions about the arch, and the arrangement of the stones around it.

4. Draw Roman cross, showing its thickness. 1st, with the eye below it and to the left; 2nd, with the eye above it and to the right.

5. (1) Draw an oblong twice as long as it is wide, the end lines being faint. (2) By a faint line divide the oblong into two squares. (3) Divide each square vertically into two equal oblongs by faint lines. (4) Draw two diagonals in each oblong thus made. (5) Draw a small rhombus above and below the intersections of these diagonals, using parts of the diagonals as two sides of the rhombus in each case. (Let the side of the rhombus be equal to one-eighth of the diagonal.)

II.

FIRST-CLASS TEACHERS.

1. Give definite instructions to a class commencing to draw from objects, about taking measurements, so as to secure proportional dimensions in their drawing.

2. In drawing a vase, goblet, or other similar object, would you draw the right or left side first? Give reasons for your answer.
3. In introducing a class to object drawing, what are the most important things to be attended to?
4. In drawing an object, should its real or apparent form be given? (b) Why?
5. State the two methods of giving a blackboard drawing lesson. (b) Which would you adopt? State reasons for doing so.
6. Give rules for drawing the perpendicular and horizontal lines in a row of houses, seen from a distance by a person looking down the street on which they are situated.
7. Draw the wheel of a wheelbarrow, or any similar wheel; 1st, with the eye opposite the centre of the end of the hub; 2nd, viewing the wheel obliquely. Let there be eight spokes in the wheel. Give construction lines in each case.

MUSIC.

Examiner: JAMES HUGHES.

FIRST AND SECOND-CLASS TEACHERS.

1. Define Interval, Unison, Ledger lines, Octave, Cleff, Measure, Bar, Voice Register.
2. Explain the difference between the Chromatic and Diatonic Scales.
3. Give the order of tones and half tones in a Major Diatonic Scale, and construct the scales of *re, la,* and *mi ♯*, giving their signatures.
4. Why may two intervals of the same name be of different lengths?
5. Fill a measure of $\frac{3}{4}$ time in as many ways as possible.
6. Make the crotchet and quaver rests, and show how they may be prolonged.
7. Name the four classes of voices, and explain the difference in their registers.
8. What notes constitute the common chord?
9. Explain the difference between Melody and Harmony.

ALGEBRA.

Examiner: J. A. McLELLAN, LL.D.

I.

1. Prove $x^m \div x^n = x^{m-n}$.
 - (1.) Simplify $(a + b + c)^2 - 3(a + b + c)c + 3(a + b + c)c^2 - c^3$.
 - (2.) Divide $1 - 3xy - y^2 - x^2$ by $1 - x - y$.
2. Prove the rule for finding the L. C. M. of two quantities. Find the L. C. M. of—
 - (1.) $x^2 + 6x^2 + 11x + 6, x^2 + 6x^2 - 25x + 150$.
 - (2.) $a^2 + b^2 + c^2 - 3abc, (a + b)^2 + 2(a + b)c + c^2$.
3. Prove $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$
 Simplify $\left(\frac{1-x^2}{1-x^2} + \frac{1-x}{1-x+x^2}\right) \div \left(\frac{1+x}{1+x+x^2} - \frac{1-x^2}{1+x^2}\right)$
4. Reduce to their lowest terms $\frac{a^{2m} + a^{2n} - 2}{a^{2m} + a^{2n} - 2}$, and $\frac{a(a+2b) + b(b+2c) + c(c+2a)}{(a^2 - b^2 - c^2 - 2bc)}$.
5. (1.) If $a^2 - pa^2 + qa - r = 0$, then $x^3 - px^2 + qx - r$ is exactly divisible by $x - a$.
 (2.) Prove that $(a + b + c)(bc + ca + ab) - (b + c)(c + a)(a + b)$ is divisible by abc . Is there any other divisor?
6. If $x = \left(\frac{a+b}{a-b}\right)^{\frac{2mn}{n-m}}$, then $\frac{a^2 - b^2}{a^2 + b^2} (\sqrt[n]{x} + \sqrt[n]{x}) = \left(\frac{a+b}{a-b}\right)^{\frac{m+n}{n-m}}$
7. Solve the equations—
 - (1.) $\frac{3-2x}{1-2x} - \frac{5-2x}{7-2x} = 1 - \frac{4x^2-2}{7-16x+4x^2}$
 - (2.) $8x - 2y = 5z - 6y = 7z - 4z = 1$.
 - * (3.) $\frac{x+8}{x+4} - \frac{x+1}{x+2} = \frac{4x+9}{2x+7} - \frac{12x+17}{6x+16}$.

8. A person going at the rate of p miles an hour, and desiring to reach home by a certain time, finds, when he has still r miles to go, that, if he were continuing to travel at the same rate, he would be q hours too late. How much must he increase his speed to reach home in time?
9. Of the three digits comprising a number, the second is double of the third; the sum of the first and third is 9, and the sum of the three digits is 17. Find the number.
10. A owes B \$ a , due m months hence, and also \$ b due n months hence. Find the equation which determines the time at which both sums could be paid at once, reckoning interest at 5 per cent. per annum.

ALGEBRA.

II.

1. Simplify $\left\{\left(\frac{x+y}{x-y}\right)^2 + 1\right\} \left\{\left(\frac{x+z}{x-z}\right)^2 + 1\right\} \left\{\left(\frac{y+z}{y-z}\right)^2 + 1\right\} \times \frac{x^2(y-z) + y^2(z-x) + z^2(x-y)}{x^2y^2 + x^2y^4 + x^4z^2 + x^2z^4 + y^4z^2 + y^2z^4 + 2x^2y^2z^2}$.
2. Solve (1.) $\frac{ax+m+1}{ax+m-1} + \frac{ax+n}{ax+n-2} = \frac{ax+m}{ax+m-2} + \frac{ax+n+1}{ax+n-1}$.
 (2.) $\sqrt[3]{1+\sqrt{x}} + \sqrt[3]{1-\sqrt{x}} = 2$.
3. A, B, and C start from the same place; B, after a quarter of an hour, doubles his rate, and C, after walking 10 minutes, diminishes his rate one-sixth; at the end of half an hour, A is a quarter of a mile before B, and half a mile before C, and it is observed that the total distance walked by the three, had they each continued to walk uniformly from the first, is $6\frac{1}{2}$ miles. Find the original rate of each.
4. (1.) Investigate the relations that must exist between the constants in order that $Ax^2 + By^2 + Cz^2 + ayz + bzx + cxy$ shall be a perfect square.
 (2.) Find the conditions that the values of x and y derived from the equations $ax + by = \frac{a^3}{x} + \frac{b^3}{y} = c^2$ may be rational.
5. If $x^2 + px + q$ and $x^2 + mx + n$ have a common factor, then $(n-q)^2 + n(m-p)^2 = m(m-p)(n-q)$.
6. Prove $(a^m)^n = a^{mn}$, whether m and n be positive or negative, integral or fractional.
 Show that $(x^{2m} + x^{2n})^{\frac{1}{mn}} = \frac{1}{x^n} + \frac{1}{x^m} \times (x^{m-n} + x^{n-m})^{\frac{1}{mn}}$.
7. (1.) If $\frac{a}{b} = \frac{c}{d}$, then $\sqrt{\frac{a^2n + b^2n}{c^2n + d^2n}} = \left(\frac{a-b}{c-d}\right)^n$.
 (2.) If $\frac{a^2d^n \times -b^2c^n}{\frac{1}{2}n(a^n - b^n - c^n + d^n)} = \frac{a^2c^n - b^2d^n}{\frac{1}{2}n(a^n - b^n - d^n + c^n)}$, then each of these fractions = $\frac{1}{n}(a^n + b^n + c^n + d^n)$.
8. If x be very small, show that—
 $\frac{(1+2x)^{\frac{1}{2}} + (1+8x)^{\frac{1}{3}}}{2+5x-(1+4x)^{\frac{1}{2}}} = 2 - 4x$, very nearly.
9. Prove that $1 - n^2 + \frac{n^2(n^2-1^2)}{1^2 \cdot 2^2} + \frac{n^2(n^2-1^2)(n^2-2^2)}{1^2 \cdot 2^2 \cdot 3^2} - \dots = 0$.
10. If a debt \$ a at compound interest be discharged in n years by annual payments of $\frac{a}{m}$, show that $(1+r)^n(1-mr) = 1$, where r is the interest on \$1 for a year.
11. Solve—(1.) $3x^2 - 2xy = 55$.
 $x^2 - 5xy + 8y^2 = 7$.
 (2.) $\frac{5}{x^2 - 7x + 10} + \frac{5}{x^2 - 18x + 40} = x^2 - 10x + 19$.
 (3.) $a^2b^2x^{\frac{1}{2}} - 4a^{\frac{3}{2}} \cdot \frac{3}{2}x^{\frac{2}{2}} = (a-b)^2x^{\frac{1}{2}}$.

* Candidates for 2nd-class certificates may omit this equation.

SOLUTIONS I.

1. Book-work.

(1.) $(a + b + c)^3 - 3(a + b + c)^2 + 3(a + b + c)c^2 - c^3$
 $= (a + b + c - c)^3$
 $= (a + b)^3$

(2.) $1 - 3xy - y^3 - x^3$
 $= 1 - (x^3 + 3x^2y + 3xy^2 + y^3) - 3xy + 3x^2y + 3xy^2$
 $= 1 - (x + y)^3 - 3xy \{1 - (x + y)\}$
 $= \{1 - (x + y)\} \{1 + (x + y) + (x + y)^2 - 3xy\}$
 $= (1 - x - y)(1 + x + y + x^2 - xy + y^2);$
 \therefore Quotient $= 1 + x + y + x^2 - xy + y^2.$

Or the result may be obtained by $\div n$.

2. Book-work.

(1.) $x^3 + 6x^2 + 11x + 6$ and $x^3 + 6x^2 - 25x + 150$ have no C. M. \therefore L. C. M. is their product.

(2.) $a^3 + b^3 + c^3 - 3abc$
 $= a^3 + 3a^2b + 3ab^2 + b^3 + c^3 - 3a^2b - 3ab^2 - 3abc$
 $= (a + b)^3 + c^3 - 3ab(a + b + c)$
 $= (a + b + c) \{ (a + b)^2 - c(a + b) + c^2 - 3ab \}$
 $= (a + b + c) \{ a^2 - ab + b^2 - ac - bc + c^2 \}$
 and $(a + b)^2 + 2(a + b)c + c^2 = (a + b + c)^2;$
 \therefore L. C. M. $= (a + b + c)^2 (a^2 - ab + b^2 - ac - bc + c^2);$
 or $= (a + b + c) (a^3 + b^3 + c^3 - 3abc).$

3. Quotient $= \frac{1+x}{1+x+x^2} \div \frac{1-x}{1-x+x^2}$
 $= \frac{1+x}{1+x} \cdot \frac{1-x}{1-x+x^2}$
 $= \frac{(1+x^2) + (1-x^2)}{(1+x^2) - (1-x^2)} = \frac{1}{x^2}$

4. (a) $\frac{a^{3m} + a^{2m} - 2}{a^{2m} + a^m - 2} = \frac{a^{3m} - 1 + a^{2m} - 1}{a^{2m} - 1 + a^m - 1}$
 $= \frac{(a^m - 1) \{ (a^{2m} + a^m + 1) + (a^m + 1) \}}{(a^m - 1) (a^m + 1 + 1)}$
 $= \frac{a^{2m} + 2a^m + 2}{a^m + 2}$

Or by finding the G. C. M. $a^m - 1$, the result is obtained by $\div n$

(b) $\frac{a(a+2b) + b(b+2c) + c(c+2a)}{a^3 - b^3 - c^3 - 2bc}$
 $= \frac{(a+b+c)^2}{a^3 - (b^3 + 2bc + c^3)} = \frac{(a+b+c)^2}{(a+b+c)(a-b-c)}$
 $= \frac{a+b+c}{a-b-c}$

5. (1.) Let $\frac{x^3 - px^2 + qx - r}{n - a} = Q + \frac{R}{n - a};$

Where R does not contain x, and \therefore does not change its value for a change in the value of x.

Then $x^3 - px^2 + qx - r = Q(x - a) + R.$

Put $x = a,$
 and $a^3 - pa^2 + qa - r = R;$
 but $a^3 - pa^2 + qa - r = 0$
 $\therefore R = 0$

$\therefore x^3 - px^2 + qx - r$ is exactly \div ble by $x - a.$

(2.) Put $a = 0,$ and quantity becomes
 $(b + c)bc - (b + c)bc$
 $= 0$

$\therefore a$ is a factor,

Similarly b and c are factors, and \therefore quantity is \div ble by $abc.$

To show that there is no other factor;—there can be no literal factor, for the quantity and abc are of the same dimensions. To determine the numerical factor, let $nabc =$ quantity.

Put $a = b = c = 1;$
 $\therefore n = 8 \times 8 - 2 \times 2 \times 2$
 $= 1;$
 \therefore no numerical factor.

6. $\frac{a^3 - b^3}{a^2 + b^2} \left(\frac{1}{x^m} + \frac{1}{x^n} \right)$

$$= \frac{a^2 - b^2}{a^2 + b^2} \left\{ \left(\frac{a+b}{a-b} \right)^{\frac{2n}{n-m}} + \left(\frac{a+b}{a-b} \right)^{\frac{2m}{n-m}} \right\}$$

$$= \frac{a^2 - b^2}{a^2 + b^2} \left(\frac{a+b}{a-b} \right)^{\frac{2m}{n-m}} \left\{ \left(\frac{a+b}{a-b} \right)^{\frac{2n}{n-m}} - \frac{2m}{n-m} + 1 \right\}$$

$$= \frac{a^2 - b^2}{a^2 + b^2} \left(\frac{a+b}{a-b} \right)^{\frac{2m}{n-m}} \left\{ 2 \cdot \frac{a^2 + b^2}{(a-b)^2} \right\}$$

$$= \left(\frac{a+b}{a-b} \right)^{1 + \frac{2m}{n-m}}$$

$$= \left(\frac{a+b}{a-b} \right)^{\frac{n+m}{n-m}}$$

7. (1) $\frac{3-2x}{1-2x} - \frac{5-2x}{7-2x} = 1 - \frac{4x^2-2}{7-16x+4x^2}$
 $1 + \frac{2}{1-2x} - 1 + \frac{2}{7-2x} = \text{etc.}$
 $14 - 4x + 2 - 4x = 7 - 16x + 4x^2 - 4x^2 + 2$
 $16 - 8x = 9 - 16x$
 $7 = -8x$
 $x = -\frac{7}{8}$

(2) $3x - 2y = 1$
 $\therefore 9x - 6y = 3$
 and $5z - 6y = 1$
 $\therefore 9x - 5z = 2$
 and $7x - 4z = 1$
 $\therefore 36x - 20z = 8$
 and $35x - 20z = 5$
 $\therefore x = 3;$
 and $y = 4;$
 and $z = 5.$

(3) $\frac{x+8}{x+4} - \frac{x+1}{x+2} = \frac{4x+9}{2x+7} - \frac{12x+17}{6x+16};$
 $\therefore (x^2 + 5x + 6) - (x^2 + 5x + 4) = \frac{x^2 + 6x + 8}{(24x^2 + 118x + 144) - (24x^2 + 118x + 119)}$
 $= \frac{2}{12x^2 + 74x + 112}$

$\therefore \frac{x^2 + 6x + 8}{25} = \frac{12x^2 + 74x + 112}{25};$
 $\therefore x^2 + 2x - 24 = 0;$
 $\therefore (x + 6)(x - 4) = 0;$
 $\therefore x = 4, \text{ or } -6$

8. Let $x =$ increase.

Then $\frac{r}{p+x} = \frac{r}{p} - q$
 $pr = p^2 + rx - p^2q - pqx;$
 $\therefore x = \frac{p^2q}{r - pq}.$

9. Let $x =$ 3rd digit,
 $\therefore 2x =$ 2nd
 $9 - x =$ 1st
 $\therefore 9 + 2x = 17;$
 $\therefore x = 4;$
 $\therefore 584 =$ number.

10. Suppose $m > n.$ Let x be the equated time. The interest of \$ b for the time $x - n,$ must be $=$ l to the discount of \$ a for the time $m - x,$ or

$$b(x - n) \frac{5}{100} = \frac{a(m - x) \frac{5}{100}}{1 + (m - x) \frac{5}{100}}$$

from which we obtain a quadratic $= n$ for determining $x.$

II.

(1) The first factor is at once seen to be $8(x^2 + y^2)(y^2 + z^2)(z^2 + x^2) - \{(x - y)(y - z)(z - x)\}^2,$ and the second factor is $(x - y)(y - z)(z - x) \div (x^2 + y^2)(y^2 + z^2)(z^2 + x^2);$
 \therefore result $= 8 \div (x - y)(y - z)(z - x).$

(2) 1. Performing the divisions represented by the fractions we have

$$\frac{1}{ax+m-1} + \frac{1}{ax+n-2} = \frac{1}{ax+m-2} + \frac{1}{ax+n-1};$$

adding the fractions on each side we find $2ax+m+n-3$ is a factor of the equation, $\therefore x=3-m-n$. It is easily seen that the coefficients of x^2 and x vanish.

2. Cubing we have

$$1 + \sqrt{x+1} - \sqrt{x+3} \sqrt[3]{1-x} \times 2 = 8. \therefore x = 0.$$

(3) Let $x = A$'s rate, y, B 's, z, C 's; then

$$\frac{1}{4}(x+y+z) = 6\frac{1}{4}, \frac{x}{2} - \frac{3y}{4} = \frac{1}{4},$$

$$\frac{3y}{4} - \frac{4z}{9} = \frac{1}{4}; \text{ and } x = 5, y = 3, z = 4\frac{1}{4}.$$

(4) 1. The given quantity, if a perfect square, must be of the form $\sqrt{A} \cdot x + \sqrt{B} \cdot y + \sqrt{C} \cdot z)^2$. Square and equate coefficients.

Then $A = \frac{bc}{2a}, B = \frac{ac}{2b}, C = \frac{ab}{2c}$.

2. Solving for x we get

$ac^2x^2 + (b^4 - c^4 - a^4)x + a^3c^2 = 0$ \therefore the vals. of x are rational when $(b^4 - c^4 - a^4)^2 - 4ac^2 \times a^3c^2$ is a perfect square; i.e., when $b^4 - c^4 - a^4 = \pm 2a^2c^2$, or $(a^2 \pm c^2)^2 = b^4$, or $a^2 \pm c^2 = \pm b^2$. Similarly the values of y are rational when $b^2 \pm c^2 = \pm a^2$; and the only condition common to these two sets of conditions is that $a^2 + b^2 = c^2$, hence when this condition holds, the values of x and y are both rational.

(5) Let $x + a$ be the common factor; then

(1) $a^2 + pa + q = 0$.

(2) $a^2 + ma + n = 0. \therefore a(m-p) + n - q = 0$, and $a = -\frac{n-q}{m-p}$

Substituting this value of a in (2) we get

$$\left(\frac{n-q}{m-p}\right)^2 - m \cdot \frac{n-q}{m-p} + n = 0; \text{ or}$$

$$(n-q)^2 + n(m-p)^2 = m(m-p)(n-q).$$

(6) $(x^{2m} + x^{2n})^{\frac{1}{mn}} = \{x^{m+n}(x^{m-n} + x^{n-m})\}^{\frac{1}{mn}} = x^{\frac{1}{n} + \frac{1}{m}}(x^{m-n} + x^{n-m})^{\frac{1}{mn}}$

(7) 1. $\frac{a^{2n}}{b^{2n}} = \frac{c^{2n}}{d^{2n}} \therefore \frac{a^{2n} + b^{2n}}{b^{2n}} = \frac{c^{2n} + d^{2n}}{d^{2n}}$;

Also $\frac{(a-b)^{2n}}{b^{2n}} = \frac{(c-d)^{2n}}{d^{2n}}$;

$$\therefore \frac{a^{2n} + b^{2n}}{(a-b)^{2n}} = \frac{c^{2n} + d^{2n}}{(c-d)^{2n}} \text{ and } \frac{a^{2n} + b^{2n}}{c^{2n} + d^{2n}} = \left(\frac{a-b}{c-d}\right)^{2n}$$

$$\sqrt{\frac{a^{2n} + b^{2n}}{c^{2n} + d^{2n}}} = \left(\frac{a-b}{c-d}\right)^n.$$

2. Take sum of nums. \div by sum of denoms. for one result; then difference of nums. \div by diff. of denoms. for a second result. Then of these two results, sum of nums. \div sum of denoms. gives

$$\frac{1}{n}(a^n + b^n + c^n + d^n).$$

(8) Expanding and retaining terms involving only first power of x , we get given expression

$$\begin{aligned} &= \frac{1 + \frac{1}{4} \cdot 2x + 1 + \frac{1}{3} \cdot 3x}{2 + 5x - (1 + \frac{1}{4} \cdot 4x)} = \frac{2 + 2x}{1 + 3x} \\ &= \frac{(2 + 2x)(1 + 3x)^{-1}}{(2 + 2x)(1 - 3x)} = \text{(by expanding)} \\ &= \frac{2 - 4x}{2 - 4x}. \end{aligned}$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{1 \cdot 2} x^2 + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} x^3 + \&c.$$

$$\left(1 + \frac{1}{x}\right)^{-n} = 1 - \frac{n}{x} + \frac{n(n+1)}{1 \cdot 2} \frac{1}{x^2} - \frac{n(n+1)(n+2)}{1 \cdot 2 \cdot 3} \frac{1}{x^3} + \&c.$$

Multiplying these results, we see that $1 - n^2 + \frac{n^2(n^2-1)}{2^2} -$

&c., is the coefficient of x^0 in the expansion of

$(1+x)^n \times \left(1 + \frac{1}{x}\right)^{-n}$ i.e., of $(1+x)^n \times \frac{x^n}{(1+x)^n}$ i.e., of x^n , and therefore = 0.

10. Amount of \$ a for n years = $a(1+r)^n$. And amount of annuity $\frac{a}{m}$ at end of n years = $\frac{a}{m} \left\{ \frac{(1+r)^n - 1}{(1+r) - 1} \right\}$ $\therefore (1+r)^n =$

$$\frac{(1+r)^n - 1}{mr}, \text{ and } (1+r)^n (1-mr) = 1.$$

(11) 1. Multiplying the equations together crosswise and transposing we get

$$34x^2 - 261xy + 44y^2 = 0, \text{ or } (2x - 5y)(17x - 88y) = 0;$$

$$\therefore 2x = 5y, \text{ and } 17x = 88y.$$

Each of these taken in turn with the given equations will give the values of x and y .

2. The equation reduces to

$$\frac{10}{x^2 - 10x + 16} = x^2 - 10x + 19, \text{ or}$$

$$10 = (x^2 - 10x)^2 + 35(x^2 - 10x) + 304, \text{ a quadrate in } x^2 - 10x.$$

3. Dividing through by $x^{\frac{1}{2}}$ there results

$$a^2 b^2 x^{\frac{p-q}{2}} - 4a^2 b^2 x^{\frac{p-q}{2}} = (a-b)^2; \text{ or}$$

$$\left(\frac{p-q}{2}\right)^2 - 4a^2 b^2 x^{\frac{p-q}{2}} = (a-b)^2, \text{ whence}$$

$$abx^{\frac{p-q}{2}} = \left(\frac{1}{a} + \frac{1}{b}\right)^2 \text{ or } -\left(\frac{1}{a} - \frac{1}{b}\right)^2; \text{ and finally}$$

$$x = \left(\frac{1}{b^2} - \frac{1}{a^2}\right)^{\frac{4pq}{p-q}}.$$

Notes and News.

ONTARIO.

The meeting of the Provincial Teachers' Association, which took place this year about the middle of August, was a most successful one. The programme announced beforehand was, with a few exceptions, adhered to, and the proceedings were of the most interesting character throughout. In the absence of the President, Rev. Dr. Caven, his address was read by the Secretary, A. McMurchy, M.A. The paper was of a highly practical character, and dealt in an able and useful manner with the difficult subject of "Discipline in Schools." Under the head of "Teachers and their Mission," the same subject was subsequently treated by Rev. Dr. Fyfe in an equally able and suggestive address. The cordial thanks of the Association were voted to both gentlemen for their addresses. One of the liveliest discussions which took place during the meeting of the Convention was that on township school boards. The subject was ably introduced by Mr. J. H. Smith, P. S. inspector for Wentworth. Mr. Smith took strong ground in favour of township boards, and replied to the objections ordinarily urged against them. Those who subsequently addressed the Convention on the subject nearly all favoured the township system, while they deprecated any attempt to make it compulsory. A resolution, embodying very accurately the general opinion as manifested by the discussion, was carried unanimously. The subject of uniform promotion examinations in Public Schools was introduced by Mr. J. M. Moran, of Stratford, who, after explaining in a very lucid manner the advantages resulting from the adoption of the system in counties, suggested that a Provincial scheme might profitably be set on foot. On this latter point there was evidently some difference of opinion amongst the members of the Convention, but there appeared to be none as to the desirability of having county promotion examinations, and a resolution expressive of this view was carried without dissent. Incidentally in the course of the discussion several speakers put in strong pleas for written examinations as a good means of disciplining pupils. A pleasant incident occurred during the session set apart for the reception of delegates. Mr. Munro, who appeared as the representative of the

Educational Society of Eastern Ontario, conveyed to the Ontario Association its fraternal greetings, and in response to a request from the chair, he further announced that there was no disposition on the part of the Eastern Society to set itself up as a rival to the general Association. This intimation was received with such symptoms of pleasure as to make it plain that there had been a considerable amount of mistrust respecting the motives underlying the movement to which the younger Association owed its origin. This feeling being removed, there was nothing left but to accept cordially and return in the same way the greetings of the Eastern Society. This was briefly and felicitously done on behalf of the General Association by Mr. J. M. Smith and Mr. A. McMurchy. Mr. Dawson, of Belleville, gave the Convention a humorous and instructive account of his visit as a delegate to the Protestant Teachers' Association of Quebec. The lessons which he learned during his visit, and which he so pleasantly presented to his fellow-members, show that the duties of delegates to sister associations should not be performed in a merely perfunctory manner. Such visits, when made by a keen critic and shrewd observer, are calculated to wield an important influence on the manner of conducting the Association's proceedings. A brief but interesting paper by Dr. Tassie on "Public and High School Programmes," led to a spirited discussion, the general drift of which was strongly in favour of limiting the number of subjects taken up in the Public Schools and of retaining in them the fifth and sixth classes. The retention of natural science on the Public School programme was advocated by some of the speakers on the ground of practical utility. One of the evenings was placed at the service of Dr. Ellis, who read a deeply interesting but somewhat abstruse paper on certain chemical phenomena. On motion of Mr. Kirkland, who is a member of the Senate of Toronto University, a committee was appointed to wait upon the Ontario Government with a view to the establishment of scholarships in connection with the recently instituted "Ladies' Examinations." The work done this year in the Public School section of the Association was largely of an institute character, but a good deal of time was also devoted to the discussion of "County Training Schools," after which a resolution was unanimously adopted approving of the scheme about to go into operation. In the High School Section there were long and interesting discussions on the curriculum of the Provincial University and the Intermediate Examination, the first of which was introduced by Mr. Purslow, of Port Hope, and the second by Mr. Seath, of St. Catharines. The view taken of the new curriculum for matriculation was one of general approval and hopefulness, though some points were strongly objected to. The dislike of the intermediate was much less pronounced than it was last year, and some suggestions were made for still further improving it. The subject of "County Model Schools" was the most important one taken up by the Inspectors' section, but no resolution was adopted. The Model School Masters held a meeting of their own, at which some members of the Central Committee were present. By request, Mr. G. W. Ross explained, on behalf of the Committee, the manner in which it was proposed that the schools should be conducted, and before the meeting broke up a unanimous vote of thanks was passed to the Central Committee by the Masters present. On the whole, the County Training School scheme seems to have won the general approbation of the masters and inspectors, a state of affairs which cannot but be gratifying to the Minister of Education, and which greatly improves the chances of making these schools a useful appendage of the Educational system.

The officers of the Ontario Teachers' Association for the coming year are as follows: President, J. A. McLellan, LL.D.; Recording Secretary, A. McMurchy, M.A.; Corresponding Secretary, James Hughes; Treasurer, S. McAllister. The officers of the Public School Section are: Chairman, S. McAllister, Toronto; Secretary, H. Dickinson, Stratford; Executive Committee, D. Johnson, Cobourg; R. McQueen, Kirkwall; W. R. Harvey, Barrie; C. Sangster, Belleville; J. Hughes, Toronto. The officers of the Public School Section are: Chairman, Dr. Kelly, Brantford; Secretary, James Hodgson, Yorkville; Executive Committee, Messrs. Moran, Carson, Purslow and Agnew. The election of President of the General Association was by acclamation. The re-election of Messrs. McMurchy and McAllister to the positions they have so long and ably filled was a fitting recognition of the manner in which they have laboured for many years for the success of the Association.

Dr. May, of the Education Department, who has been appointed one of the Secretaries of the Paris Exposition Commission, and was mainly instrumental in organizing the Teachers' Excursion to the

Centennial last year, proposed to the Ontario Teachers' Association, at its recent annual meeting, a similar excursion to Paris in 1878. A committee was appointed to ascertain the best way of carrying out such a project, and to take steps to give effect to Dr. May's suggestions. The Committee met subsequently and organized with T. Kirkland, M.A., as permanent Chairman, and W. Houston, M.A., as Secretary, the latter gentleman, as well as Dr. Kelly and one or two others, having been added to its membership by the committee itself. After hearing Dr. May's views at some length, it was resolved to communicate with the teachers of other Provinces with a view to securing their co-operation.

QUEBEC.

According to the official programme of studies, Sacred History and Canadian History only are studied in the Elementary and Model Schools, which correspond to the Public Schools of Ontario. In the Academies, which correspond to High Schools in some degree, history is prescribed in the following order: (1.) History of Canada, (2) France, (3) England, (4) U. States.

Many of the prizes sent out by the Council of Public Instruction are works of Canadian authors. The writings of Ferland, Chauveau, De Gaspe, Guerin, Lajoie, Lemay and others cannot fail to excite a strong interest in Canadian subjects.

The Roman Catholic Board of Examiners of Candidates for the office of School Inspector consists of the Rev. Messrs. Verreau and Lagacé, Hon. M. Chauveau, P. T. Murphy, Esq., and Dr. Hubert Larue. Each candidate must be over 25 and under 60 years of age. He must produce (1) a baptismal certificate, (2) a diploma of qualification from one of the Normal Schools or Boards of Examiners of the Province, (3) a testimonial from the schools in which he has taught during the last preceding five years, (4) a certificate of good conduct. He must also be examined in: (1) The branches of School Instruction, (2) The Art of Teaching, (3) The School Laws, (4) Construction of School Buildings. Also he must compose a theme on a proposed subject, and be able to translate French into English and *vice versa*.

The English Examiners, sanctioned by the Protestant Committee of the Council of Public Instruction, are Morrison's, Bain's First English Grammar, Lennie's, and Bullion's. The Board of Examiners, however, recommend Morrell as a guide to the character of the questions to be asked on certain subjects to candidates for Model School and Academy diplomas.

On and after the first Tuesday of November, 1877, Protestant candidates for Diplomas coming before Protestant and mixed Boards will be examined by written or printed papers on every subject except dictation, reading and mental arithmetic. Papers prepared by a joint committee appointed for that purpose will be issued to all said Boards of Examiners.

The Superintendent of Public Instruction has been authorized by his Excellency the Lieut.-Governor in Council to organize the Depository for Books and other school necessaries in accordance with the Act of the Provincial Legislature passed last session. The articles are to be sold to School Municipalities at cost price, plus cost of storage and dispatch.

At the last meeting of the Convocation of McGill University there were 13 candidates for the degree of Bachelor of Applied Science.

NEW BRUNSWICK.

The opening of the new Normal School edifice in Fredericton came off with great *clat* a few weeks ago. Addresses were delivered by the Lieutenant-Governor, and a number of persons intimately connected with the work of public instruction. The most important address was the one made by Dr. Rand, Provincial Superintendent. The portion referring to training schools will be found elsewhere in this number. The greater part of the address was taken up with a review of the history of education in the Province, and a brief sketch of its present condition, which, according to all who alluded to it on the auspicious occasion, is extremely hopeful. In one part of his address, Dr. Rand says: "I have stated two or three leading facts by way of indicating what has been so far accomplished by our present law in respect of what is technically called the quantity of education. But the satisfactory solution of the problem of quantity is one thing: that of the problem of quality is another and more difficult thing. I have already stated that while the law proposes to provide the means of education for all the people, it also proposed to secure a quality of instruction good enough for all. Unless it intelligently employs such agencies as are adapted to secure this object, all other success is only seeming. But it cannot be attained in a day, and must always demand the

unceasing co-operation of all the forces evoked by the school system. In pursuance of the quality of instruction, a uniform series of text books of a superior character is now in universal use in the schools of this Province. This is a very important factor in securing the quality of instruction desired. The salaries of teachers have risen to a fairly remunerative amount under the operation of the mode of support provided by the law, until, on the average, the teachers of New Brunswick are now better paid than are those of any other Province of the Dominion. There is a special reason why this should be so, which will appear as I proceed; but the fact indicates the presence in our system of another important factor, without which it must be impossible to secure and retain in the public service teachers having the qualifications and abilities required to guarantee the quality of the instruction, no matter how perfect may be the texts ordained. The Normal School has been a matter of solicitude to the Department from the day on which the law came into force, and though every practicable facility has been afforded to it, the extent and character of its accommodations hitherto have not been what were demanded to ensure a sufficient and suitable supply of teachers, if the quality of our school instruction was to be of that genuine and progressive character contemplated by that enactment. And yet it has done noble work all this time for the province, under the laborious principalship of Mr. Crocket, and the labors of his associates in the Normal and Model departments. During the five years ended October 31st last (I cannot yet command the facts respecting those licensed April 30th last), of the number of students in attendance in the stone barracks yonder, 450 received from the Board of Education licenses valid throughout New Brunswick. Of these, ten, for various reasons, have not yet given the Province the benefit of their services in the schools. Of the remainder (440), twenty per cent. hold licenses of the first class; fifty-one per cent. of the second class; and twenty-nine per cent. of the third class. Thirty-five per cent. of the whole number are young men, and sixty-five per cent. young women. Of the possible time these teachers could have taught subsequent to their attendance at the Normal School, these 154 young men were actually employed in the schools 83 per cent., and these 286 young women 86 per cent. When it is borne in mind that in this statement no allowance is made for the loss of time in securing appointments to schools, or from sickness, nor for the fact that some of our very best young ladies will get married, the record shows that the Province is receiving a splendid return for all the means expended upon the Normal School, and that this great factor, upon which we must rely so largely in elevating the quality of the instruction given in the schools, has already played a very important part in this work. With our improved accommodation, this school will be able more completely to respond to the needs of the country. The place occupied by the Normal School in our school system has no counterpart in any school system yet existing in any other Province or State on this continent, unless it be in that of Prince Edward Island. It is not, like the Normal Schools of Nova Scotia, Ontario, and the American States, an adjunct of the system; but is central and vital to it. It is not the head, but in respect of agency by which the quality of school instruction is to be guaranteed even to the extremities of the Province, it is the heart of the system. Until one undergoes satisfactorily a preparatory training in this school, or in another of kindred character in some other country, he is ineligible for examination for admission into the profession of teaching in New Brunswick. It is obvious, therefore, that hereafter, what with first and second and third term students teachers, we shall require to have about two hundred in regular preparation year in and year out, in order fully to meet the necessities of our schools, and to give a desirable range of selection to the various boards of trustees."

The Provincial Board of Education has issued a series of regulations for the conduct of Teachers' Institutes in the various inspection districts, and also of a Provincial Institute. According to the regulations, any ten teachers in a district may, by a written request to the inspector, secure the organization of a local institute, to the membership of which all regularly licensed resident teachers are eligible on payment of a fee not greater than one dollar. The officers are to be elected annually, and to a committee of management chosen by the members is entrusted the task of drawing up a programme. The institute meets once a year, and each teacher in the district is authorized, on giving due notice to trustees and pupils, to absent himself from school during the days on which it is held, while no abatement is made in the amount of the grant to either the school or the teacher in those cases where

the schools are kept vacant for this cause. The Chief Superintendent of the Province is *ex-officio* President of the Provincial Institute, which also meets once a year. The proceedings at both classes of meetings are apparently to be conducted with a view to making the members better acquainted with methods of teaching and modes of School organization and management.

NOVA SCOTIA.

The corner stone of a new Normal School building was laid with Masonic ceremonies, at Truro, on the 7th of July. The proceedings were of a highly interesting character, and were listened to by a large concourse of people. Speeches were made by Lieut.-Gov. Archibald, Chief Justice Young, Vice-Admiral Sir A. Cooper Key, Sir Robert Laffon, Governor of Bermuda, the Provincial Secretary, the Chancellor of the University of Halifax, the Provincial Superintendent of Public Instruction, and J. B. Caulkin, M.A., the Principal of the Normal School. Want of space forbids us from doing more than give the following extract from the Lieutenant-Governor's speech, which is of special interest as containing an historical sketch of the Nova Scotia School system. Referring to that system he said: "Its strides had surprised its best friends. In 1802, the first attempt to establish an educational institution was in Windsor, when the Government granted \$1,600 to assist in bearing the expenses of a college that had then received a Royal Charter, but nothing was done to extend the blessing of education to the masses. In 1811, for every \$200 raised by the people of any district the Government of the day gave a supplement of \$100. His Honor here contrasted this with the amounts now granted by Governments in our day. In 1826 the sum appropriated to common schools was \$13,000, a small amount when we realize the fact that the county of Colchester alone, in 1875, spent \$39,000 for educating its boys and girls—a sum three times as large as the whole Province spent in the year mentioned. Looking back for fifty years over our history, but little change is found in educational matters for the first twenty-five years. During the last half of that period we notice some improvement. Dr. Dawson was elected Superintendent of Education, and worked against the most adverse circumstances, constantly urging upon the people and Legislature the necessity of having a Normal School. He failed in his attempt to get it, and, though a great educational enthusiast, he gave up in despair and went to more genial fields of educational labor. His mantle fell upon the lamented Dr. Forrester's shoulders. By constant importuning he at last, in 1854, obtained an Act for the establishment of a Provincial Normal School. This work was furthered greatly at the time by the invaluable assistance of the Hon. Samuel Creelman, then Financial Secretary. Sir William Young was at the head of the Executive, and he gave all the assistance in his power, but Mr. Creelman was most persistent, and it was greatly to be regretted that he was not present to-day. The old building was erected in 1855, and the Government was asked to vote only a paltry \$4,000 for the whole outfit. This was a small sum for the Province of Nova Scotia to give when compared with the \$10,000 that the people in the town of Truro alone have expended in the erection of the Model School near by. The property belonging to the Normal School has so improved that, looking at it in a pecuniary point, it had ever been a paying investment. Sir Gaspard LeMarchant was Governor of Nova Scotia at the time of the opening of the school. He expressed great regret that he could not be present, but the names of many could be recalled that graced the occasion. Sir Wm. Young, then Attorney-General of the Province, was present, and made a most eloquent and forcible speech in favor of our educational interests. Judge Wilkins, then Provincial Secretary, was to the front also, advocating the claims of the masses to higher education. The Hon. Hugh Bell—many here remember him—spoke on the occasion. The Hon. Samuel Creelman was present, too, and was proud of the progress that had been made. The opening was most auspicious, and the best friends of the Normal School were satisfied with what had been achieved up to that time. Objections were at once raised to the school. Why turn out, at so great an expense, educated teachers when the people in the country cannot pay them or appreciate their labors? You are offering wares unsaleable because unseasonable. Public prejudice was appealed to. No man cares to be taxed, especially if he does not see any adequate return for such a tax. The energy of a Forrester overcame this, and his public lectures so prepared the minds of the people that in 1864 the country was ready for the Educational Act that we now enjoy. Dr. Tupper introduced the Bill of 1864, and the Opposition to a man were prepared to support it. The educational interests of Nova Scotia

and the future glory of our country were not disgraced by a petty squabble between political parties. That Act was strongly opposed by the people. It was the greatest innovation yet, and for two years it received some pretty hard knocks. Now, who dare assail it! Its former foes are now its friends, and the man or party would be doomed that dare lay hands upon the educational system of Nova Scotia. The people of Nova Scotia to-day pay over \$500,000 annually towards the education of the rising generation, and this is sufficient proof that we are in earnest in this matter; and the pleasing feature is that Protestant and Roman Catholic work side by side, pupil and teacher, without any disturbance or confusion. Ten years ago 1,000 teachers did our school work; now over 2,000 are employed. Since 1864 nearly 900 school houses have been erected, and the people of Nova Scotia have paid \$641,000 towards the building of such.

In accordance with a minute recently adopted by the Council of Public Instruction, there will hereafter be only one examination for teachers each year, beginning on the 15th of July; only one session of the Normal School, commencing on the first Wednesday in November; a vacation of four weeks instead of three at midsummer, and one of two weeks instead of ten days at Christmas.

The School law of this Province provides for the payment from the Provincial Treasury, to each School, of a certain sum per annum, according to the attendance and the time during which the school is kept open. This sum should be paid in addition to the amount agreed upon between the trustees and the teacher as the salary of the latter, but there is a strong tendency on the part of the trustees to evade the law by inducing the teacher to assume all risk as to the amount of the public grant coming to the school. It does not seem an easy matter to prevent them from doing so, except by the adoption of the plan which prevails in Ontario, in accordance with which the grant is payable to the teacher only, but is at the same time a part of the sum agreed upon as his salary. In other words, while the teacher draws the money the school section enjoys the benefit of it, and assumes all risk as to the amount.

TALK IN THE SILENT WORLD.—This German system may literally be called the art of teaching the dumb to speak. This will hardly appear impossible if it be borne in mind that the vocal organs of congenitally deaf persons are, so long as they are young, unimpaired. The faculty of producing sound is there, but the idea of sound not being present, no attempt to employ it is made. It is true that by long disuse the larynx loses the vocal property, but in the case of deaf children there is very little difficulty in inducing them to utter articulate sounds, not so clear and musical as those produced from persons who are not deaf, but distinct and intelligible. At the same time the eye of the pupil becomes educated to follow the lips of the speaker, and to gather from their movements the words uttered. The process of teaching children on the German system is curious and interesting. The first aim is to strengthen and expand the vocal organs by gentle exercise; the next, to train the pupil to watch the motions of the lips and tongue, and endeavor to copy them. The sense of sound, to which the auditory nerve is dead, is next conveyed through the sense of touch, the pupils being taught to feel the vibrations in their own throats and bodies when the sound is emitted, and to learn to control these vibrations at will. When a correct understanding and a use of all the vowels and consonants has been obtained, the pupils are ready to form words and use them as we do. The building up of language now commences on a plan similar to that which nature follows when children learn to talk by ear. Simple words and every-day phrases come first, the more difficult being gradually built upon and out of the simpler forms of expression; and the closer the artificial educational plan approaches to the natural ear-taught process, the better will be the result in the end. In some German schools a few natural gestures are allowed to be used in the early stages of teaching, but the highest type of the system is steadfastly opposed to all signs, and makes the pupils depend entirely on language as addressed to the eye, the meaning being conveyed by analogy, and language evolved out of language, as one problem in Euclid springs naturally from the one that precedes it. It must not be supposed that extraordinary intelligence is required in the pupils. Deaf children are very observant, and when pains are taken to talk to and with them they soon learn to converse freely with those whom they meet constantly. Conversational language must not be looked for in the first two years of instruction, for it must be borne in mind that a child, when its hearing is

perfect, takes a long while to learn to talk, but about the third or fourth year pupils of average ability begin to speak very intelligibly. One concession, and one only, the deaf children require, and that is, that all speaking to them shall open their mouths widely and enunciate with distinctness—a habit valuable in all, and, as the Archbishop of Canterbury remarked, at the meeting at Lambeth Palace, invaluable to clergymen. This is "all that is necessary to put them on a level with others, and to enable them to make their way in the world." In Vienna, a fancy leather merchant, who was born deaf and dumb, employed seventy men under him. The Emperor and Empress of Austria visited his workshop before the Vienna Exhibition; he could not only speak the language of his country fluently, but also a little English. The leather merchant had visited England and other countries; was a practical horticulturist, and altogether an agreeable, intelligent, wealthy man—wealthy through his own talents and industry. In a hatter's shop in Friedberg there is a toto-congenital deaf workman. A man was convicted for theft, principally on the evidence given *in voce*, in open court, by that deaf workman, who stood the test of examination and cross-examination without any other method of communication being used than word of mouth.—*All the Year Round.*

Departmental Notices.

(Copy of an Order in Council, approved by His Honor the Lieutenant-Governor, the 28th day of July, A.D. 1877.)

Upon the recommendation of the Honorable Mr. Hardy, acting Minister of Education, the Committee of Council advise that the accompanying surrender by the Board of Education of the City of London, and the High School Board of the City of London, to Her Majesty of the lands therein mentioned, be accepted by Your Honor, and that the said surrender be enrolled in the Office of the Provincial Registrar.

The Committee further advise, that the lands in the said surrender mentioned be sold and the proceeds applied for High School purposes, under the authority of 37 Victoria, Cap. 27, Sections 88-94.

Certified.

(Signed)

J. G. SCOTT,
Clerk Executive Council, Ont.

26th July, 1877.

The Honorable The Minister of Education.

(Copy of an Order in Council, approved by His Honor the Lieutenant-Governor, the 28th day of July, A.D. 1877.)

The Committee of Council have had under consideration the annexed report of the Honorable Mr. Hardy, Pro-Minister of Education, with reference to certain arrangements proposed to be made with the publishers of the CANADA SCHOOL JOURNAL, and advise that the recommendation therein contained be acted upon.

Certified.

(Signed)

J. LONSDALE CAPREOL,
Asst. Clerk Executive Council, Ont.

30th July, 1877.

The undersigned respectfully begs to report to His Honor the Lieutenant-Governor in Council, respecting the Education Department, as follows:—

The publication of the CANADA SCHOOL JOURNAL by Messrs. Adam Miller and Company, with an editorial staff, and of contributors composed of many who take the lead in educational work in the Province, has brought under consideration the question of the continuance of the *Journal of Education*. In a former report to Your Honor in Council on this subject, the Minister recommended the continuance of the publication of the Journal in order to supply information as to the actions of the Department to Inspectors, Trustees, Teachers and others, which information required a special journal for the purpose. Now that such a journal does exist in the CANADA SCHOOL JOURNAL, whose success should be aided by the Department, and not imperilled by the competition of the *Journal of Education*, circulated gratuitously, the undersigned respectfully recommend that the arrangements proposed to be made by the undersigned with the publishers be approved of by Your Honor in Council, such arrangements being that the publishers shall be paid fifty dollars per month, and that in consideration of this sum should furnish the Department with two hundred and fifty copies of the JOURNAL for distribution to Inspectors and others, as also such space as the Department may from time to time require for the publication of Departmental matter, and that such arrangement be revocable at the pleasure of the Government.

(Signed)

ARTHUR S. HARDY,
Pro-Minister of Education.

EDUCATION DEPARTMENT,
Toronto, July 19, 1877.

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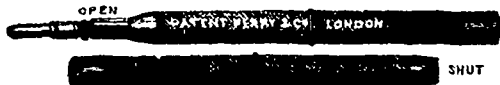
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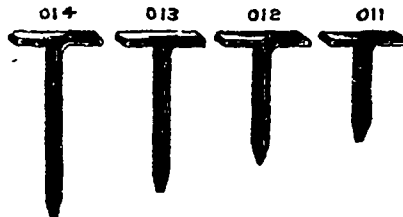


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