THE ADVENTURES OF AN x.

BY I. M. BROWN.

Chapter I.

TO think that I of all the five vowels and twenty-one consonants, should have been the one destined to meet with such adventures! I, who of all letters was the quietest and least desirous of attracting attention! I, to have been sent, into that bewildering land of puzzles, to become the jest and plaything of all men.

You will readily agree with this estimate of my own importance, if you will notice that I alone of all the letters have not yet taken part in these opening words, and only in this phrase will use be made of the last of the twenty-si$x$.

The fact is that I was ruthlessly taken from my own beloved land of Letters, to travel as a stranger in the Country of Mathematics. I will tell you my experiences from the day of my arrival there.

I was greeted by an official guide and he at once asked me where my badge was.

"My badge?" echoed I, "I haven't any."

He turned to a desk at his side and opening a drawer pulled out two black and white badges, one like this + and the other like this −. He said I must never go out of doors without one of these badges firmly pinned on in front, and the other one in my pocket ready for when I should need it. I said very stiffly that I was not in the habit of wearing any one's badge, and why should I put on his? He replied that if I did not wear a plus or minus sign I should only be allowed to travel in a very small part of the country, namely that ruled over by Queen Arithmetic, and I had been chosen to try to penetrate much further inland, into the territory of Algebra. He explained further that if possible one always wore the plus badge, for it stood for the nicer of the pairs, add and subtract,

up and down, right and left, receive and owe, pull and push, gain and loss, growing and shrinking...and so on.

He gave me a great many directions and much good advice, but I will skip all that and tell you what actually happened.

I fastened on my plus badge and went out to explore. I had gone but a very little way when, hand in hand, two letters like myself swooped down upon me shouting: "Here's another, come along and join hands with us; now our coefficient is three."

I was too bewildered to make any objection and too much out of breath from running with them to ask any questions. Presently one of them spied some more of our kind linked together. Off we went at once and joined them, all taking hands; one of the newcomers said: "Well, now our coefficient is eight." I had noticed that there were five in their group before we three joined it. I soon found that "coefficient" meant the number of letters there were. I think the word has something to do with one's efficiency or strength, just as we talk of the efficiency or strength of an army or of a man-of-war meaning the number of men there are.

Some one called out: "Hallo! there are two with minus badges, let's dodge them."

But we were not quick enough, so the two minus letters seized the last two of our line; all four were *hors de combat* for the rest of that day, and our coefficient was reduced to six.

It was not long before I learned to play this game quite well, so I walked farther into the country to find something new.

Chapter II.

In the next village I met a letter like myself, and he said: "Will you come and live with me?"

"Willingly," said I.

So he took me to a little square mat, where there was just room for us both to sit down. As we stepped on to this mat I noticed that my companion put away his badge and chalked up just outside: "$+ x^2$."

"Put away your badge too," said he, "you don't need it when we're living together."

We talked a good deal, seated on our little mat, and consequently we did not notice another x wearing a minus badge approaching. Suddenly with a shout he jumped between us saying:

"I'm here now and you can't get rid of me; so up with the walls and hoist the minus badge."

Like magic the little square mat became a cube-shaped tent and outside hung the minus sign.

"Bad luck," whispered my friend to me, "keep your eye open now for some other x with a minus badge. We can't get on a bit until somehow we can change this wretched minus into a plus; and that we can only do by getting another minus to join us; for then if we put one minus horizontal and the other vertical we'll make a plus: two minuses always make a plus."

Sure enough, soon there came down the road a pair of letters carrying a mat like our first home except that "$-x^2$" was written on it.

"Here, come here," we all shouted.

And once more our little cube-shaped tent was changed: but what the new shape was I *can't* remember. Then we arranged our minus and that of the newcomers cross-wise and were plus once more. And now our full title was "$+x^5$."

I stayed several days in this little village for I found it very confusing to be always changing the shape and sign of the house, and we had to do this every time any one went in or out.

But after a while it seemed a very simple arrangement and I thought the time had come for me to travel further.

Chapter III.

As I drew near the next village (it was called Simpleness) I noticed that all the inhabitants, numbers and letters alike, were out playing in the fields.

It was a kind of tug-of-war they played. There was a long rope and in it, sometimes in the middle and sometimes at one or other end, were fastened two little wooden rods called, as I found out, "equals."

Well, letters and numbers, higgledy-piggledy, seized hold of the rope: but as some pushed while others pulled, the rope got in a dreadful muddle. Then some one, the umpire I think, suggested that all the letters should go on one side of the little equal rods and all the numbers on the other; and any one who changed over had also to change his work, that is, if he had pulled he now pushed and *vice versa*.

But that didn't seem very much better; so they did as they had done in the first village I visited, they linked up all those with plus badges and then these paired of with the same number of minus ones: and the numbers did the same on their side. Until

at last there were only a few letters with one badge on one side pulling against some number on the other side. Lastly they tried to see what number one letter by himself could just balance. And that was the end of the game.

Chapter IV.

I enjoyed myself so much playing with the people in this village, Simpleness, that I stayed longer than was really necessary, for I had soon become a good player of their favorite game.

The fact is I'd overheard some of them talking about the life in Utility, the town that lay next in my route. And what they said made me nervous. However I was bound to travel that way, so it was no good delaying.

As I was starting forth, one of the villagers came running after me. "You'll be sure to get on all right," said he, "if you only manage to get into the service of one of the experts; whatever happens *avoid all very young employers.*"

I didn't quite know what he meant by "expert," but I thought that probably if I found an expert, he would be kind to me just because his name and mine were so alike.

Well, the streets of Utility were crowded with people who went about asking each other most complicated questions, such as:

"If a Father is three times as old as his son now, when will he be twice his age?" and "If a train had gone half a mile an hour quicker, it would have reached its destination an hour earlier; how fast did it travel?"

And any one who had made up one of these questions rushed out into the street and seized an x and insisted on his working for him.

It was quite easy work if you had a good master; he gave you very simple and straightforward directions, saying for example in a gambling question: "Suppose I lose £x and then win £2; I find I have as much as I started with; how much did I lose?"

I thought at once how I should have arranged the letters and numbers in the village Simpleness and quickly answered "£2": and he was quite pleased.

But, oh dear, the next person who employed me was a girl of about fourteen years! She said vaguely: "Let x equal the weight, how much ought I to buy?" I asked in an injured tone: "But what is x? is it pounds or ounces or grammes? and what are you going to buy? butter or cheese?"

She sighed and said: "I don't know, tons of coal, I think."

"Well," said I, "is this your order? Let x tons of coal be bought?"

"Yes, that's it; and if I had bought ten tons more I should have had twice as much. Isn't it a dreadfully hard question?"

"No," said I, "$x + 10 = 2x$, therefore $x = 10$."

"Goodness," said she, "it's the first one I've ever got a decent answer to!"

Chapter V.

Once more I set out on my lonely way.

As I approached the walls of a large city, I overtook another traveler, called y. He told me that the city we were nearing was called Togetherton, and he had heard rumors that no letter was allowed to start business by himself, it was necessary to have at least one partner. I was distressed at hearing this, for I knew no one there and I said so. He said he was in the same predicament and suggested that we should become partners. I gratefully agreed and we hired an office and called ourselves "The Simultaneous Solving Society."

We advertised that we would find values for any one who could produce two facts for us to work on. We charged our clients highly, for the work was very trying. In fact, in the first case that I undertook I fainted right away. You see the client came and said: "$3x + 2y = 13$" and "$2x + 7y = 20$." Then he did somthing to both these statements, and when I looked round, y was no longer to be seen and my client told me that I was equal to three.

"But," said I, "what has become of my friend y?"

"That's all right," said he, "now steady"; and he wrote down one of the facts again. Then I had a most dreadful feeling of substitution and knew no more until I heard my client saying: "Thank you, that's sufficient, $x = 3$ and $y = 2$."

It wasn't so bad the second time though, as I knew more or less what to expect.

Chapter VI.

After having made a great success of our Simultaneous Solving Society, I sold my share of the concern to another x; for I had determined to take a course as a common mechanic in the workshops of the factories.

I felt this would be a wise step, since the next town in my route

was a huge manufacturing center, and I always think it is a very good thing to be able to *do* the work as well as direct it.

Now I found out why the factories are so called: it is because in all the shops the most important tool is one called a "factor." Really it is almost the only instrument the workman is allowed to use. Some of the clumsier men try to struggle in old-fashioned and cumbersome tools which their parents had used before them. But the inspectors are dreadfully angry when they discover that a job has been done with these tools; they say that it never has the same neat appearance as if the proper factors had been used.

After some days of hard work here, for they say that nothing but long practice will make one proficient, the master of the factory gave me a certificate of excellence, and I felt that I was well equipped for my coming sojourn in the town of Quadraticness.

Chapter VII.

The characteristic feature of Quadraticness is the type of the houses. There must always be accommodation for an x^2, and x, and a number; and the best houses provide for the coefficients of the letters as well.

Each house has two doors, and these are kept shut and locked. When you want to come out you either unlock the door with your factors, or if that fails (sometimes the doors are very stiff) you use a combination lock. This is quite simple to use; but some people were always forgetting the combination and then they could neither let themselves out nor any one else in. The combination is an excellent one, and I never knew it to fail when it was properly used. Of course there were always some careless people who didn't work it steadily and accurately but kept making slips with it; but that was their fault, not the combination's.

Most houses had their doors clearly marked, either both in front, or both at the back, or one in the front and the other in the back. But there were some exceptional cases. Once I applied the combination, and the lock turned easily enough, but there was no real door, only a sham one! I hastily dropped the handle feeling that there were things uncanny behind the closed door and they were better left to the imagination.

Chapter VIII.

My next visit was to *Graphbury*, the large and growing suburb of Quadraticness.

Here everybody, without exception, was very keen on photography; and the houses were crammed with photographs of all descriptions.

I went to one of the best studios and arranged for my portrait to be taken.

First the photographer placed me in front of two perpendicular lines as background, telling me to think of any number. I came out a vertical line! I didn't order many copies!

On my next visit he proposed that I should be taken with my friend y; it was a favorite pose he said and easy to do well. This time the photograph was a slanting line!

I told the man then, that I couldn't have any more such ridiculous results. I was quite sure none of these graphs (they used the latter half of the word for short) resembled me in the slightest.

So in the next we had a group and we came out a circle. The photographer seeing that I was better pleased this time showed me his price list of arranged groups, saying that if I would choose the style he would do his best to satisfy me.

The price list was as follows:

	s	d
Groups of two letters, using first and second degrees, parabola	1	0
Groups of two letters, using second degree in equal quantities, cir :	1	0
Groups of two letters, using first and second degrees, circle	2	0
ellipse	2	0
hyperbola	2	6
Groups of two letters, using higher degrees, various curves	3	6

I had been told to spare no expense on my tour, so I was taken in every possible group and sent a copy of each to my Headquarters.

Chapter IX.

My next stopping place was in a large mining district. I went to interview the manager of the mines, and he advised me to watch the work for some days without taking any actual part in it.

"There are," he said, "six laws which have to be strictly observed, and although they appear simple enough at first sight, there is generally great difficulty in getting them enforced. And"—here he shrugged his shoulders—"you know the dangers of mining if the laws are not kept."

So I arranged to come the next morning when the work was in full swing and watch the proceedings.

The lift had just gone down when I arrived, and I turned into the little waiting-room. Here on the walls was a large printed copy

of the six laws. I read them carefully, remarking to myself: "What a fuss about nothing! These laws are surely easy enough to enforce."

Then the lift came creaking up.

On my way down, I tried to recollect what the laws were; but I couldn't think of more than two or three, and I began to see that after all they were a little elusive. However on glancing round the lift I saw another copy of them; apparently they find it necessary to put them in every possible place.

When I arrived at the bottom, it seemed pitch dark and I could see nothing save a few brilliant specks of light moving about. But after a moment or two my eyes became accustomed to the gloom, and I was able to distinguish queer little figures, each one carrying a lighted lantern in his cap.

These miners, I must tell you, are a special class of people, surds by name. It takes one a long time to get accustomed to their ways, and even after a fairly long acquaintance one has to deal tactfully with them or they will make good their escape and hide in a most impossible and tangled root. For this is a craze of surds, to escape, and hide under the long branch of some root; for here their lantern becomes invisible and without this guide or index of their power, it is impossible to get any work done.

I must describe this lantern or, as they call it, their index. It is a small tube with an oval-shaped glass top and bottom; on this glass is painted + or −, and some lanterns are made up with the plus at the top and others with minus at the top. Each surd paints his own particular index number after the plus or minus at both ends of his lantern.

A gang, or, as the manager technically said, "an expression," was just being sent out.

First they all ran and hid under the roots which grew on all sides. When they were driven out of these, they had to range themselves on a long ladder, which was placed horizontally. I was watching from a raised gallery and I could read clearly in the top of each one's lantern his index-number.

There were some plus and a fair number of minus ones. The manager gave an order and all those with minus signs dropped like monkeys and hung by their arms on to the rungs of the ladder, and as they dropped, their lanterns turned upside down automatically; and now I saw they all showed plus indices.

"Rearrange," called the manager, and all surds of the same kind collected together and chose one of their number to represent

them all. This one than altered the index in his lantern and took his place either standing on or hanging from the ladder, whichever was necessary to show his plus sign. And all the others of his kind put a nought as their index. The manager explained to me that they were no longer the letters or numbers they had been but were just "ones," and as such made no difference to the product of the work.

Occasionally I noticed one could extract quite easily a surd from the root in which he was hidden, but that was only when the root was one very near the surface and not deep down in the mine. And sometimes, if one knows the trick, one can extricate from one root by threading in another with it ; but the new root has to be chosen carefully or it is worse than useless.

Of course there were a great many inspectors in the mine and they went round testing all the appliances. Sometimes they helped with the work and got it done, simply by inspection, in ever so much less time than did the average workman.

I made a long stay in these mines and succeeded in making good friends of the surds. When I said goodbye I promised never to forget them and their ways.

All the same I was glad to get up into the open air again.

Chapter X.

Beyond me rose three mountain ranges, each one sloping gradually up to a higher level.

At first the climbing was easy, but it grew harder and harder. But one was well rewarded for one's trouble, for from time to time one caught glimpses of the far-off Sea of Infinity—away on the ever receding horizon of the Land of Higher Mathematics.

These mountain ranges were called The Progressions and in climbing them one had to provide oneself with certain invaluable means and formal appliances.

In the tableland of which these Progressions formed the approach, there had once been an enormous forest. But three hundred years ago two pioneers of Science had passed this way (though strangely enough they had overlooked the Surd district), and, noticing that the thicket was so dense that one could only work one's way through at a very slow pace, they had reduced it to a neat and orderly pile of logs.

And there these logs still stand in tabular array for any one to use who will.