FLATLAND—A MATHEMATICS PLAY.

A recent number of the *Mathematical Gazette* contains the following interesting report of a dramatic performance by the pupils of the Haberdashers' Aske's Girls' School, based on Dr. Abbott's *Flatland*. (*Flatland*. E. A. Abbott. 75 cents. Little, Brown & Co., Boston. Two other books on the fourth dimension are worthy of mention here. *The Fourth Dimension*. A collection of essays selected from those submitted in the *Scientific American's* prize contest. $1.50. Munn & Co., New York. *The Fourth Dimension*. Hinton. 4s. 6d. Swan Sonnenschein & Co., London.)

"The entertainment took place in the School Hall, the audience being seated in the gallery, thus looking down on the performers. In the first place, one of the pupils gave a short description of Flatland, explaining the following points: The audience were to imagine that they were looking down on an infinite plane, the inhabitants of which were aware of only two dimensions. An enormous pentagon, with gaps in its sides, drawn on the floor, represented a building. Flatlanders being unable to move out of their own plane, required nothing more than lines for walls, height having no meaning for them; the gaps in its sides were the doorways. These inhabitants were shaped like geometrical figures, and their social position was determined by the number of their sides. Thus, the many-sided figures constituted the nobility, whilst the artisans were triangles. Also, the more nearly a figure approached the regular shape, the higher the standing; thus an equilateral triangle was considered above an isosceles triangle, a square above a parallelogram, while the circle was the highest of all. By means of careful education the son of a quadrilateral, say, might in time become a pentagon, or even in some cases a son might be born possessing more sides than his father. The women, however, of all grades were merely straight lines, and so were invisible, when viewed from before or behind; in consequence they might cause considerable damage by running into those coming in the opposite direction, and, to avoid this, they were compelled by law to make a continual humming sound whenever they were in public places, so that they could be heard even though they might not be seen. As a further protection, women had to enter and leave all buildings by special doors.

In Scene I the inhabitants of Flatland were introduced to the audience by the narrator. They were represented by cardboard

models of circles, pentagons, and so on, carried horizontally on the girls' heads, thus showing the flat surfaces to the spectators seated in the gallery above.

The following characters marched around the hall and were introduced by name:

DRAMATIS PERSONAE.

The Priest's Family.

Nine Points Circle—*Priest.*
Asymptote—*Wife.*
Radial—*His son.*

The Nobleman's Family.

My Lord Manysides.
Perpendicular—*Wife.*
Aequalis and Planus—*Sons.*
Directrix and Tangenta—*Daughters.*

The Merchant's Family.

Mr. Protractor.
Bisecta—*Wife.*
Absurdus, Given and Cyclus—*Sons.*
Alterna and Corresponda—*Twin daughters.*

The Artisan's Family.

Mr. Acutus.
Similar—*Wife.*
Policeman X and Scalene—*Sons.*
Axis and Diameter—*Daughters.*

Other Characters.

His Reverence, the Circumcircle—*Priest.*
Sir Multilatus—*Nobleman.*
Mr. Ratio—*Schoolmaster.*
Mr. Rectangulus—*A heretic.*
Mr. Slantsides.
Base and Altitude—*His daughters.*

SCENE II.—AT PLAY.

Here the children "dance" and play "patterns," that is, they arrange themselves so as to form the well-known figures of geometrical propositions. These games would appear very dull and uninteresting to our children, who by virtue of their third dimension are enabled to play so many games with a sphere!

In the course of this scene one child relates a queer dream he had in which he visited a world of one dimension. Here all the

inhabitants were lines and moved in lines. They could walk backwards and forwards along their own lines without turning, but could never pass each other; their only means of communication, except with their immediate neighbors, was by shouting. The dreamer relates that these one-dimensional beings could not see him, although he was close beside them, but they could hear him. He says he insulted their king to whom he talked, by taking him for a woman, seeing that he was only a line. These creatures were much incensed at the folly of the idea of there being a "right" or "left"—"before" and "behind" they could understand, but "right" and "left" had no meaning for them.

Scene III. opens with the master awaiting the arrival of his pupils in the schoolroom. When these arrive they wish their master good morning, and greet him with a shake of the head—a bow or courtesy being, of course, impossible to a Flatlander. Lessons begin; the essential thing for a child of Flatland to learn is to recognize the size of angles by touch, so that he may leave school well equipped for later life. For, when two Flatlanders meet, they feel each other's angles, and thus recognize the grade of the person they have met; a mistake in this might lead to a great social trouble. Considerable time, therefore, is given to this subject in the school curriculum, and some of the children become very clever at it, being able to tell an angle within a degree by merely feeling it.

The next subject for the day is so-called algebra—in this they say their tables and then go on to squares, cubes, and symbols. Then follows a lesson on dimensions. The schoolmaster shows with models that a line is formed by the movement of a point, and an area by the movement of a line. One of the pupils, evidently a thinker, besides being the dreamer of Scene II., tries to connect this lesson with the last, and says: "If you can both square and cube x, why should you not be able to get another figure beyond a square when you multiply the length of a line by itself again? And what does an area form when it is moved?" The schoolmaster thinks that these are foolish questions, and shows that an area cannot be moved so as to generate anything else than an area. Just then a voice is hear to say "Move it up." The Flatland characters cannot see who is talking, for the voice proceeds from a sphere which is above the Flatland plane, and therefore invisible to them. The master ponders over this so deeply that he does not realize that all his pupils have run away, and the scene closes with the schoolmaster trying, in a very

puzzled way, to find out what is moving his model "up," a word hitherto unknown to Flatlanders.

In Scene IV. Lord Manysides and Sir Multilatus meet in the street and recognize each other in the way indicated in the previous scene. While talking, they encounter Mr. Protractor, who, though only a merchant, is intelligent beyond his sides, and has become a friend of Sir Multilatus. He introduces Mr. Protractor to Lord Manysides, the method of introduction being peculiar; first, Lord Manysides feels all Mr. Protractor's sides and angles, so that he will be able to recognize him by touch when next they meet, and then the operation is repeated by Mr. Protractor. After some conversation, Lord Manysides invites Mr. Protractor and his wife to dinner.

SCENE V.—HOUSE OF LORD MANYSIDES.

Lord Manysides, on returning from his walk, tells his wife that he has asked Mr. and Mrs. Protractor to dinner. She is so angry at his having asked a mere merchant and his wife to dinner that she runs at her husband as hard as she can, and kills him by piercing his polygon with her rod. She is overcome by grief and remorse, and makes no resistance when Policeman X comes to arrest her.

SCENE VI.—IN THE PRISON.

There are several prisoners present when Lady Manysides is brought into the prison, and these are discussing the various causes for their imprisonment. One says that he is there for fraud —being an isosceles triangle, he applied for a post open only to a rhombus, and obtained it because he and his son walked with their bases in contact.

Another is our old friend, the dreamer, who is charged with heresy because he would persist in discussing the possibility of a third dimension.

SCENE VII.—IN THE LAW COURT.

The trial of the heretic is proceeding, and everybody is pointing out the absurdity of the idea that there could be a third dimension, when a new witness suddenly appears, entering where there is no door, much to the surprise of everybody in court. However, he looks like a circle, so all make way for him, supposing him to be of the nobility; but they notice this peculiarity about him, that his size is continually changing, and sometimes he disappears altogether. The fact is that he is a sphere, and he thinks to convince them of the third dimension by bobbing up and down, and by

jumping over their line wall. But this point is quite lost on the Flatlanders, who cannot conceive such an idea. He tries hard to explain himself to those present, and lets them feel him all over, but they are quite mystified, except the dreamer, who at last sees some glimmer of light on his doubts.

The court breaks up; the prisoner is released and goes away with the sphere to learn more of this strange phenomenon.

ANOTHER CLEAN RECORD IN THE CANAL ZONE.

The report of the department of sanitation of the Isthmian Canal Commission for September, 1913, showed that during that month not a single white man, woman or child from the United States had died from disease on the Canal Zone. The report for February, 1914, shows that another record has been established. During that month there were 7,592 white employes. Among this number, equal to the population of a good-sized city, there was not a single death from disease during the month. Two white employes were killed by accident, one by electric shock and the other by injury received on the railroad, but no white employe, either American or foreign, died from disease during that time. As might be expected, the death-rate among other classes was equally low. Of the 5,309 white employes from the United States, there was only a single death by violence. Of the 3,875 white women and children from the United States, there was one death from accidental drowning and three from disease. One, a child of 4 years, died of diarrhea; another, a woman of 70, died of old age, and a third, a woman of 44, died of pulmonary tuberculosis. Out of a total of 9,184 white American employes and their families, there were only three deaths from disease and two from violence, while among the total 10,963 Americans on the Canal Zone, there was only a single additional death from violence, making a total of six deaths for the month among nearly eleven thousand persons, equal to an annual average death-rate of 6.56 per thousand. Nor are the benefits of improved sanitary conditions limited to white employes and their families. In February, 1914, there were 41,867 colored employes, and among this number there were only twenty-two deaths from disease and six deaths from violence, making an average death-rate per thousand from disease of 6.31, equivalent to a total annual average death-rate, for the entire 49,459 employes, of 5.34 per thousand. Of the twenty-one deaths, four were from pneumonia, seven from tuberculosis and one each from organic disease of the heart and typhoid fever, leaving nine deaths from all other diseases. After living for five or six years amid conditions which have produced such a startling reduction in the death-rate, will the men who have dug the Panama Canal be able to find any city in the United States which is sufficiently cleanly and healthy for them to live in? Let us hope, says *The Journal of the American Medical Association,* that the ten thousand Americans, returning to this country after a practical demonstration of what modern scientific knowledge can do to prevent disease, may prove to be the little leaven which will leaven the entire lump. If this is the case, the indirect benefits of the Panama Canal will be incomparably greater than its commercial or military value.