follows an investigation of collineation in a plane, comprising perspective transformations, and the linear transformations of translation, rotation, and dilatation, with combinations of these. The intimate relation that exists between projective and descriptive geometry is shown. The third chapter gives the general theory of conics, the projective properties of the circle being extended to conics by perspective transformations. The next chapter deals with pencils and ranges of conics and their products, and especially with cubics, the latter being classified under the five standard types by the help of the Steinerian transformation. Throughout the book analytical and geometrical methods are employed side by side, some portions of the subject being better suited to the former treatment; moreover, the analysis affords excellent illustrations of modern analytical geometry. The main purpose of the author has been to develop the subject in regard to its practical applications in mechanics, and the last chapter is devoted to such examples. Thus we find problems in graphic statics, plane stresses, and in the stress ellipse of an elastic material, and there is an interesting account of various linkages by means of which linear and perspective transformations can be mechanically obtained. The book is excellently got up in every way, and the diagrams are quite perfect and may well serve as models of what such figures ought to be. The author is a very clever draughtsman, and his skill as a writer is equally pronounced.

LETTERS TO THE EDITOR.

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Fictitious Problems in Mathematics.

IN my younger days it was well recognised that such statements as "perfectly smooth" and the like were mere conventional phrases for designating an ideal state of matter, which was assumed to exist for the purpose of simplifying the mathematical conditions as far as possible. Nobody can learn mathematics without working out a large number of problems and examples, and in order to make these sufficiently easy for the beginner, various fictitious hypotheses have to be introduced.

Similar objections would apply to the phrase "frictionless liquid"; but it would be impossible for anyone to learn hydrodynamics without first studying the mathematical theory of this fictitious form of matter. In fact, the introduction of viscosity leads to such formidable difficulties, that nobody has yet succeeded in solving such a simple problem as the motion due to a doublet situated at the centre of a sphere; and the solution, if it could be obtained, would throw much light on the mode of attacking more difficult problems. A. B. BASSET.

May 28.

IN NATURE of May 18 the wording of a problem set near the beginning of my "Rigid Dynamics" is rather adversely commented on. In the problem a man is described as walking along a perfectly rough board which rests on a smooth table, and the criticism is that the two suppositions are inconsistent; but this depends on what is meant by the words used, and perhaps I may be allowed to make an explanation.

When bodies are said to be perfectly rough, it is usually meant that they are so rough that the amount of friction necessary to prevent sliding in the given circumstances can certainly be called into play. In art. 156 of the treatise on dynamics, just after the laws of friction have been discussed, the words "perfectly rough" are defined to have this meaning. The board in question has therefore no special peculiarity. All that is stated is that the coefficient of friction between the man and the board exceeds a certain finite quantity.

The board rests on a smooth table, but the coefficient of friction now depends on both the board and the table, and this may be quite different from that between the man and the board. There is nothing amiss in supposing this coefficient to be zero. One way of effecting this experimentally would be to polish the table and remove all roughnesses from it. This was the plan indicated.

Where, then, is the inconsistency?

By using the ordinary abbreviations of language, the wording of the question has been made concise, and thus attention was specially directed to the dynamical principle involved in the solution.

The problem has been understood by so many students in the sense above described, and worked without a single objection having been raised, that I think the meaning must be perfectly clear. Indeed, I cannot imagine what other meaning it could have. E. J. ROUTH.

May 20.

On the Spontaneous Action of Radio-active Bodies on Gelatin Media.

IN the course of some experiments on the formation of unstable molecular aggregates, notably in phosphorescent bodies, I was led to try whether such dynamically unstable groupings could be produced by the action of radium upon certain organic substances. It will scarcely be necessary to enter here into an account of the many speculative experiments which I have at one time or another tried, but it will suffice if I describe, as briefly as possible, the experiment which, amongst others, has led to a very curious result, and that is the effect of radium chloride and radium bromide upon gelatin media, such as those generally used for bacterial cultures.

An extract of meat of 1 lb. of beef to 1 litre of water, together with 1 per cent. of Witter peptone, 1 per cent. of sodium chloride, and 10 per cent. of gold labelled gelatin, was slowly heated in the usual way, sterilised, and then cooled. The gelatin culture medium thus prepared, and commonly known as bouillon, is acted upon by radium salts and some other slightly radio-active bodies in a most remarkable manner.

In one experiment the salt was placed in a small hermetically sealed tube, one end of which was drawn out to a fine point, so that it could be easily broken. This was inserted in a test-tube containing the gelatin medium. The latter was stopped up with cotton wool in the usual way with such experiments, and then sterilised at a temperature of about 130° C. under pressure for about thirty minutes. Controls without radium were also at various times thus similarly sterilised.

When the gelatin had stood for some time and become settled, the fine end of the tube containing the radium salt was broken, from outside, without opening the test-tube, by means of a wire hook in a side tube.

The salt, which in this particular experiment consisted of $2\frac{1}{2}$ milligrams of radium bromide, was thus allowed to drop upon the surface of the gelatin.

After twenty-four hours or so in the case of the bromide, and about three or four days in that of the chloride, a peculiar culture-like growth appeared on the surface, and gradually made its way downwards, until after a fortnight, in some cases, it had grown fully a centimetre beneath the surface.

If the medium was sterilised several times before the radium was dropped on it, so that its colour was altered, probably by the inversion of the sugar, the growth was greatly retarded, and was confined chiefly to the surface.

It was found that plane polarised light, when transmitted through the tube at right angles to its axis, was rotated left-handedly in that part of the gelatin containing the growth, and in that part alone.

The controls showed no contamination whatever, and no rotation. The test-tubes were opened and microscopic slides examined under a twelfth power. They presented the appearance shown in Fig. 1. At first sight these seemed to be microbes, but as they did not give sub-cultures when inoculated in fresh media they could scarcely be bacteria. The progress of any of the sub-cultures after a month was extremely small, and certainly