MECHANICAL GEOMETRY: AN APPLICATION TO GEOMETRY OF SOME PROPOSITIONS IN STATICS

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MECHANICAL GEOMETRY.

AN APPLICATION TO GEOMETRY OF SOME PROPOSITIONS IN STATICS.

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PREFACE.

OUR knowledge of Geometry has been greatly increased by the application of Algebra and the Infinitesimal Calculus to that science. I have endeavoured, in the following pages, to demonstrate that *elementary* Statics can also be advantageously applied to Geometry, thinking that a complete separation of Pure from Applied Mathematics ought no more to be insisted upon than the separation of Geometry from Analysis.

This book will recommend itself to Problem Makers, and to those who want to satisfy themselves quickly as to the truth of certain geometrical statements. Some may also think that the road to a solution, short, and free from ambiguity, is often clearly pointed out by *the new methods;* and these, by comparison, will occasionally be found preferable to the use of Pure Geometry, of Co-ordinates, and of Abridged Notation. Originality of solution alone can be expected in subjects so hackneyed as the properties of straight lines and circles in one plane, to which this volume is confined. Some of the illustrating examples, however, are new.

In the *equations of points* (Chapter I.), and *of forces* (Chapter II.), I have extended the meaning of the sign of equality; in them it means *equivalence*. In Chapter II. and the following ones, multiplication often signifies *juxtaposition* of the capital letters.

I have explained and exemplified, in the first eight chapters, some of the processes by which equations of forces, of distances, and of areas, can be derived from equations of points. In Chapers II., VI., IX., X. will be found *the method of the separation of the letters* which define either a force, or a distance, or an area. The magnitude of a line is easily ascertained by the processes of Chapters VII. and VIII. Chapters XI. and XII. contain the application of the preceding ones to the Areal Equations of the Straight Line and Circle. An equation involving one variable only, can be obtained, representing a straight line when of the first degree, a conic when of the second degree, a cubic when of the third, and so on. Moreover, most of the propositions in this book are actually true for a System of Points in Space, the others being readily made so, by changing in their enunciations, right lines into planes, areas into volumes, and circles into spheres. These and other further applications of the Mechanical Geometry I have in manuscript.

LONDON, *February*, 1869.

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MECHANICAL GEOMETRY.

CHAPTER I.

NOTATION, WITH ITS APPLICATION TO STRAIGHT LINES, TRIANGLES, QUADRILATERALS, POLYGONS AND CIRCLES IN ONE PLANE.—RATIOS OF SEGMENTS OF INTERSECTING LINES.—THREE OR MORE LINES THROUGH ONE POINT.—THREE OR MORE POINTS IN ONE RIGHT LINE.

1. **Notation.** Let the equation,

$(a+b+c+d+\text{etc.})\ \mathrm{P}=a\mathrm{A}+b\mathrm{B}+c\mathrm{C}+d\mathrm{D}+\text{etc.}$ (1)

mean that P is the centre of parallel forces: a, at the point A, b at B, c at C, etc.; those forces which act in one direction having the same sign, those acting in opposite direction having the opposite sign. Then $a+b+c+d+\text{etc.}$ is the resultant of these parallel forces.

The equation $0=a\mathrm{A}+b\mathrm{B}+c\mathrm{C}+d\mathrm{D}+\text{etc.}$ (2) means that parallel forces a at the point A, b at B, c at C, etc., are in equilibrium. Then the algebraic sum of these forces must be zero, or

$$0=a+b+c+d+\text{etc.}$$

The equation (1) is to be read:

$a+b+c+d+\text{etc.}$ at P equals a at $\mathrm{A}+b$ at $\mathrm{B}+c$ at $\mathrm{C}+\text{etc.}$