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Geometric Origami
By Robert Geretschläger, Arbelos, 2008
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Origami is the traditional Japanese art of paper folding which has been practised in that country for over 400 years. Not surprisingly, this art form with its strict dependence on a sequence of precise folds, has long been of interest to mathematicians. In 1989, the first International Meeting of Origami Science and Technology was held; since that time there have been numerous conferences devoted to this burgeoning field, and today the research literature is extensive and ever growing.

The book *Geometric Origami* provides a nice balance between theory and practical application. If your interest is to fold a regular triskaidecagon (otherwise known as a 13-gon), you will find detailed instructions, accompanied by clear drawings, to guide you on your way. On the other hand, for those whose interests are theoretical, they will find a clear exposition of the mathematics underlying this construction.

This is a book which yields wonderful nuggets, regardless whether it is read carefully from beginning to end, or whether it is skimmed superficially. Part I, which develops the underlying mathematical theory, provides a clear and careful discussion of the axioms of origami constructions, and shows that these are more powerful than the corresponding axioms governing Euclidean constructions. Specifically, origami constructions are powerful enough to provide geometric solutions to the problem of solving the general cubic equation (and, indeed, the general quartic as well), something that is beyond the scope of Euclidean constructions. Hence, as the author shows, origami constructions enable one to solve two of the classical construction problems: duplicating the cube and trisecting a general angle.

In Part II, the author gives clear step-by-step origami constructions for a fascinating class of problems. All of these results are bolstered by a thorough discussion of the underlying theory. Much of this section focuses on origami constructions of regular polygons, and Geretschläger tackles this from several directions. First, he explores the general question of which n-gons are constructible (for example, he shows that if $n = 5 \cdot 2^k \cdot 3^\ell$, then the corresponding n-gon can be folded). Subsequently, the author devotes one chapter to questions around the theory and construction of the regular pentagon, followed by a chapter exploring similar questions for the regular heptagon. The book concludes with a final chapter describing how to fold the regular nonagon, triskaidecagon, 17-gon, and 19-gon.

This book is a delightful addition to a wonderful corner of mathematics where art and geometry meet in such a fruitful union. Anyone with a working knowledge of elementary geometry, algebra, and the geometry of complex numbers will have little trouble following the theoretical discussions. It will be of value to a wide range of audiences; newcomers to the field of mathematical paper-folding will find, easily accessible, all the tools they need, while experts will enjoy a well-written, beautifully illustrated reference work.