

THE ORIGIN AND GROWTH OF MATHEMATICAL CONCEPTS

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1. **Introduction.** According to A. N. Whitehead [1, p. 20], "The science of Pure Mathematics, in its modern developments, may claim to be the most original creation of the human spirit"; a statement with which probably few mathematicians would quarrel. A layman, however, might and probably would take this to mean that modern mathematics is something which has already been created; a creation, that is, which has already been accomplished and is now safely embalmed with remains on view in any good library.

Of course, as mathematicians we know that mathematics is in no such static shape; that it is, on the contrary, a dynamic affair, changing even from day to day. Our late colleagues who were in the forefront of mathematical creation about the turn of the century, 1900, would be amazed to see what mathematics is like today; indeed, many of them, I'd wager, would not like some of the modern developments, probably taking the same attitude toward them that some mathematicians of the late 19th century took toward Cantor's innovations regarding the infinite. Moreover, those of us who are active today would probably feel the same way toward the mathematics of the year 2000, if we were in some way able to view it. We ourselves probably have not sufficient perception of the changes going on in mathematics at the present time; it is well known that the participants in great social changes are usually unaware of them. And there is some evidence that our awareness of the process of mathematical change, although not so at variance with the facts as that of the layman, is still so defective in some ways as to lead to unfortunate but avoidable situations. This is partly due, I suppose, to our being so busy creating new mathematics that we have little time or patience to view our behavior from the outside and study its characteristics. And even when we do so, we seem prone to take such a specialized angle from which to make our observations that we get only a partial perspective.

2. **Motives.** Poincaré remarked, in one of his numerous essays [2, p. 376], that "mathematical science must reflect on itself," and

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