PREFACE

This work was motivated by the need to provide an intensive course in paraxial optics for students of optometry and vision science. Its organization reflects my experiences in teaching Geometrical Optics in a changing optometry curriculum. Where once optics was central to the training of optometrists, it is now one of many areas of knowledge to be mastered. As a result, course hours in optics have contracted, although the subject material has expanded with the development of sophisticated optical instrumentation, and increasing diversity in ophthalmic materials and lenses.

The challenge, then, was to determine the most effective and efficient way to teach the essentials of geometrical optics, within these constraints, to students who, most commonly, are not physics or mathematics majors. The goal was for the students to retain a lifelong basic understanding of image formation by lenses and mirrors.

To work toward this goal, I organized this work so that the single spherical refracting surface is the basic optical element. Spherical mirrors are treated as special cases of refraction, with the same applicable equations. Thin lens equations follow as combinations of spherical refracting surfaces. The cardinal points of the thick lens make it equivalent to a thin lens. Ultimately, one set of vergence equations is applicable to all these elements.

As recently as 40 years ago we thought that everything important about optics had been discovered. We relegated optics to classical physics. Physicists primarily were interested in atomic and nuclear physics. Today optics is in the forefront of scientific and technological study. This metamorphosis is the result of the invention of the laser, and the development of holography, optical fibers for telecommunications, thin film technology and optical memory for computers.

We divided classical optics into geometrical and physical branches, but today the subdivisions are many times more numerous, as can be gleaned from the titles of books: Optical Holography, Optical Physics, Optical System Design, Optical Engineering, Applied Optics, Modern Optics, and the list goes on.

This book covers only a tiny fraction of geometrical optics, mainly paraxial optics. The laws of geometrical optics go back to ancient times for reflection of light, and the 17th century for the refraction of light. In fact, just one law, Snell's Law, **[n sin a = n' sin a']** encapsulates most of the geometrical optics in this course. Furthermore, we mainly will consider a simplification of this law for the paraxial case: **[n a = n'a]**.

Although the ideas are not very complicated, the reader's first challenge will be to reacquire some basic knowledge and skills in using geometry, trigonometry and algebra. Then it is essential to use only the sign convention and nomenclature consistently to solve problems. Failure to solve problems is frequently caused by confusion whether a distance is positive or negative. The second most important habit to develop is to draw clear and fully labeled diagrams.

To test your understanding of the material you must do the homework problems. They should be done regularly. Cramming at exam time has been the undoing of many students. Furthermore, regularly doing homework will enable you to raise timely questions in class.

Milton Katz