Simple Optics Documentation

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Contents

1   Important Info

All optics diagrams drawn with this package **must** be contained within a "tikzpicture" environment

Example.

\begin{center}

\begin{tikzpicture}

\mirror{0}{0}{-4}{3}

\end{tikzpicture}

\end{center}

Figure 1: Simple mirror example

2   Quick Macro Reference

The available macros are

- \mirror{x}{y}{focal length}{mirror height}
- \leftplanoconvexlens{x}{y}{focal length}{mirror height}{thickness}
- \rightplanoconvexlens{x}{y}{focal length}{mirror height}{thickness}
- \leftplanoconcavelens{x}{y}{focal length}{mirror height}{thickness}
- \rightplanoconcavelens{x}{y}{focal length}{mirror height}{thickness}
- \biconvexlens{x}{y}{focal length}{mirror height}{thickness}
- \biconcavelens{x}{y}{focal length}{mirror height}{thickness}
- \convexconcavelens{x}{y}{focal length}{mirror height}{thickness}

- \concaveconvexlens{x}{y}{focal length}{mirror height}{thickness}

3   Mirrors

Mirrors can be drawn using the \mirror macro.

The macro takes the following parameters, all of which are required.

\mirror{x}{y}{focal length}{mirror height}

The parameters x and y are the coordinates for where the mirror will be placed. The focal length and height are simply the focal length and height of the mirror.

If you want to flip the mirror the other way, just specify a negative focal length. Examples of both are done below with the code below each.

Figure 2: Positive focal length example   Figure 3: Negative focal length example

\begin{center}   \begin{center}
\begin{tikzpicture}   \begin{tikzpicture}
\mirror{0}{0}{3}{4}   \mirror{0}{0}{-3}{4}
\end{tikzpicture}   \end{tikzpicture}
\end{center}   \end{center}

4   Lenses

The lenses are made using mirrors.

There are a few different lenses that can be drawn with this package, each of which has its own macro.

4.1   Plano Lenses

Plano lenses have one flat side and the other side is either convex or concave.

The plano lenses have macros following this format

\leftplano"convex/concave"lens{x}{y}{focal length}{mirror height}{thickness}

or

\rightplano"convex/concave"lens{x}{y}{focal length}{mirror height}{thickness}

4.1.1 Plano-Convex Lenses

This package provides two plano-covex lens macros. One faces left and the other right. The left and right refer to the flat side of the lens. These are shown below.

Figure 4: Left plano convex lens

Figure 5: Right plano convex lens

```
\begin{center}
\begin{tikzpicture}
\leftplanoconvexlens{0}{0}{3}{4}{0.3}
\end{tikzpicture}
\end{center}
```

```
\begin{center}
\begin{tikzpicture}
\rightplanoconvexlens{0}{0}{3}{4}{0.3}
\end{tikzpicture}
\end{center}
```

4.1.2 Plano-Concave Lenses

The same can be done with plano concave lenses. Again there are two available macros. One faces left and the other right. The left and right refer to the flat side of the lens. These are shown below.

Figure 6: Left plano concave lens

Figure 7: Right plano concave lens

\begin{center}
\begin{tikzpicture}
\leftplanoconcavelens{0}{0}{5}{3}{0.5}
\end{tikzpicture}
\end{center}

\begin{center}
\begin{tikzpicture}
\rightplanoconcavelens{0}{0}{5}{3}{0.5}
\end{tikzpicture}
\end{center}

4.2 Bi Lenses

Bi lenses are made of two mirrors facing opposite directions.

Bi lenses have macros with this format

\bi"convex/concave"lens{x}{y}{focal length}{mirror height}{thickness}
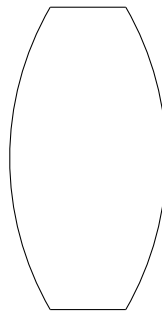
4.2.1 Bi-Convex Lens

Figure 8: Bi convex lens

\begin{center}
\begin{tikzpicture}

\biconvexlens{0}{0}{1}{2}{1}

\end{tikzpicture}

\end{center}

4.2.2   Bi-Concave Lens
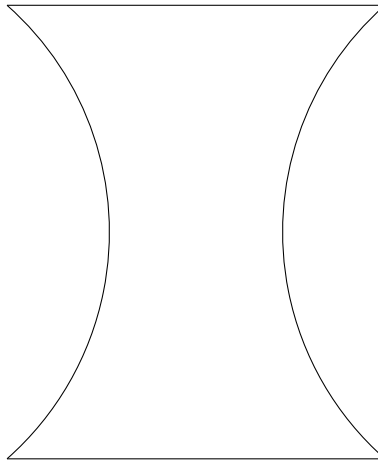

Figure 9: Bi concave lens

\begin{center}

\begin{tikzpicture}

\biconcavelens{0}{0}{1}{3}{5}

\end{tikzpicture}

\end{center}

4.3   Convex-Concave and Concave-Convex Lenses

Convex and concave mirrors can be combined to make convex-concave lenses and concave-convex lenses.

They have macros with the format

\convexconcavelens{x}{y}{focal length}{mirror height}{thickness}

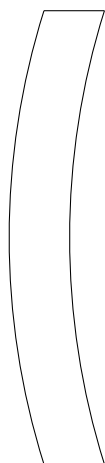\concaveconvexlens{x}{y}{focal length}{mirror height}{thickness}
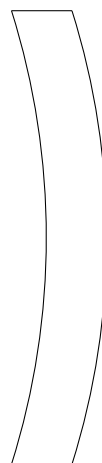
Figure 10: Convex-Concave lens

Figure 11: Concave-Convex lens

\begin{center}
\begin{tikzpicture}
\convexconcavelens{0}{0}{2.5}{3}{0.8}
\end{tikzpicture}
\end{center}

\begin{center}
\begin{tikzpicture}
\concaveconvexlens{0}{0}{2.5}{3}{0.8}
\end{tikzpicture}
\end{center}

5 Multiple At Once

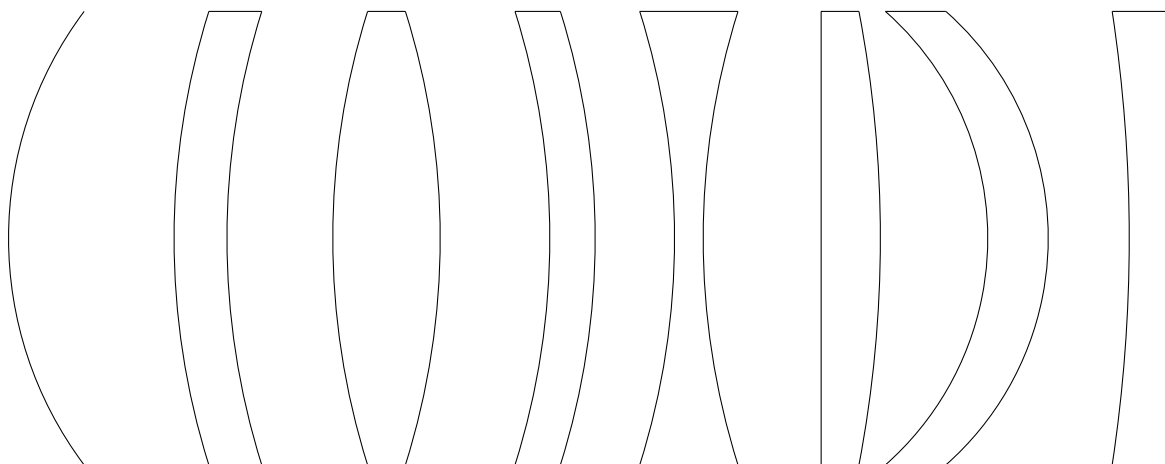The macros can all be used at the same time to produce diagrams with multiple lenses and/or mirrors.

Figure 12: Concave-Convex lens

\begin{center}

\begin{tikzpicture}

```
\mirror{1}{0}{2.5}{3}
\convexconcavelens{3}{0}{2.5}{3}{0.7}
\biconvexlens{5}{0}{2.5}{3}{0.5}
\concaveconvexlens{7}{0}{2.5}{3}{0.6}
\biconcavelens{9}{0}{2.5}{3}{1.3}
\leftplanoconvexlens{11}{0}{4}{3}{0.5}
\concaveconvexlens{12}{0}{1}{3}{0.8}
\rightplanoconcavelens{15}{0}{5}{3}{0.8}
\end{tikzpicture}
\end{center}
```