

## Tools and Materials Required

- **A small cardboard box**  
(approx 8in x 6in x 12in)
- **A magnifying glass**
- **Scissors or a craft knife**  
(for adult use or under close supervision for older children)
- **Tape**
- **A smart phone**

## Directions

- Turn your box so that one of the narrow sides is facing up. Put the magnifying glass in the middle and draw around it.
- Cut a hole in the box that is slightly smaller than the circle (the box should hold the magnifying glass, without it falling through).
- Cut the circle of cardboard into a wide strip. Form it into a triangular tube and secure with tape. This will be the smartphone stand.
- Tape the phone stand into the box so that the phone will be in line with the magnifying glass (the cut out hole). It should be at least 5-6 inches from the glass.
- Place the magnifying glass on the box so the glass aligns with the cut out hole. Secure with tape.
- Set up a video on your phone (lock the phone onto landscape orientation) and place it on the stand inside the box.
- Darken the lights and point the projector at a blank white wall. Play with the best distance from the wall to get a sharp image.
- You will notice that the image is upside down. Turn the phone upside down to project the image correctly.



## STEM Facts

The lens is convex (its sides bend outwards). Light passing through the lens is also bent outwards, which is why the projected image is bigger than the one on the smartphone.

As the lens bends the light, it also flips the image upside down. This is why we need to turn the phone upside down to get a right side up projected image. The lens in your eye works the same way, but our brain flips it up the right way again.

## Notes

- Cutting should be done by an adult or under adult supervision.
- Some apps do not allow you to lock the screen orientation, if you are having problems try a different video player.