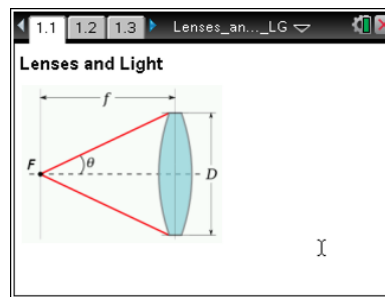




Open the TI-Nspire document *Lenses\_and\_Light.tns*.

How do lenses work? When light passes through a lens what happens to it as it leaves the lens? In this activity, you will explore the paths of light rays through different lenses. Then you will determine how real images and virtual images form.



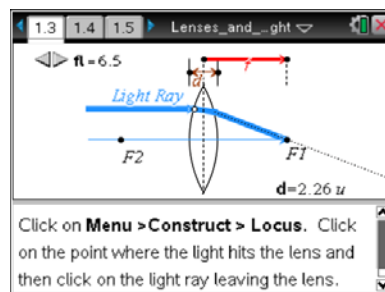
Move to pages 1.2 and 1.3.

Read 1.2 and move on to page 1.3 and explore.

Press **ctrl** **▶** and **ctrl** **◀** to navigate through the lesson.

**Convex Lenses**

- With the cursor over the image press **Menu > Construction > Locus**. Click on the point where the light ray hits the lens first, and then click on the light ray leaving the lens.



Move to pages 1.4–1.6. Answer the following questions here or in the .tns file.

- As light passes through a convex lens, light rays \_\_\_\_\_.
 

A. travel straight through	C. converge
B. diverge	D. cannot be determined
- The point where light rays come together is known as the \_\_\_\_\_.
 

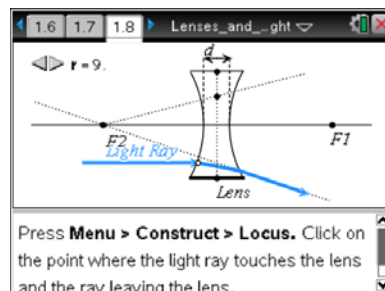
A. focal point	C. radial point
B. divergent point	D. concentration point
- The thicker the lens, the \_\_\_\_\_.
 

A. shorter the focal length	B. longer the focal length	C. the focal length cannot be determined
-----------------------------	----------------------------	--

Move to pages 1.7 and 1.8.

**Concave Lenses**

- On Page 1.8 there is a concave lens. Grab the point where the Light Ray touches the lens and drag it up and down the lens. Observe the effect on the Light Ray leaving the lens.
- With the cursor over the image press **Menu > Construction > Locus**. Click on the point where the Light Ray hits the lens, then click on the light ray leaving the lens.



Move to pages 1.9 and 1.10. Answer the following questions here or in the .tns file.

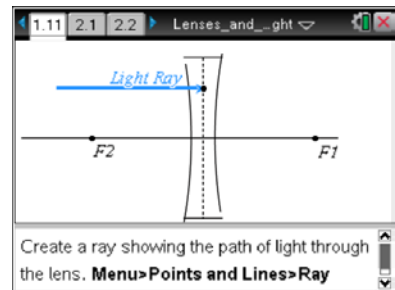


Q4. What occurs when the light passes through a concave lens?

Q5. How can the path of light leaving the lens be predicted?

**Move to page 1.11.**

4. Create a ray showing the path of light through the lens. Press **Menu > Points and Lines > Ray**.

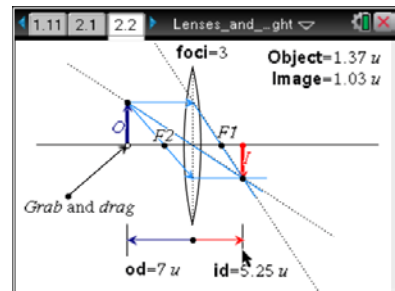


**Move to pages 2.1 and 2.2.**

**Images and Convex Lenses**

An image is created by the convergence of light rays. There are two types of images, real and virtual. When light rays converge on the opposite side of the lens from an object a real image is created. If the light rays converge on the same side as the object it is a virtual image.

5. Grab the point at the base of the Object (O) arrow and drag the object back and forth viewing the image (I).



**Move to pages 2.3–2.8. Answer the following questions here or in the .tns file.**

- Q6. The image is the same size as the object when \_\_\_\_\_.
- |   |   |
|---|---|
| A. the object is at the focal point     | C. the object is at 2 times the focal point |
| B. the object is at 1/2 the focal point | D. the object is at 3 times the focal point |
- Q7. As the object moves away from the focal point and the lens, the image gets \_\_\_\_\_.
- |            |                   |
|------------|-------------------|
| A. smaller | C. stays same     |
| B. bigger  | D. doesn't change |
- Q8. When the object is at the focal point, \_\_\_\_\_.
- |                          |   |
|--------------------------|---|
| A. there is no image     | C. the image is too close to the focal point to be seen |
| B. the image is far away | D. the image cannot be determined                       |

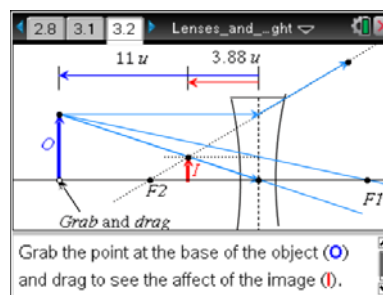


- Q9. When the object is between the lens and the focal point, the image appears \_\_\_\_\_.
- |   |  |
|---|--|
| A. larger and on the same side of the lens as the object      | C. smaller and on the same side of the lens as the object    |
| B. smaller and on the opposite side of the lens as the object | D. larger and on the opposite side of the lens as the object |
- Q10. When the image appears on the opposite side of the lens from the object, the image is \_\_\_\_\_.
- |                   |                            |
|-------------------|----------------------------|
| A. always larger  | C. always the same side up |
| B. always smaller | D. always upside down      |
- Q11. When the virtual image is on the same side of the lens as the object, the image is \_\_\_\_\_.
- |                   |                            |
|-------------------|----------------------------|
| A. always larger  | C. always the same side up |
| B. always smaller | D. always upside down      |

**Move to pages 3.1 and 3.2.**

**Concave Lenses and Images**

5. Grab the point on the object (O) and drag it back and forth, observing the effect on the image (I).



**Move to pages 3.3–3.9. Answer the following questions here or in the .tns file.**

- Q12. The light rays passing through a concave lens \_\_\_\_\_.
- |                    |                       |
|--------------------|-----------------------|
| A. always diverge  | C. sometimes diverge  |
| B. always converge | D. sometimes converge |
- Q13. The image that is created on the same side of the lens is real. True or False?
- Q14. As the object moves away from the focal point and the lens, the image \_\_\_\_\_.
- |   |  |
|---|--|
| A. gets bigger and moves toward the lens        | C. gets smaller and moves toward the lens        |
| B. gets bigger and moves toward the focal point | D. gets smaller and moves toward the focal point |
- Q15. To create a larger image, the object needs to \_\_\_\_\_.
- |                                       |  |
|---------------------------------------|--|
| A. always move toward the focal point | C. always move away from the focal point |
| B. always move toward the lens        | D. always move away from the lens        |
- Q16. If the object gets close enough to the lens, the image will appear on the opposite side of the lens right-side up. True or False?
- Q17. The image is always right-side up when using a concave lens. True or False?
- Q18. The image is always virtual when using a concave lens. True or False?