Physics

2nd Edition

# Ray Diagrams for **Mirrors**

Student Worksheets

by Robert Prior

Physics

instructions

# Ray Diagrams for **Mirrors**

Drawing ray diagrams is a skill used in many branches of optics. As with any skill, practice makes perfect. This booklet contains many practice diagrams so you can become perfect.

Although there are an infinite number of light rays, you only need to draw three rays to locate the image.

For clarity, draw each ray in a different colour. This booklet uses **red** for rays through the vertex, **green** for rays parallel to the principal axis, **blue** for rays through the focus, and **yellow** for rays through the centre of curvature.

Real rays, which represent the path followed by a beam of light, are drawn as solid lines: ⟶

Virtual rays, which represent the path that a beam of light appears to follow, are drawn as dashed lines: - - - ➔

*Always **use a ruler** and draw your lines carefully! A small mistake in a line can lead to a big mistake in an image.*

*Engraving on the title page of the **Thesaurus opticus***

# A Note for **Students**

Confidence comes from practice. That is why this workbook is so long, so you can get lots of practice. That said, you don't need to do the entire book — instead you should concentrate on the types of diagram that you have trouble with.

For example, if you are having trouble with virtual images then do more of the diagrams with virtual images on them. Once you know the vocabulary you don't need to keep labelling the diagrams.

There are essentially ten different diagrams here, with six different objects. The candle and trees require only that the you be able to locate the image, while the animals require you to understand the image facing as well. The giraffe and one tree are large enough that spherical aberration is very obvious, while the candle is short enough that it isn't evident.

Although the solutions show four rays, many instructors only require that their students construct three. For best results they should be the three rays closest to the vertex.

## A note on aberration

These diagrams use the actual surface of the mirror for drawing rays, which clearly illustrates why spherical aberration occurs.

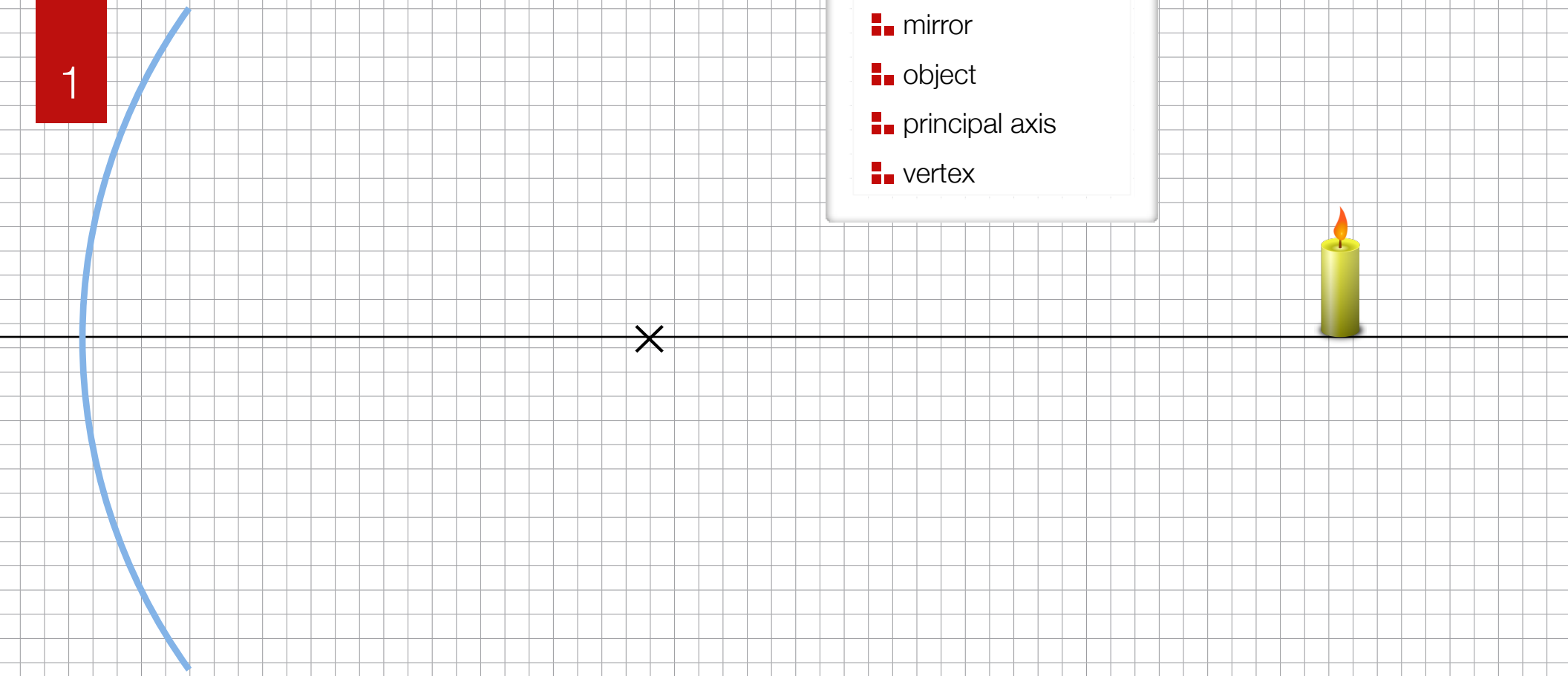
Some physics courses draw ray diagrams as if the mirror is a flat plane, which means there is no spherical aberration. If your course does that then this workbook is probably of little use to you — ask your instructor to be sure.

1

## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex

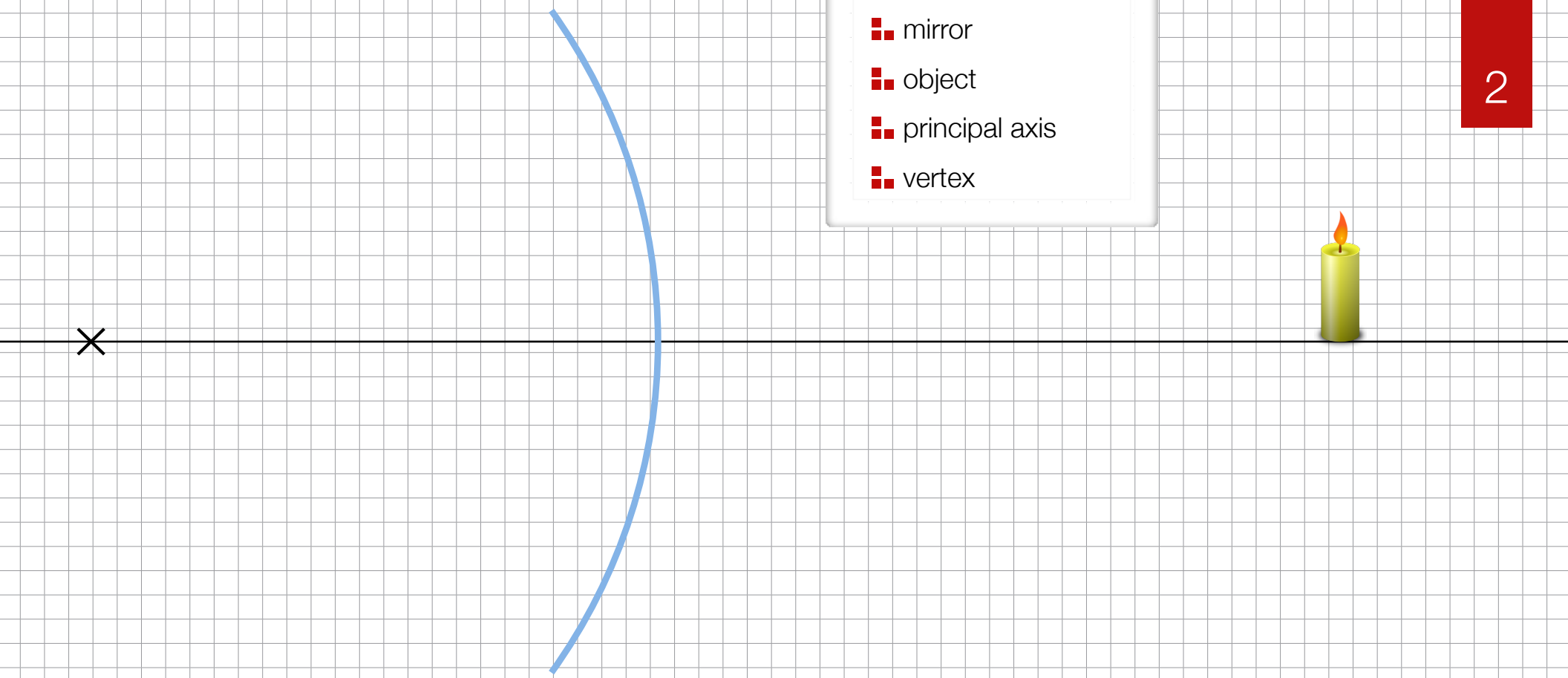


## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex





3



## Instructions

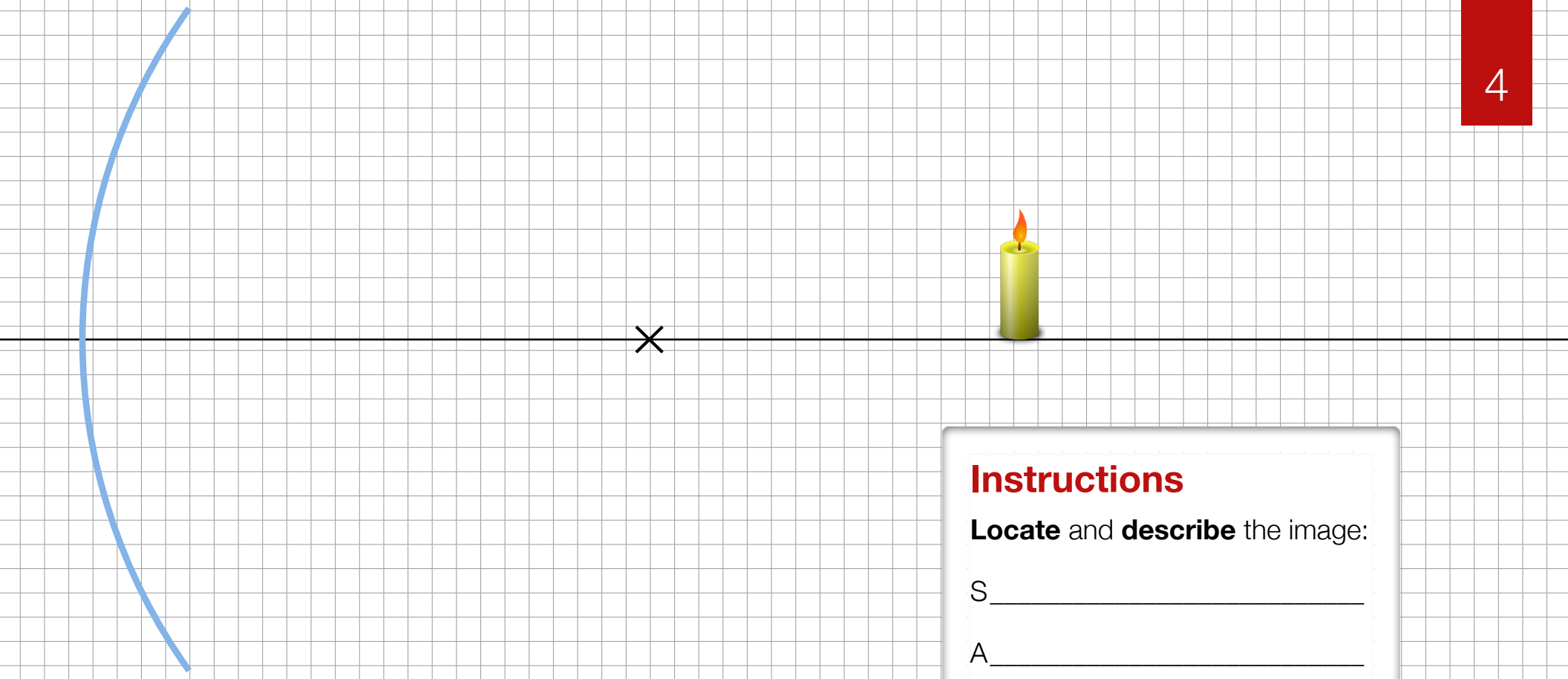
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

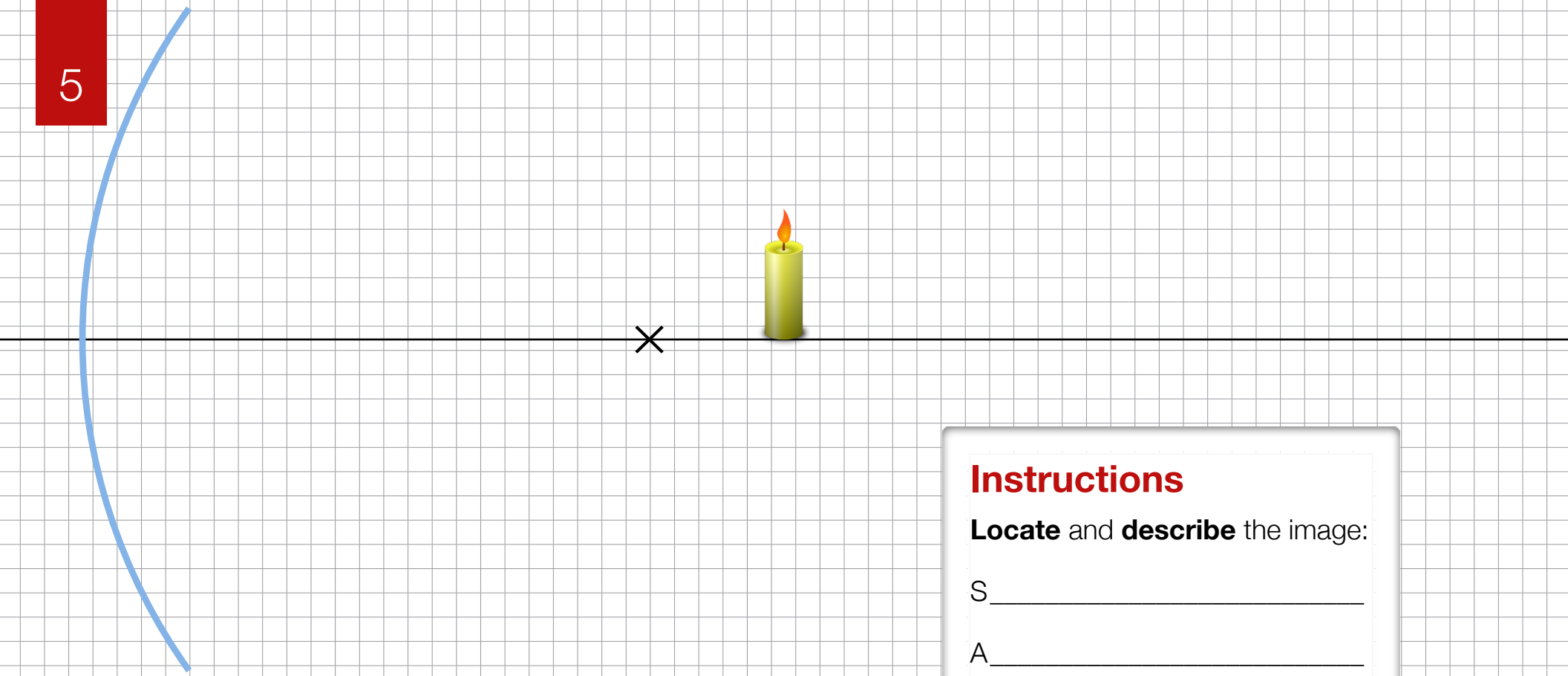
S _____

A _____

L _____

T _____

5



## Instructions

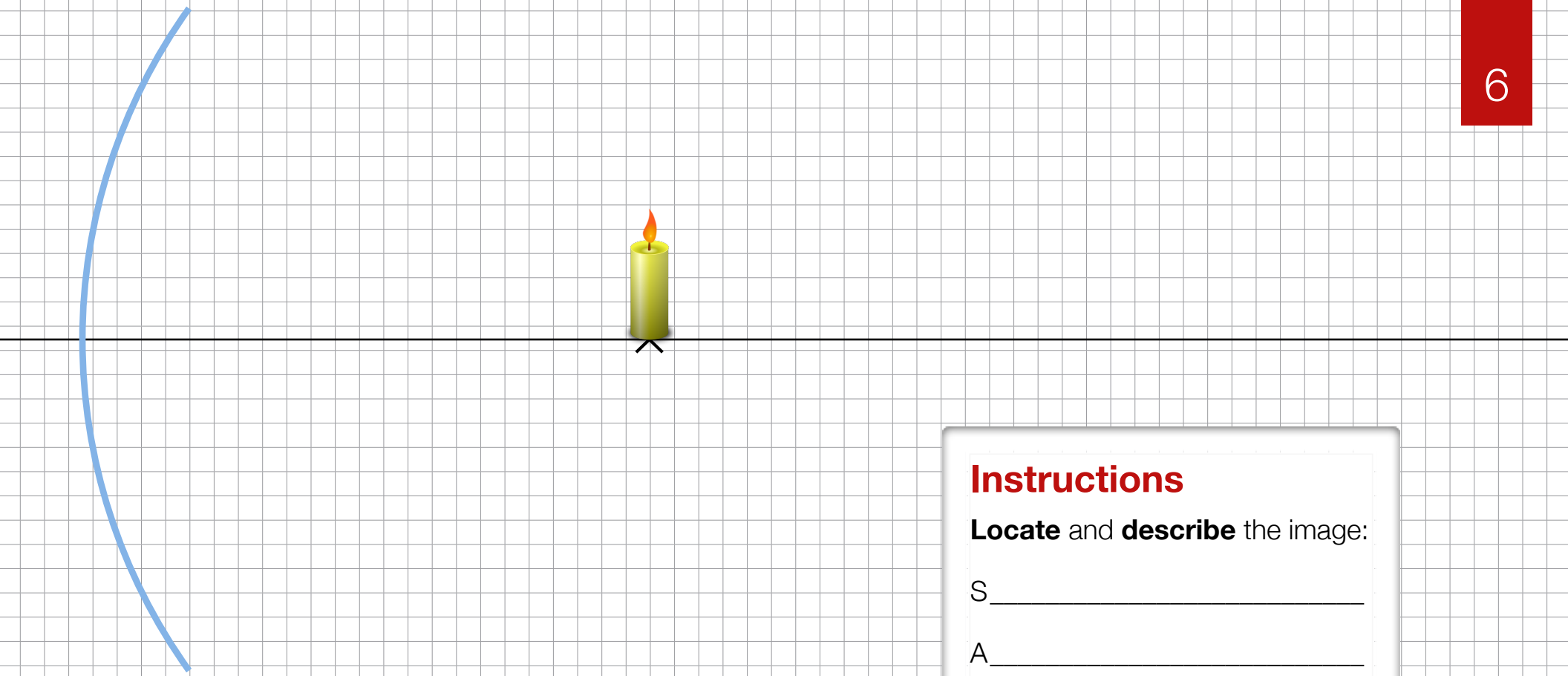
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

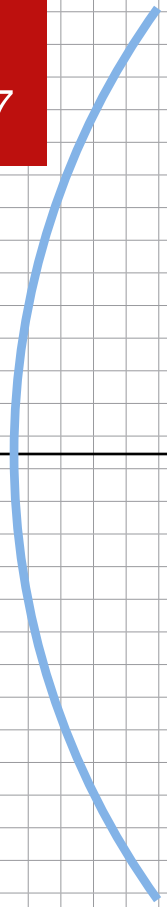
S _____

A _____

L _____

T _____

7



## Instructions

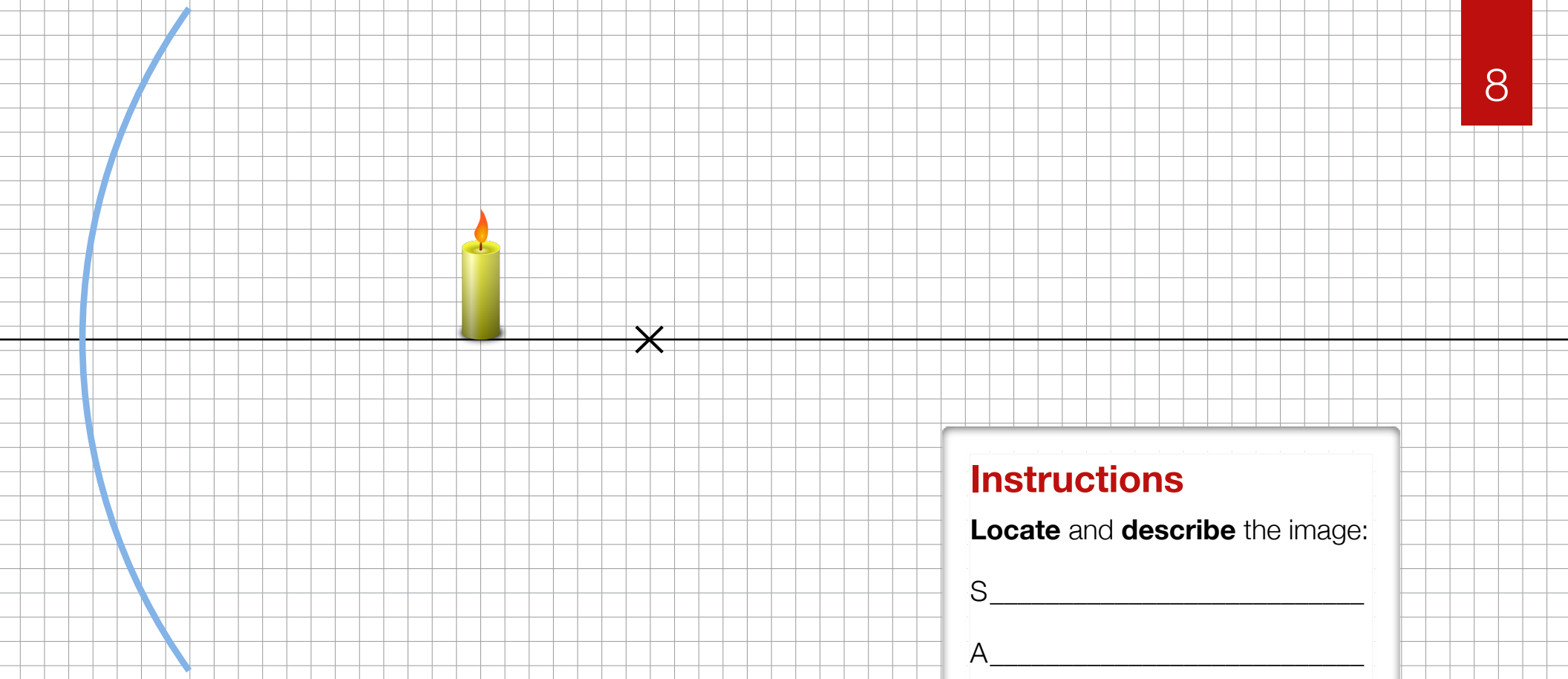
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

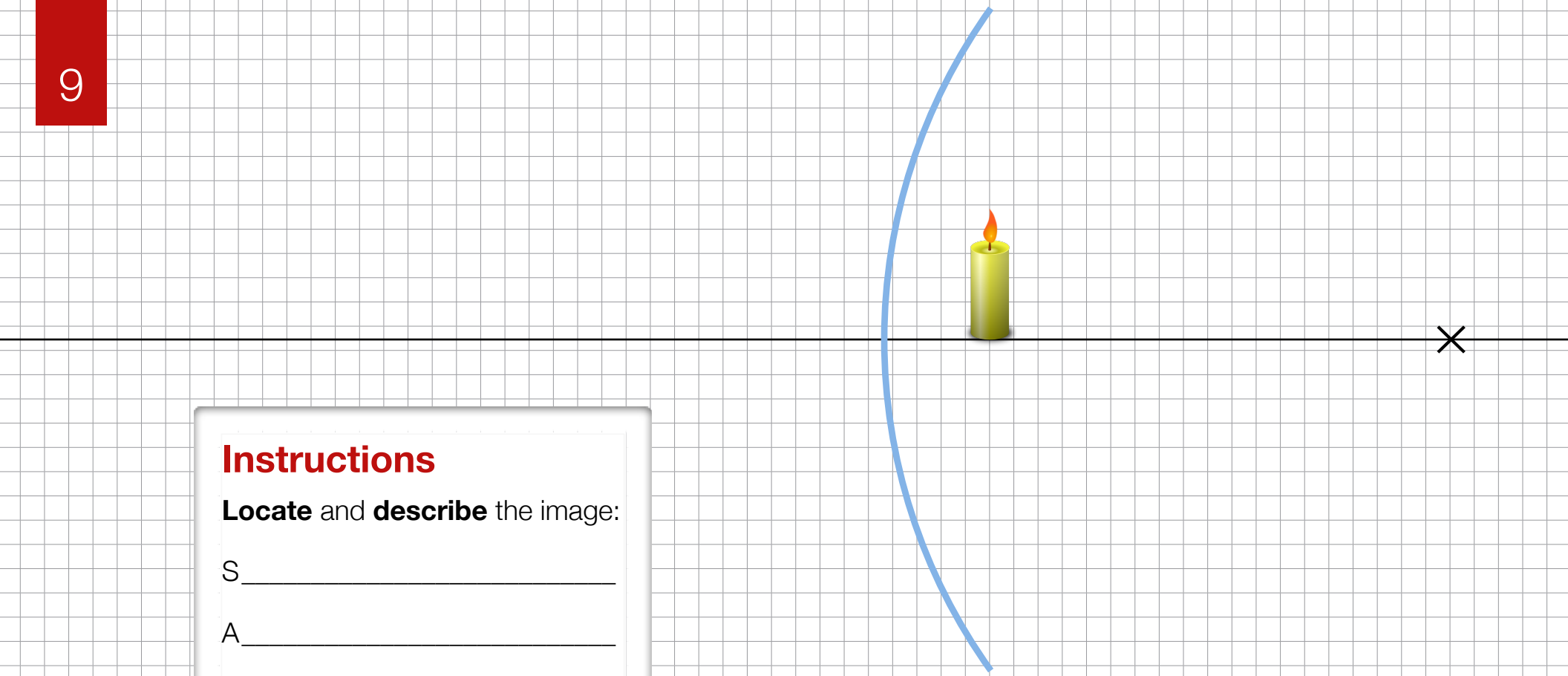
S _____

A _____

L _____

T _____

9



## Instructions

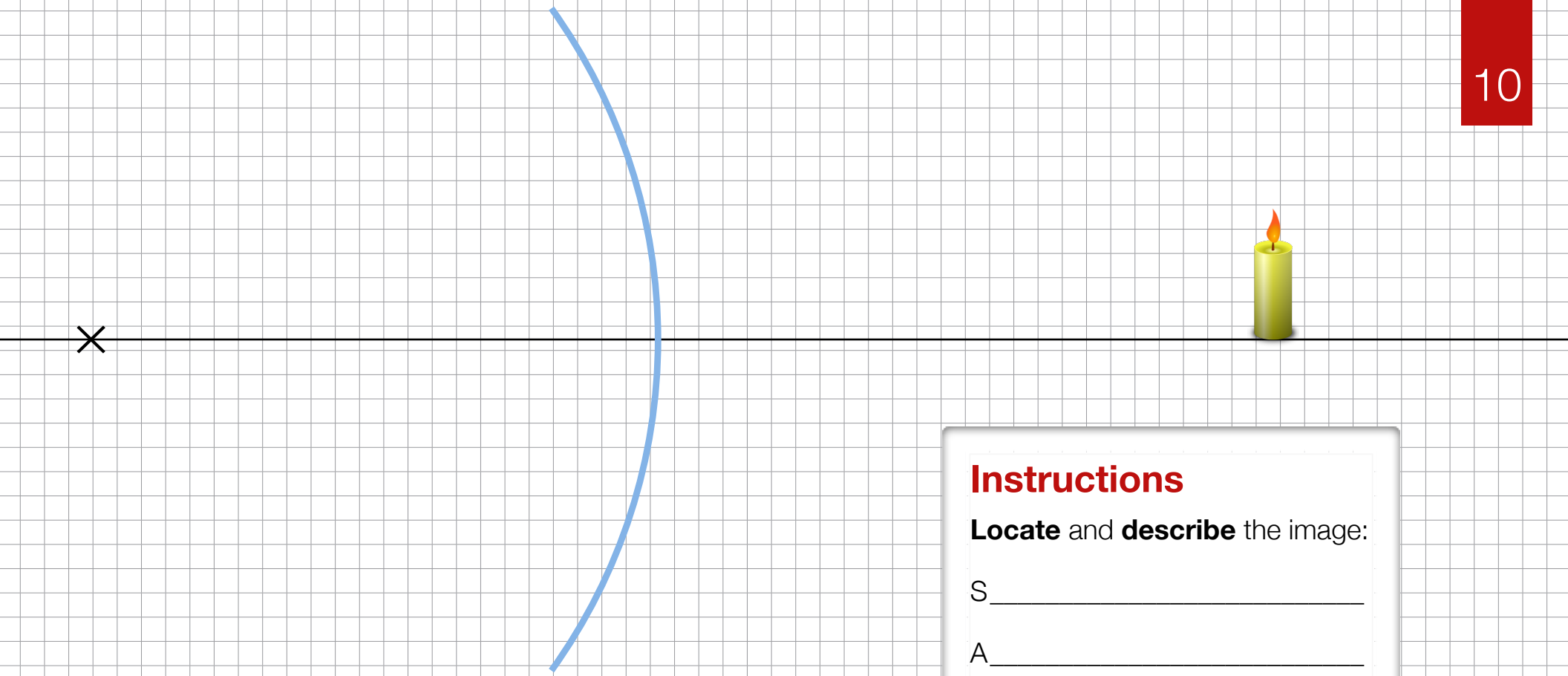
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

S _____

A _____

L _____

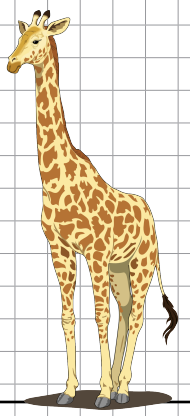
T _____

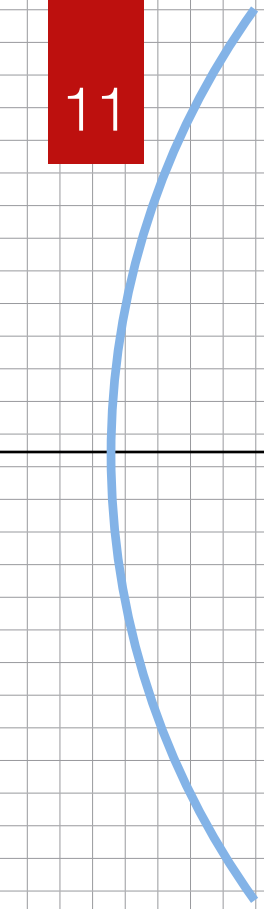
11

## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex

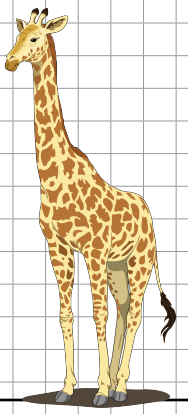




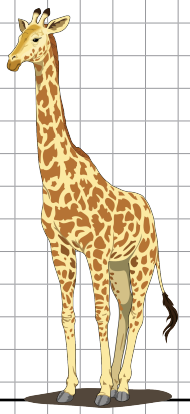
## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex



13



## Instructions

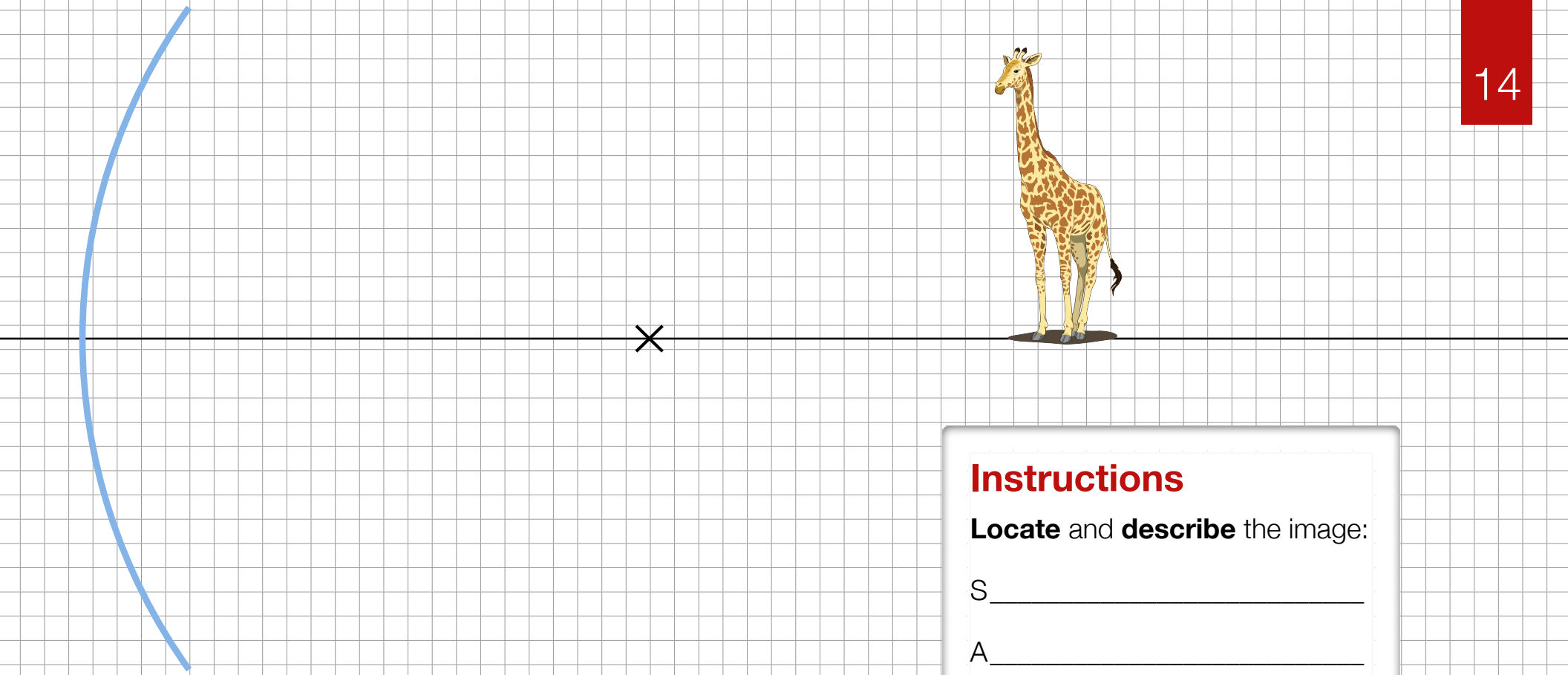
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

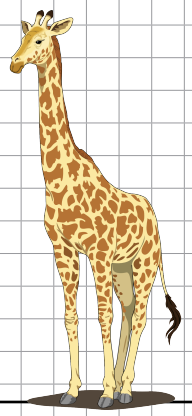
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

S _____

A _____

L _____

T _____

## Instructions

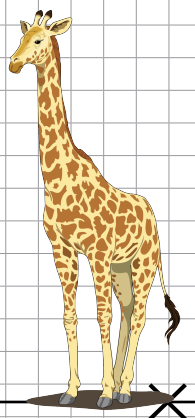
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

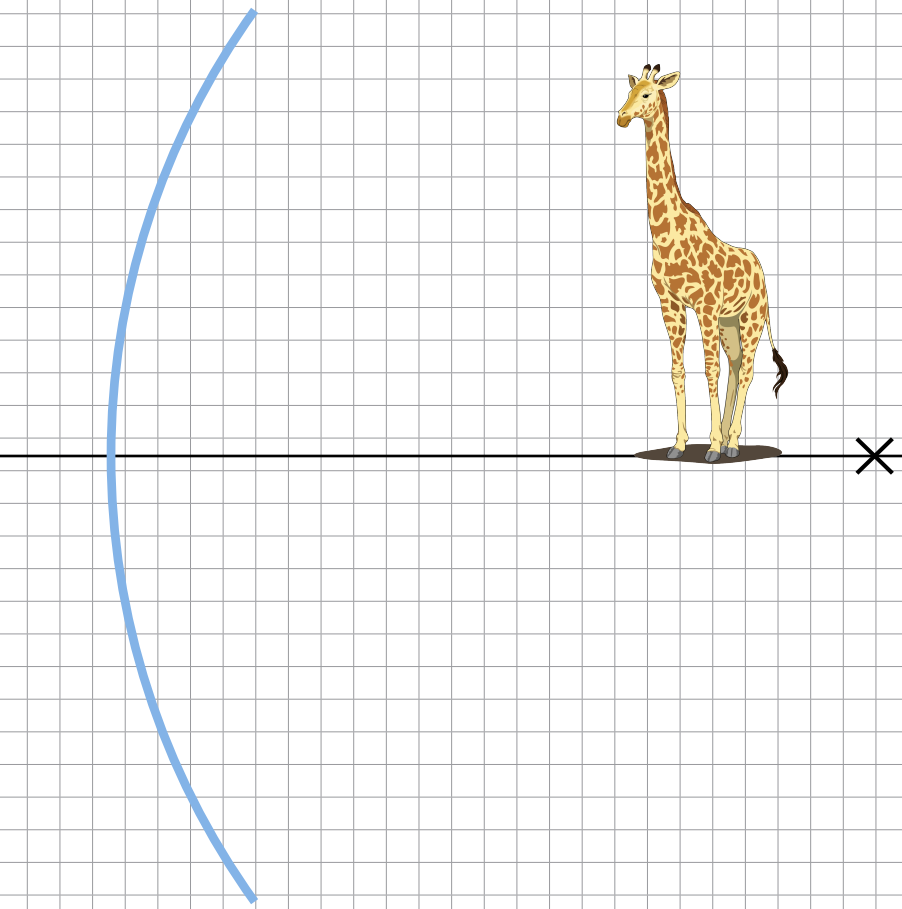
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

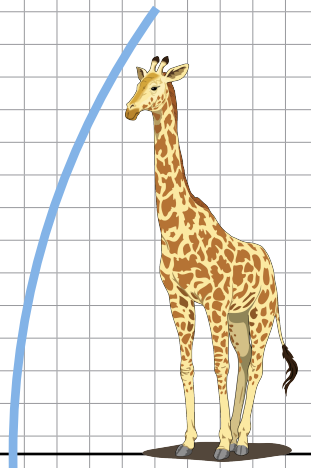
S _____

A _____

L _____

T _____

19



## Instructions

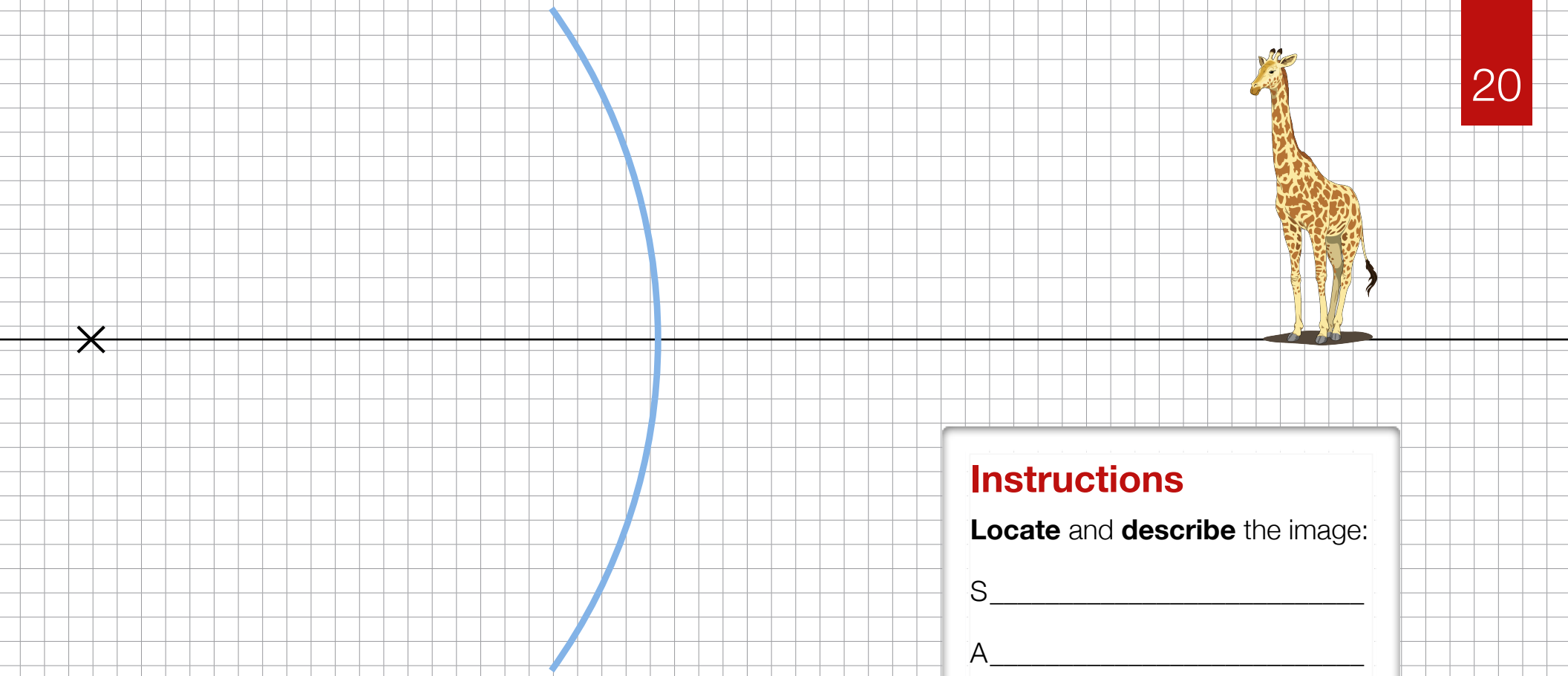
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____





## Instructions

**Locate** and **describe** the image:

S _____

A _____

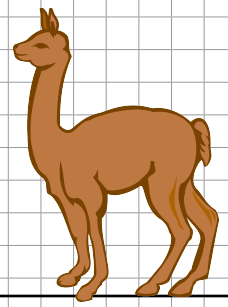
L _____

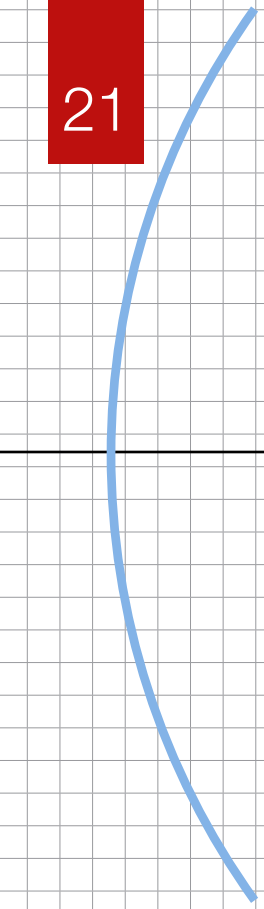
T _____

## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex



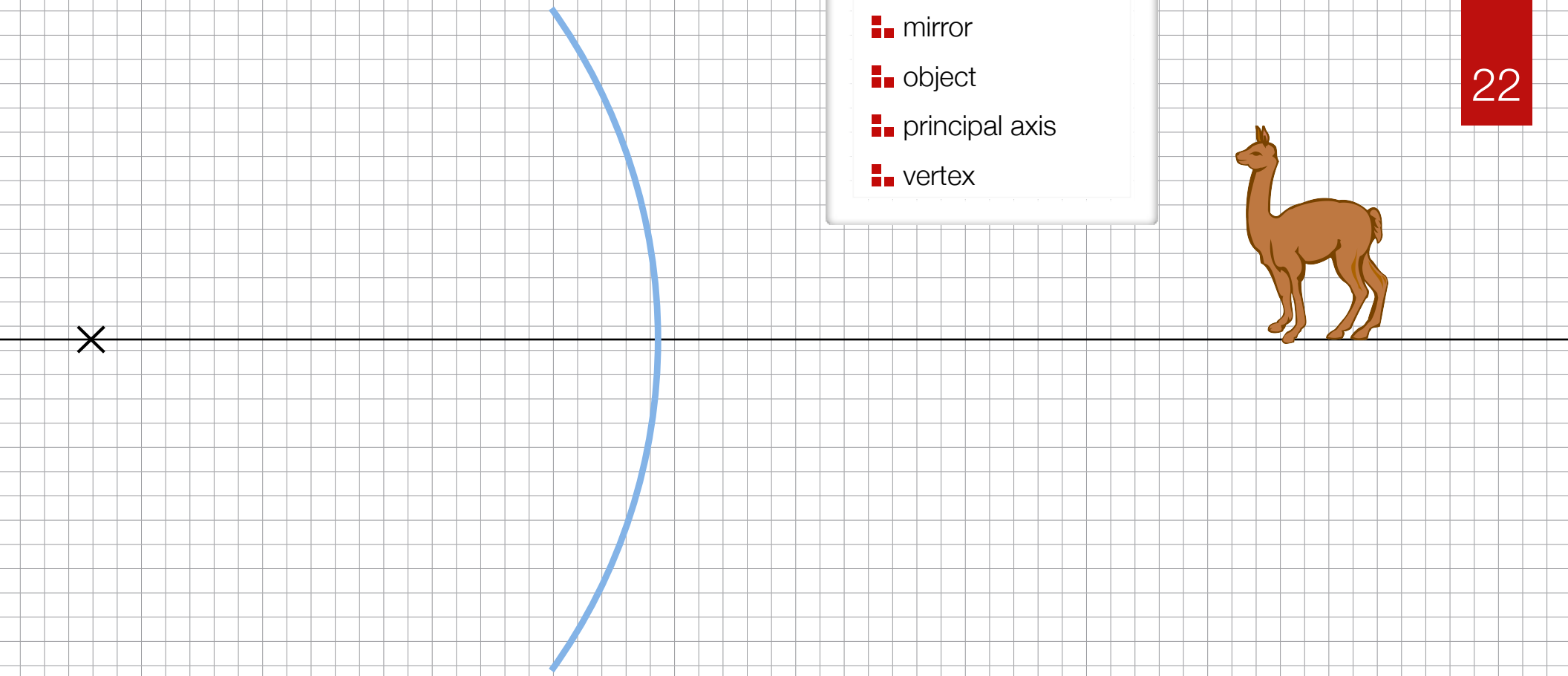


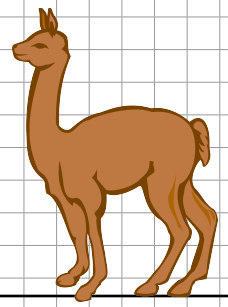
## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex







## Instructions

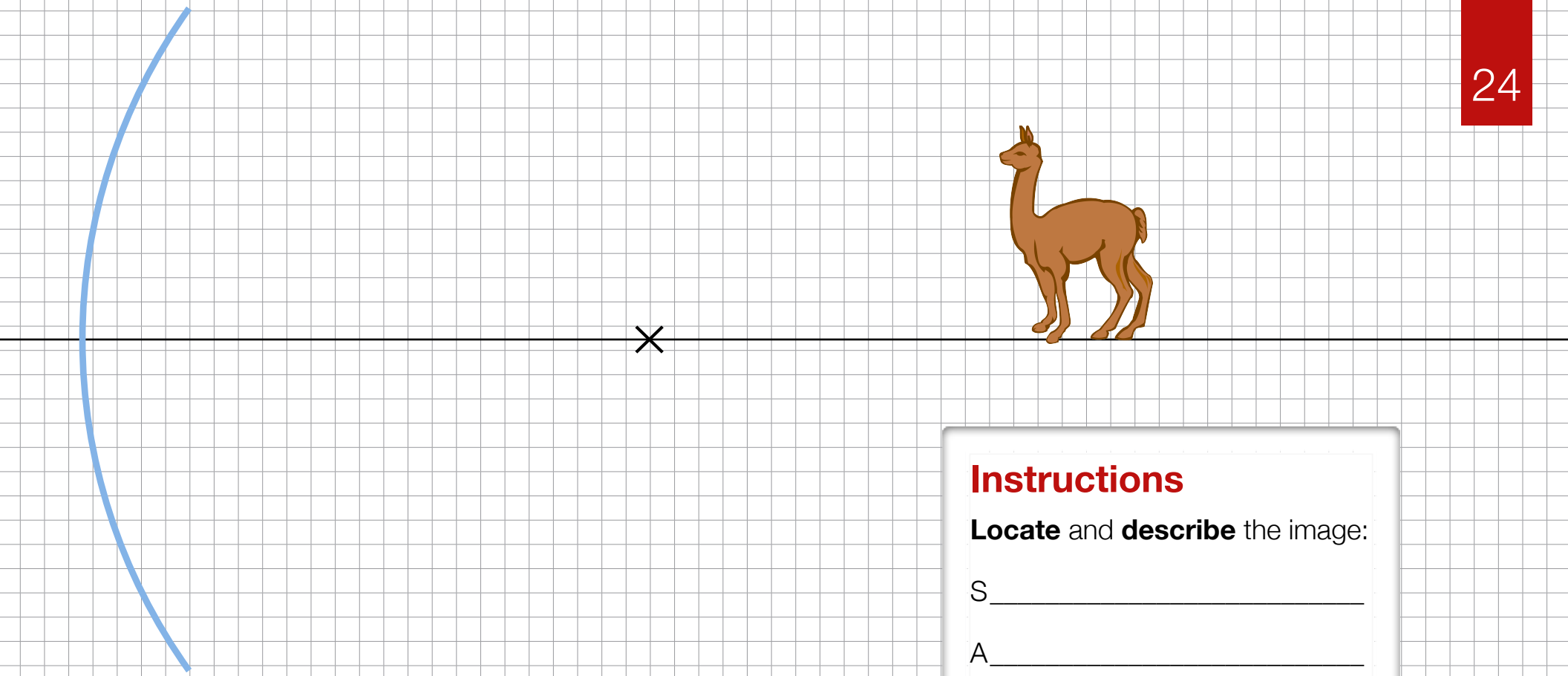
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

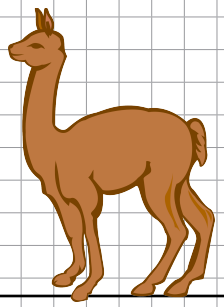
S _____

A _____

L _____

T _____

25



## Instructions

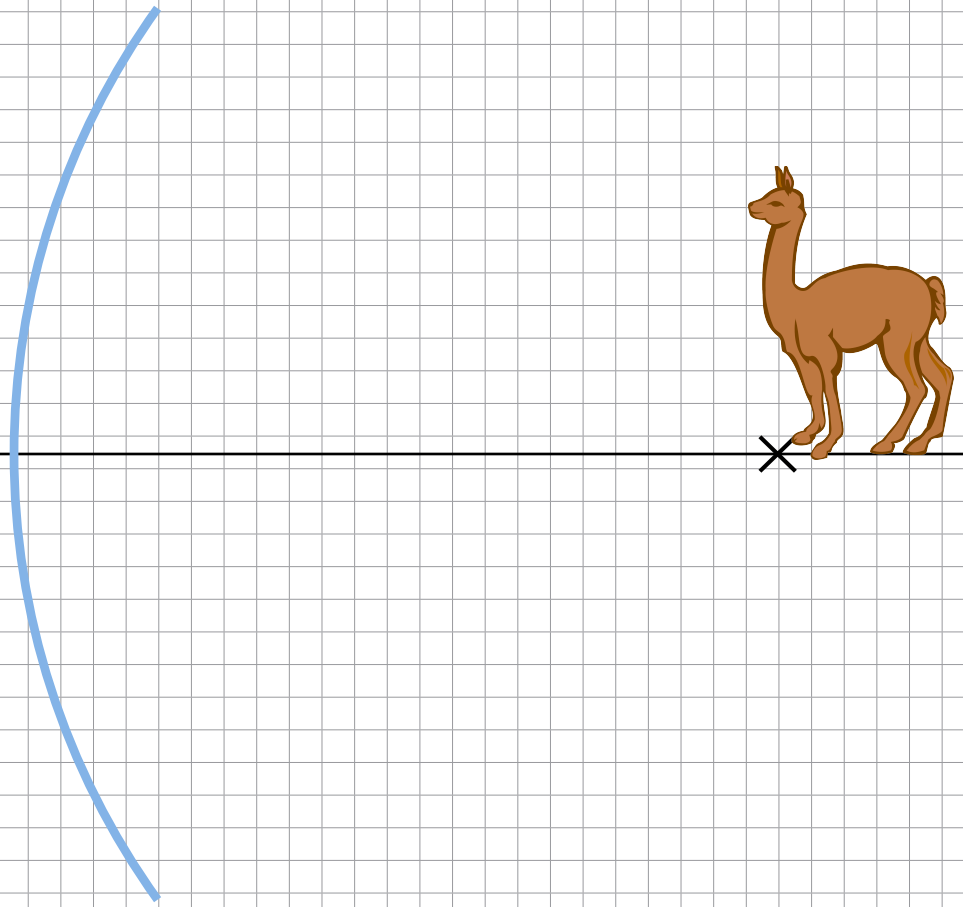
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

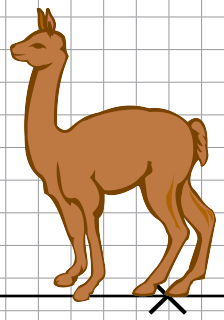
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

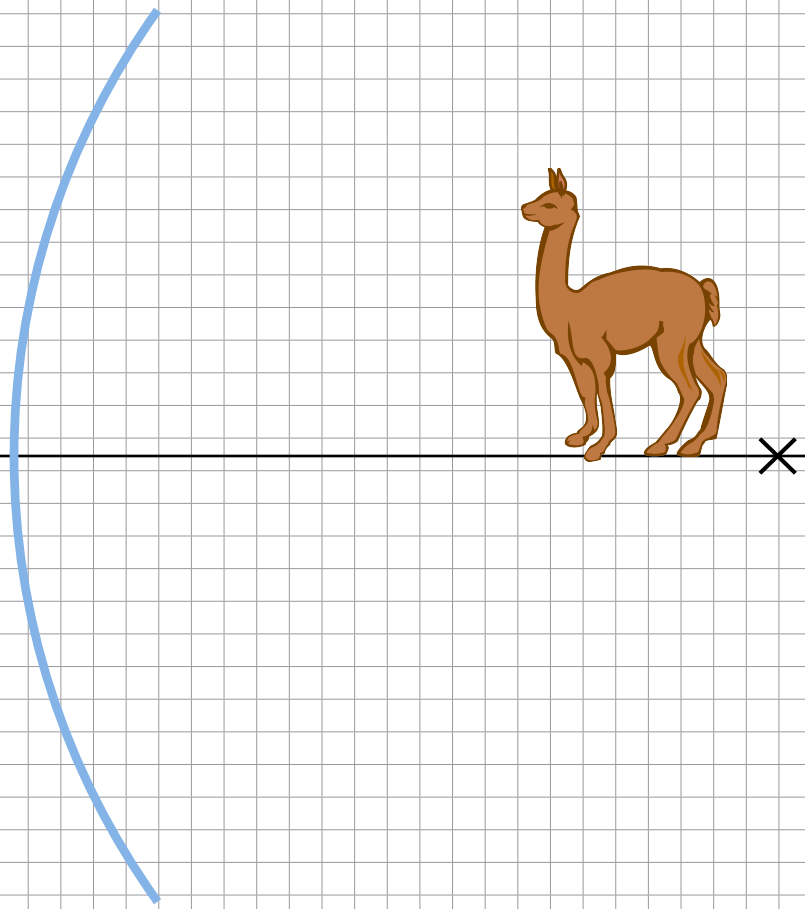
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

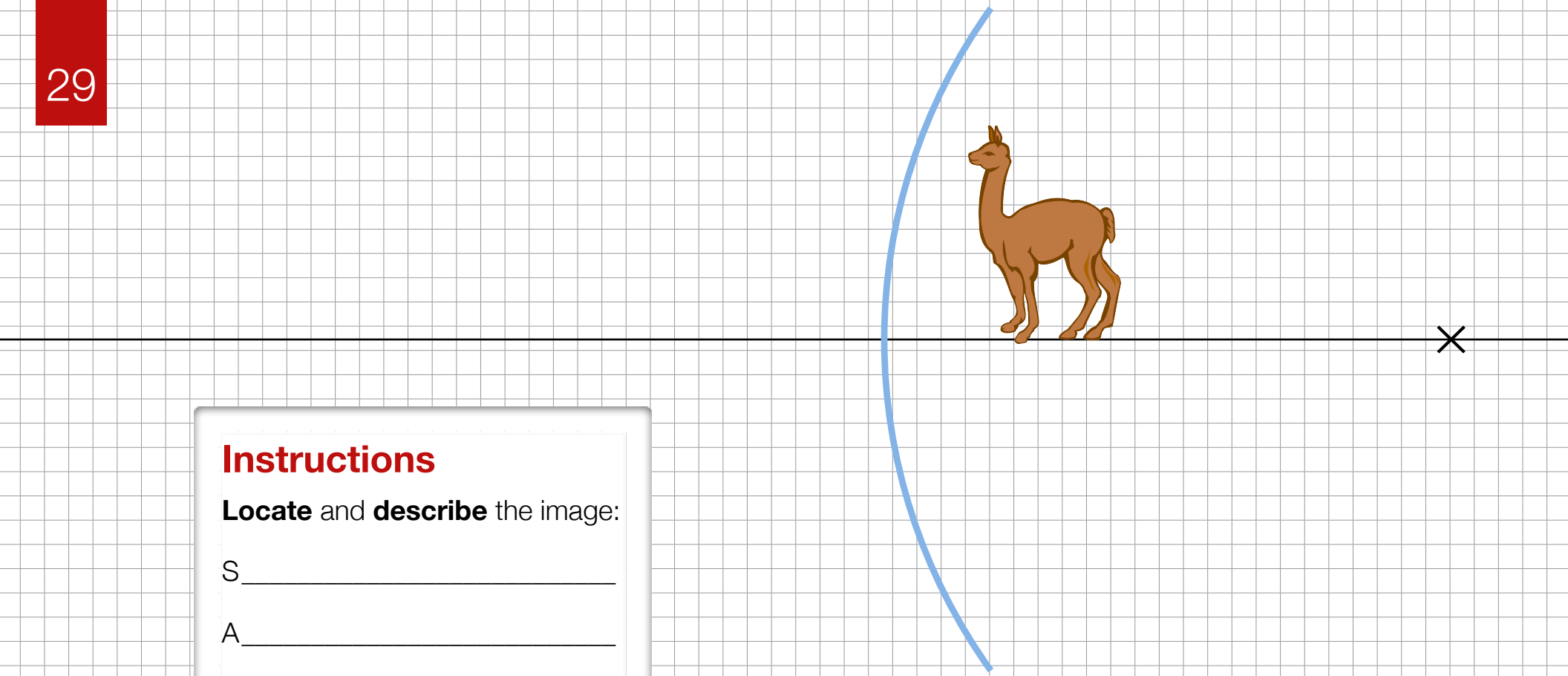
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

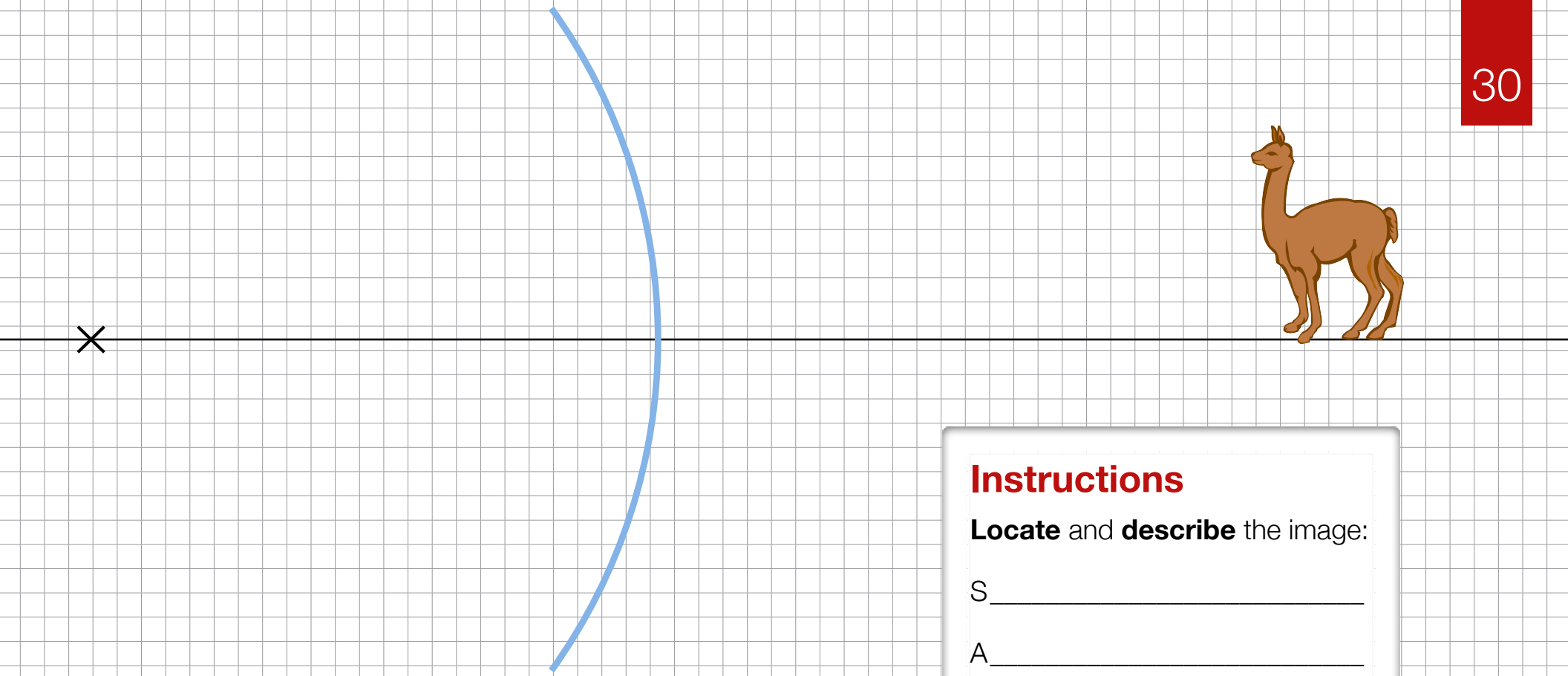
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____





## Instructions

**Locate** and **describe** the image:

S _____

A _____

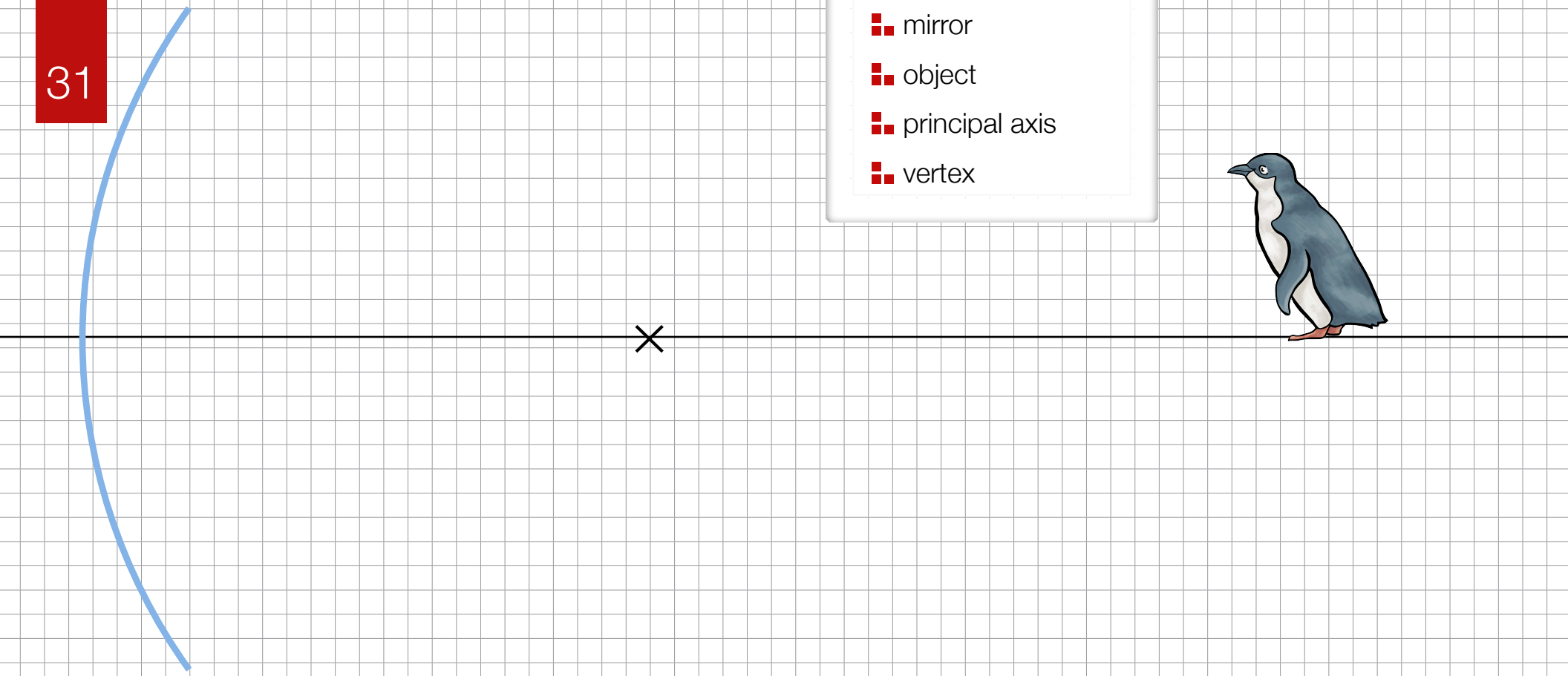
L _____

T _____

## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex

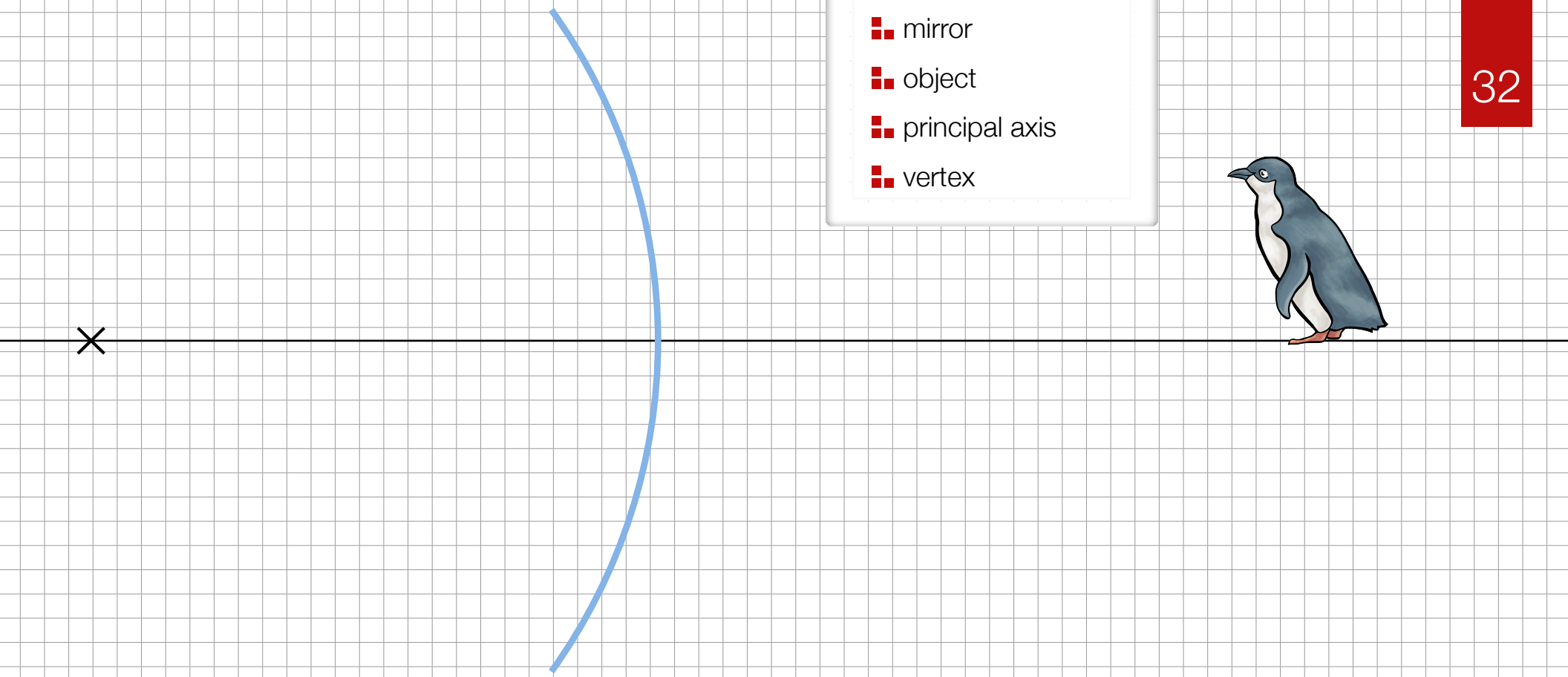


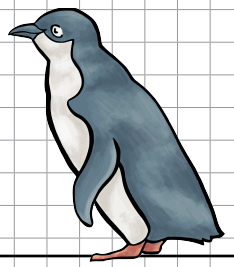
## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex







## Instructions

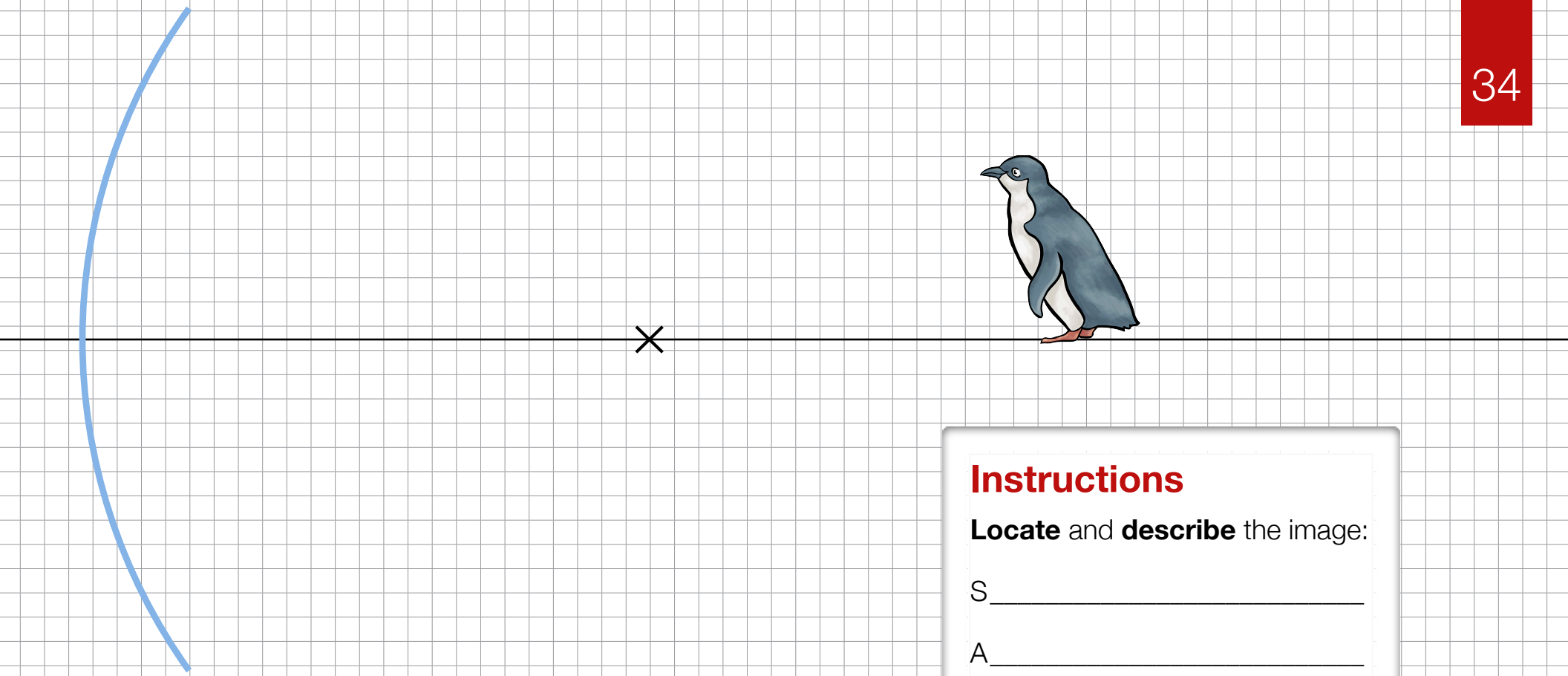
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

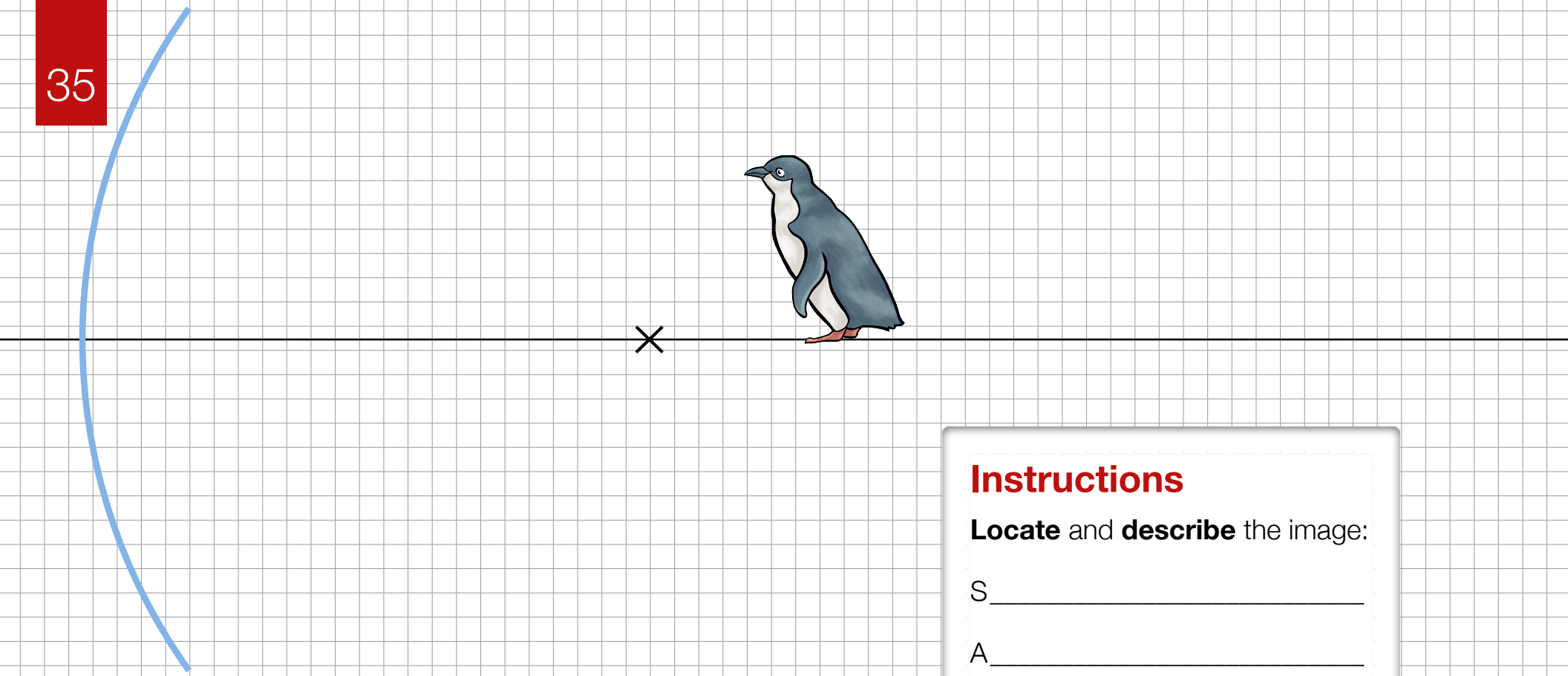
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

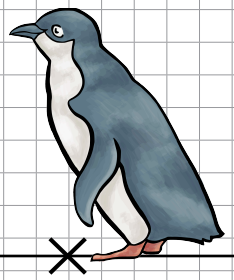
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

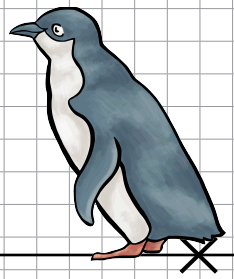
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

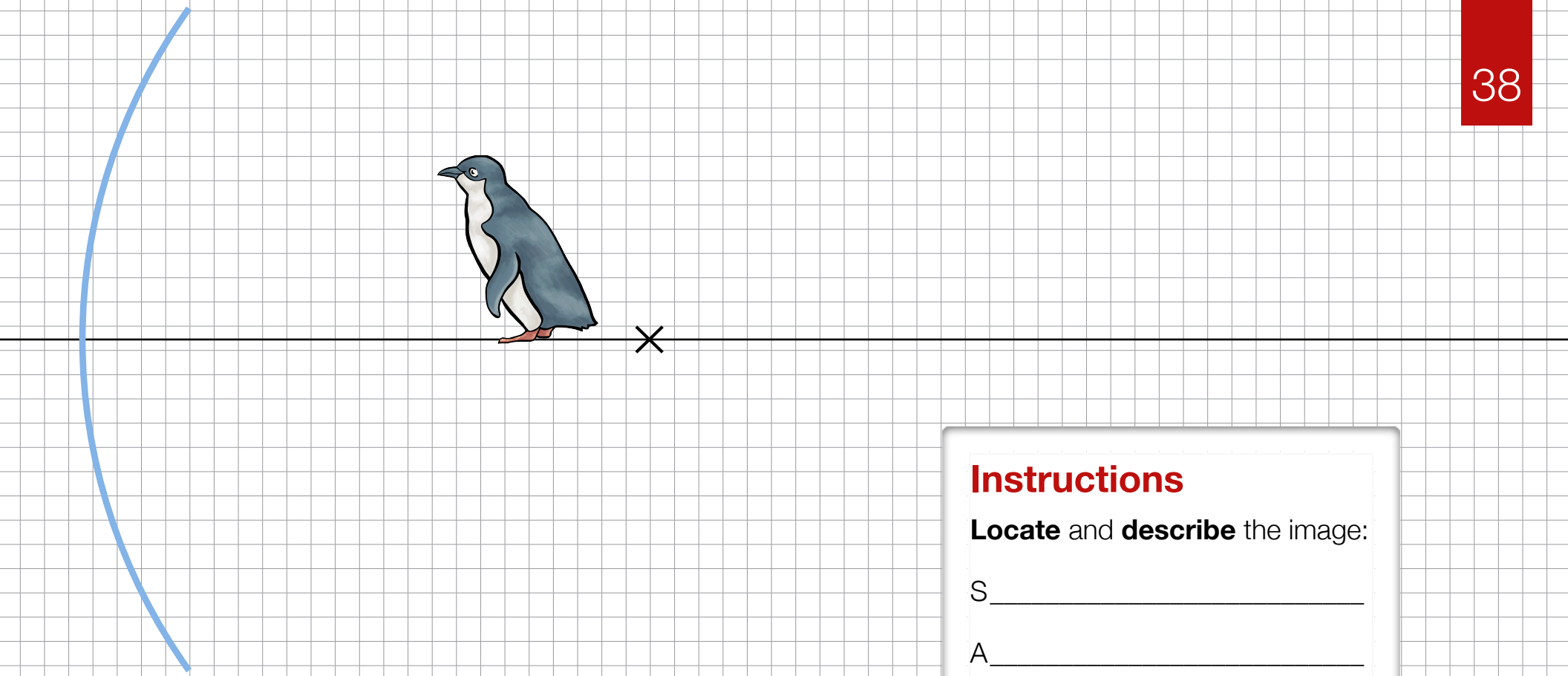
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

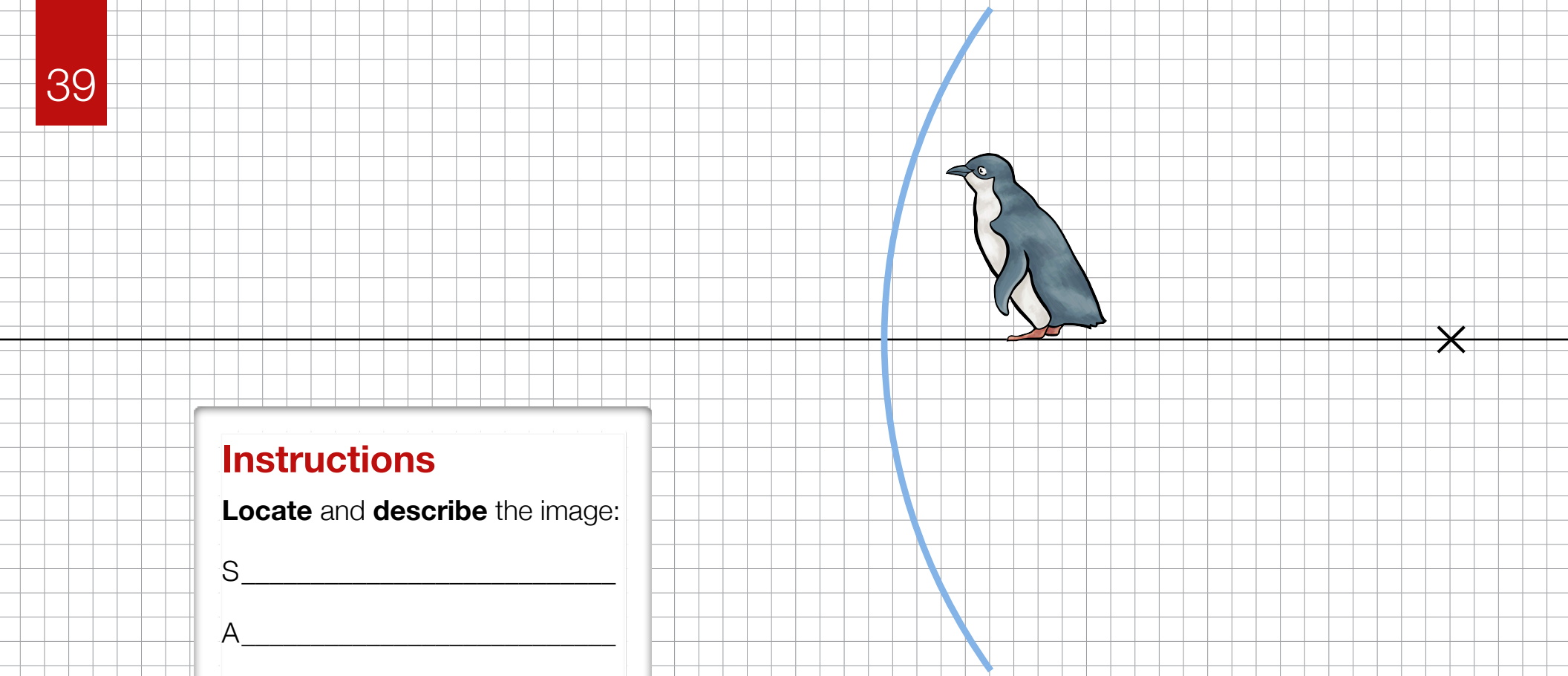
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

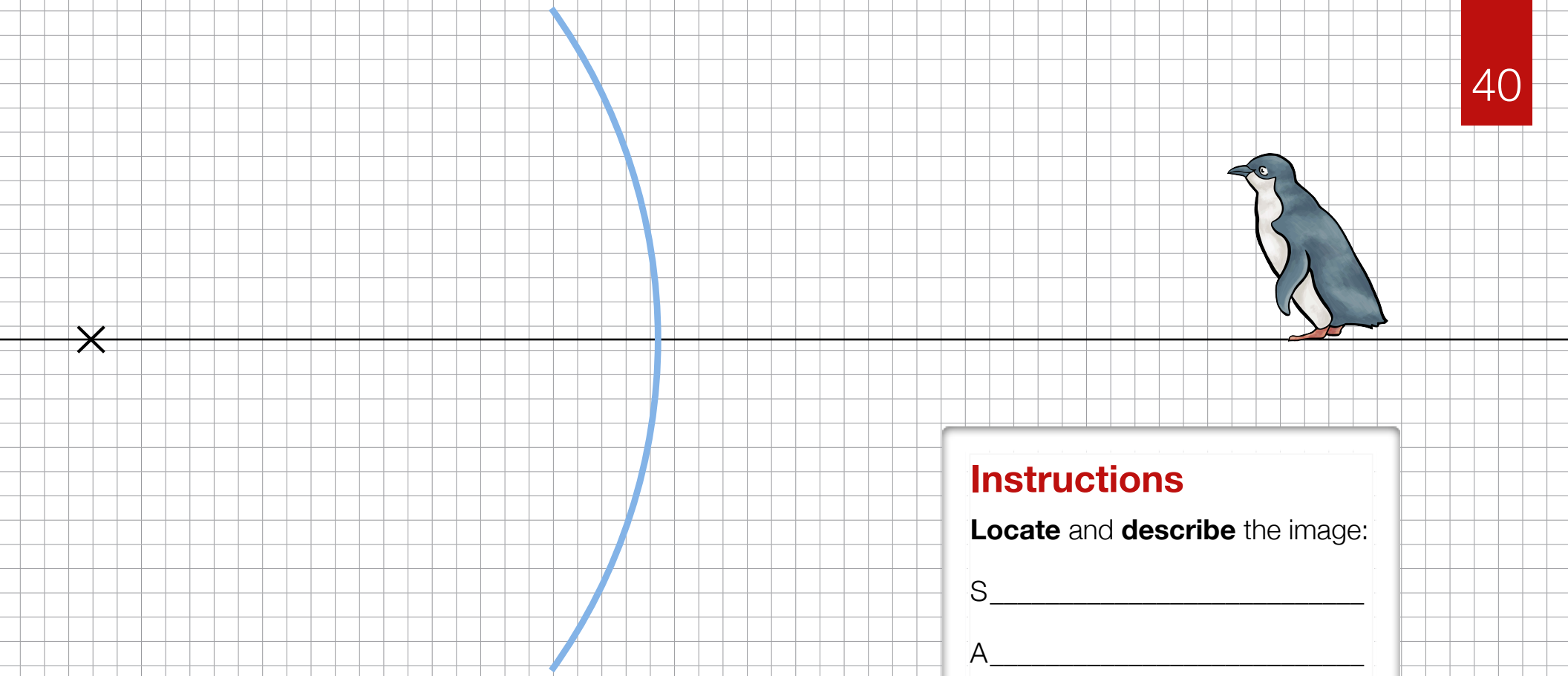
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

S _____

A _____

L _____

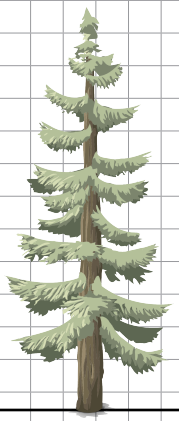
T _____

41

## Instructions

Label the following:

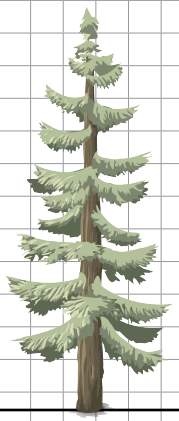
- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex

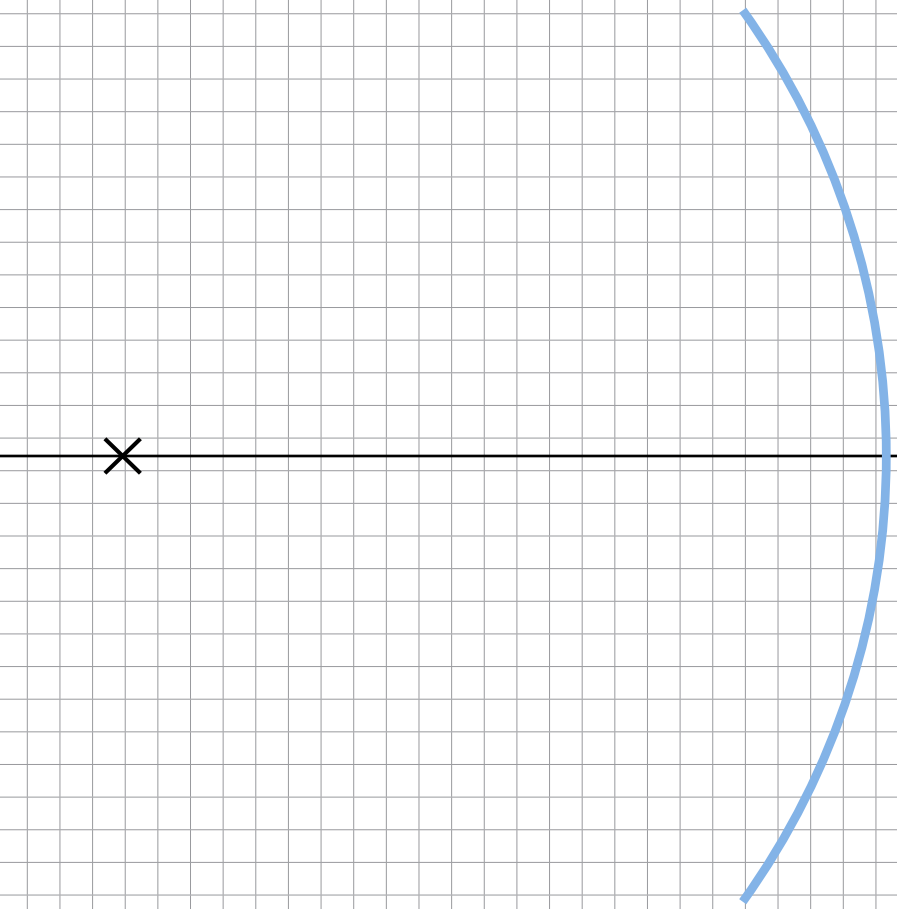


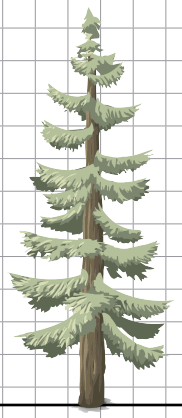
## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex







## Instructions

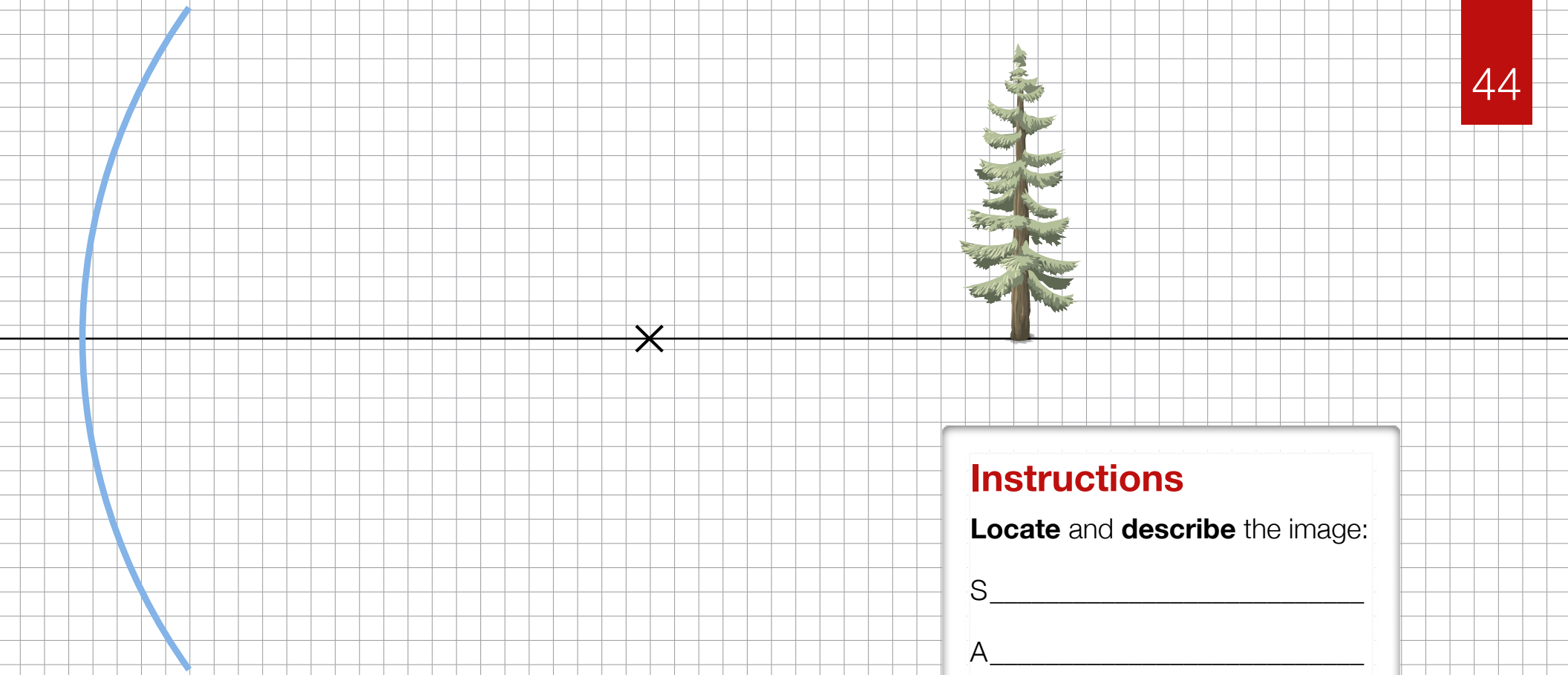
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

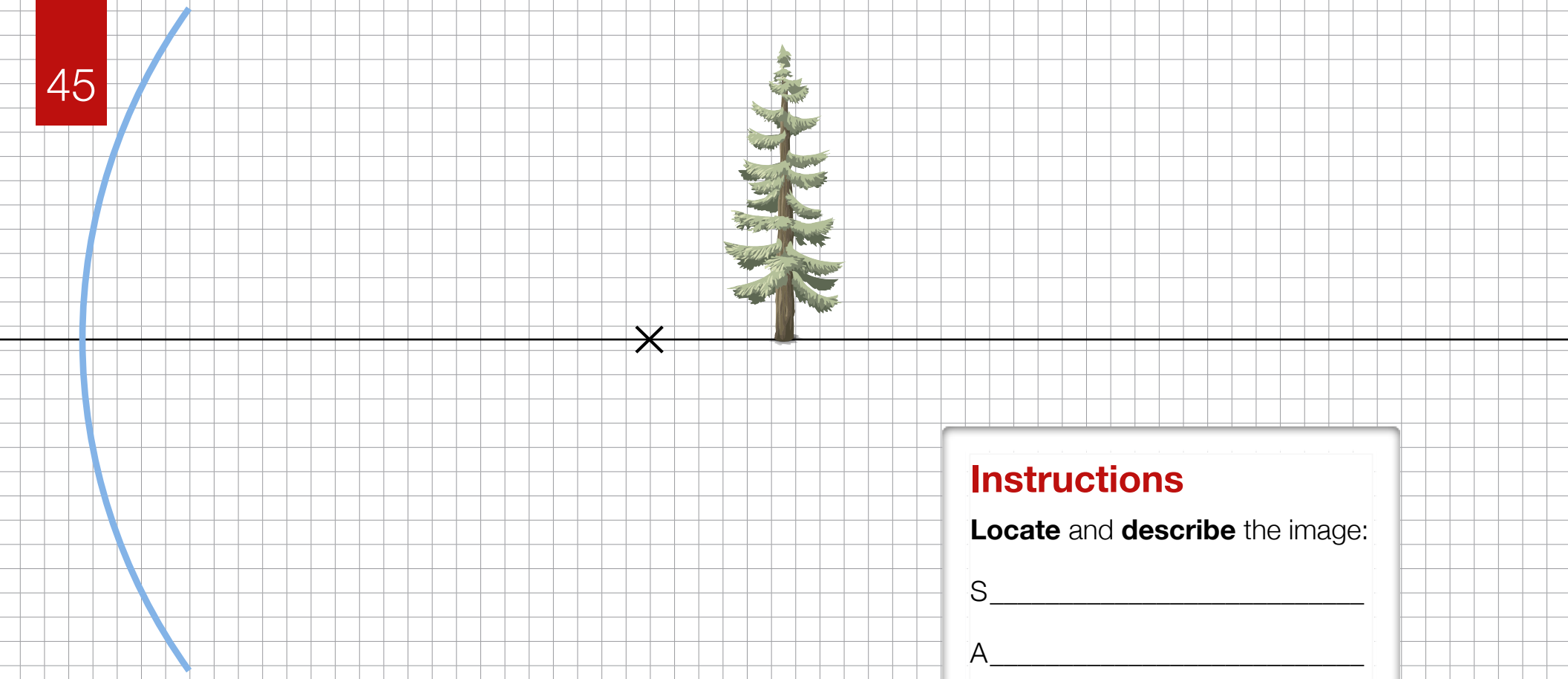
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

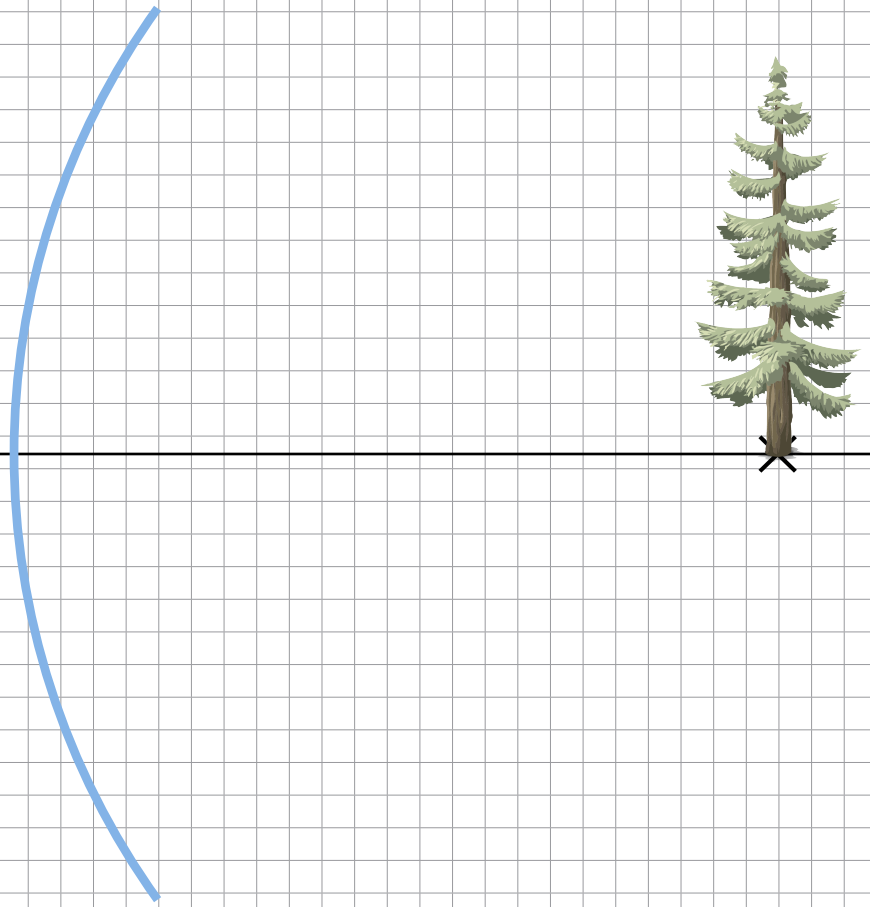
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

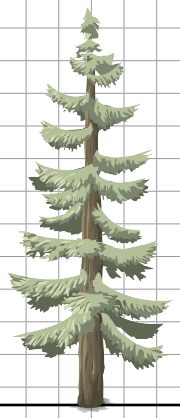
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

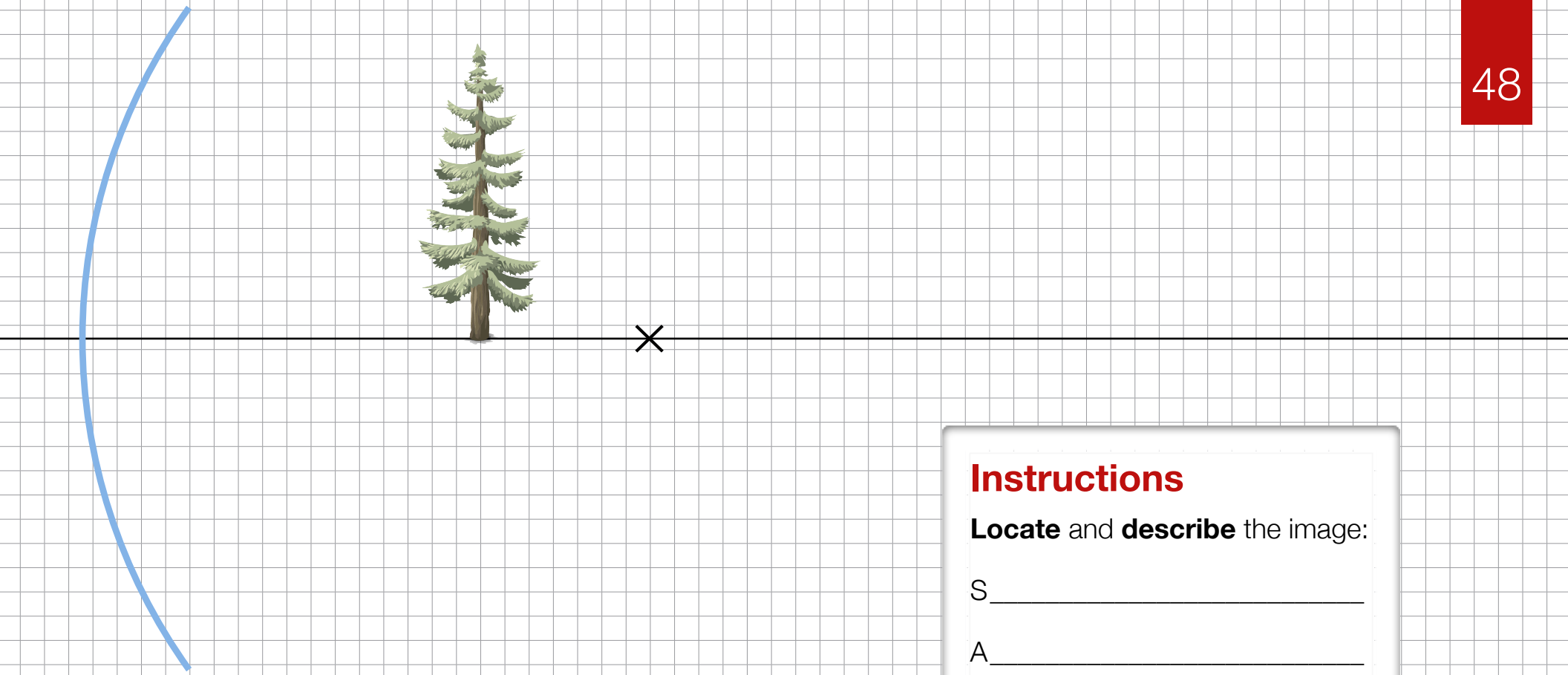
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

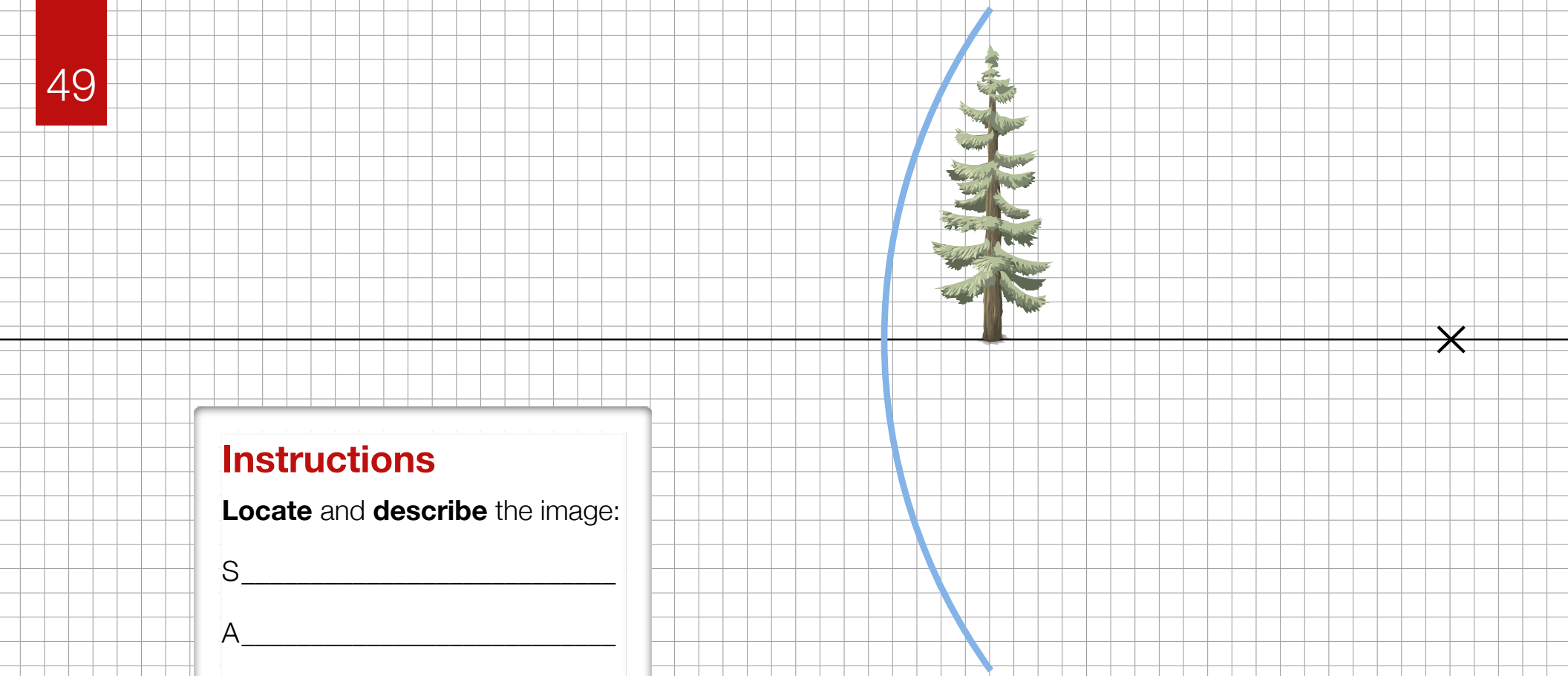
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

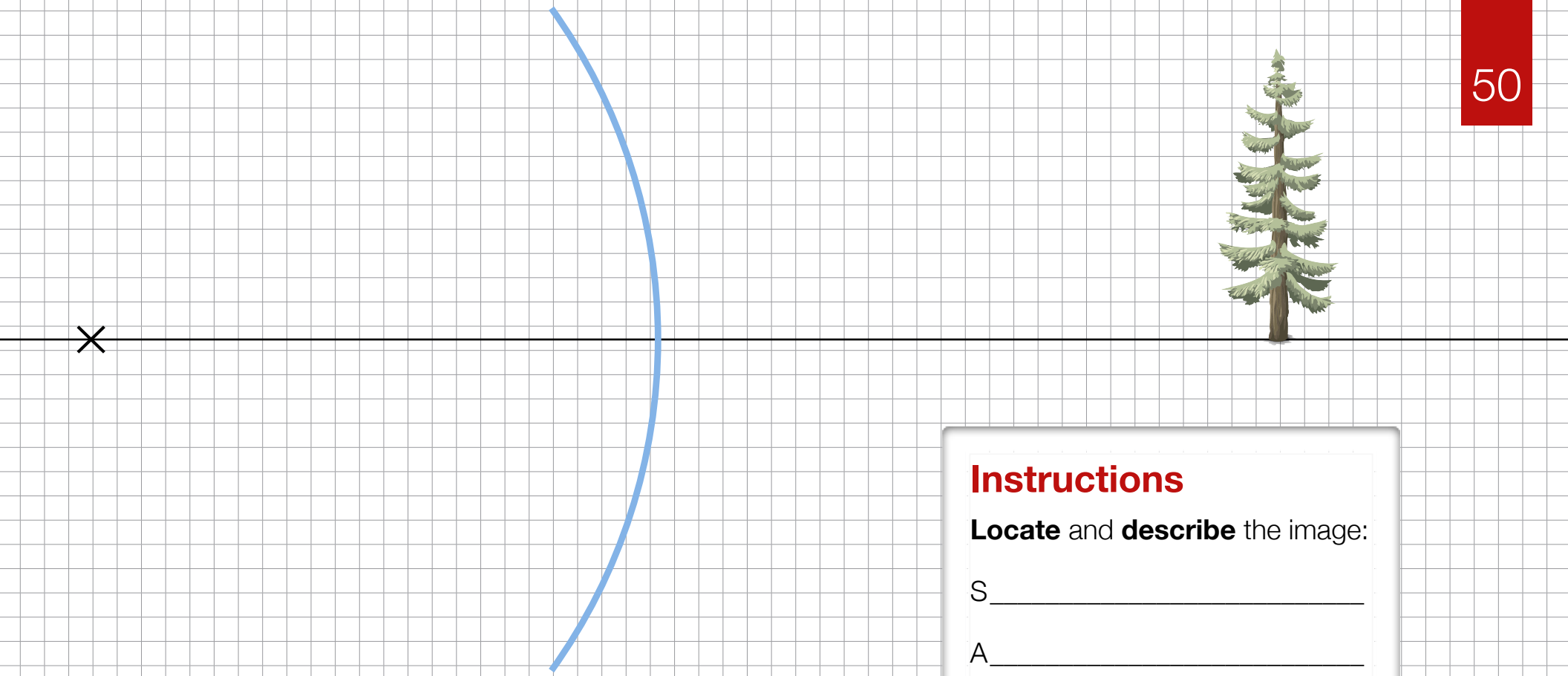
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

S _____

A _____

L _____

T _____

## Instructions

Label the following:

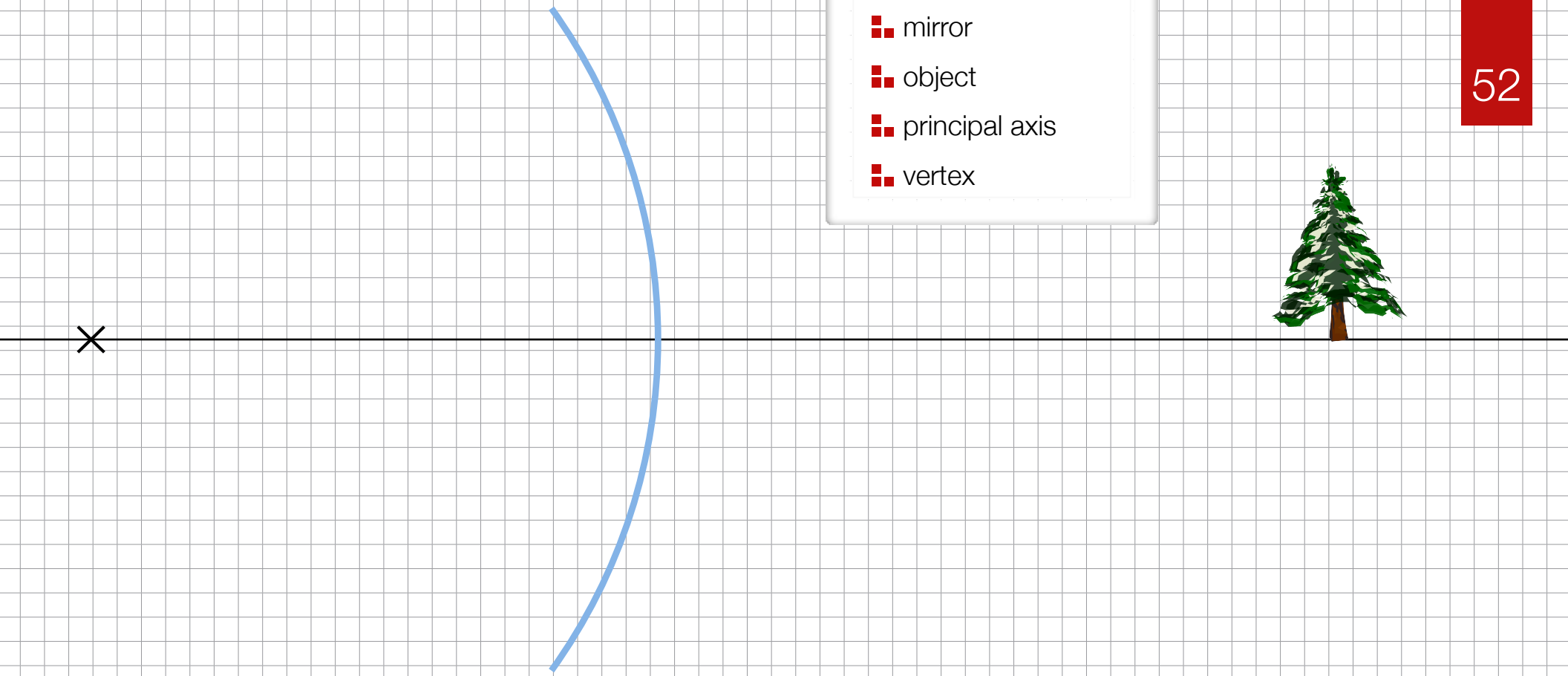
- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex

## Instructions

Label the following:

- centre of curvature
- focus
- mirror
- object
- principal axis
- vertex





## Instructions

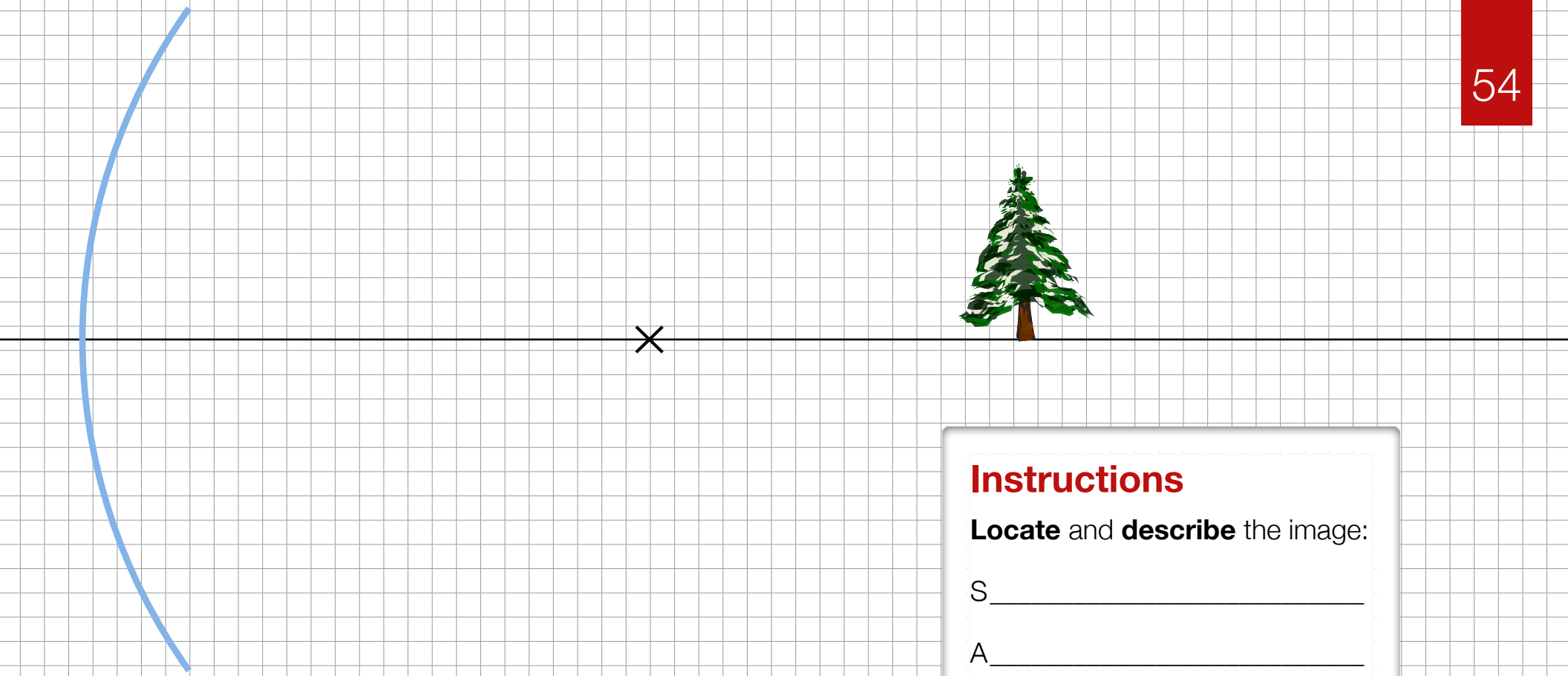
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

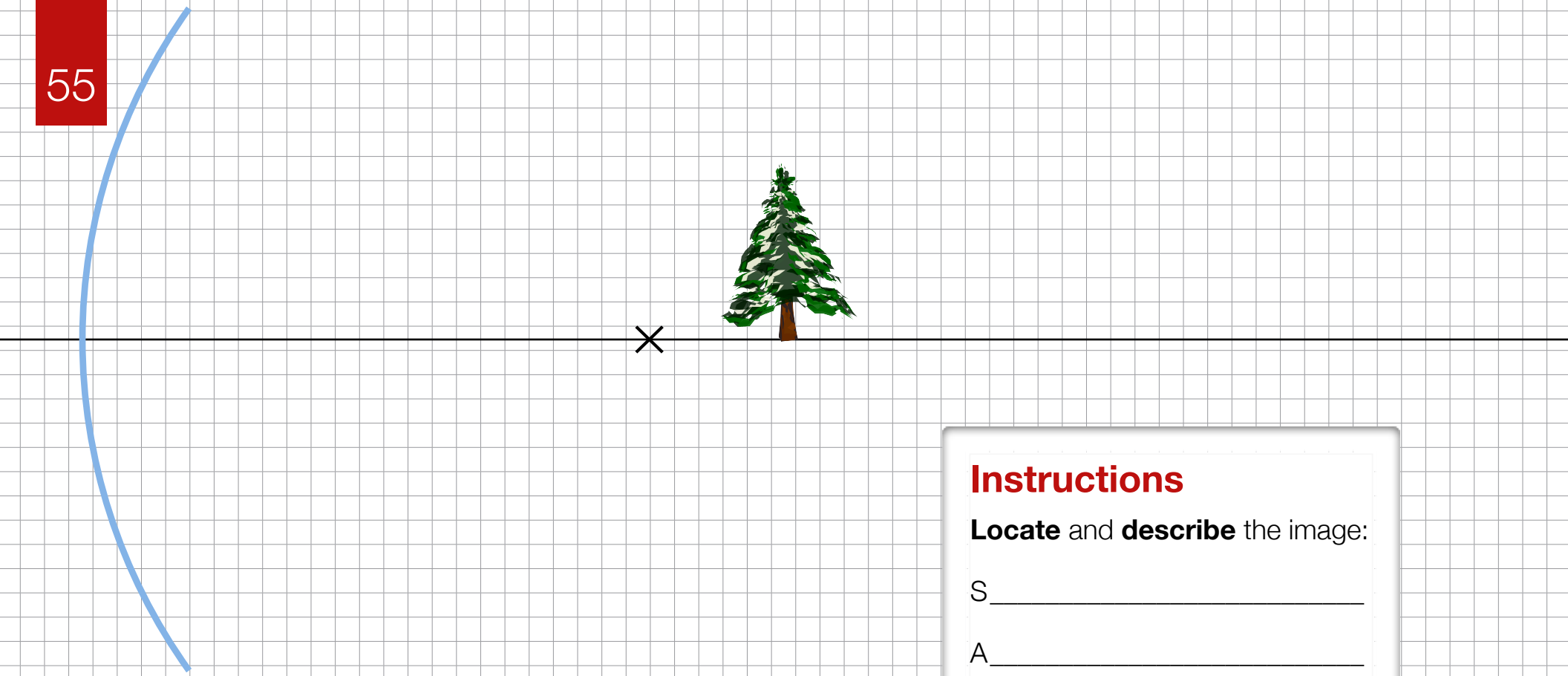
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

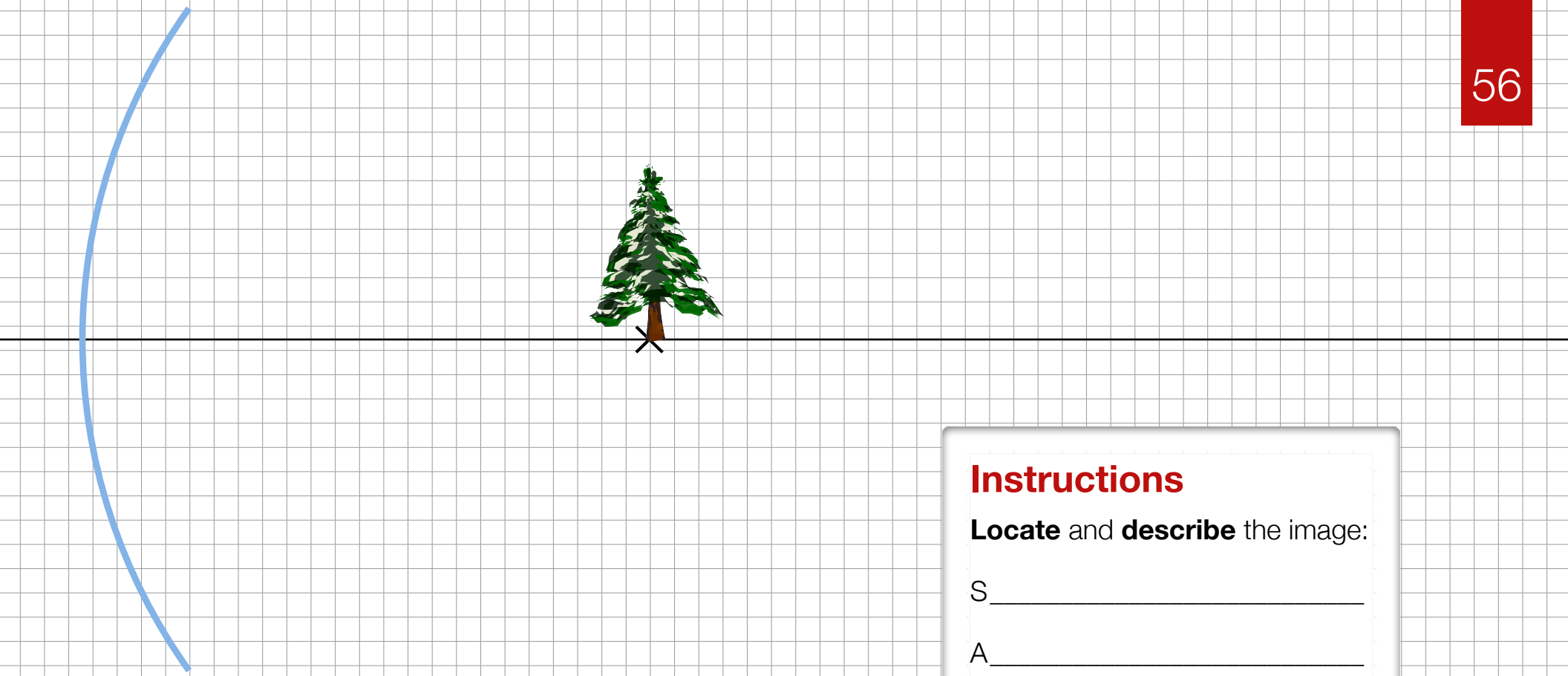
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

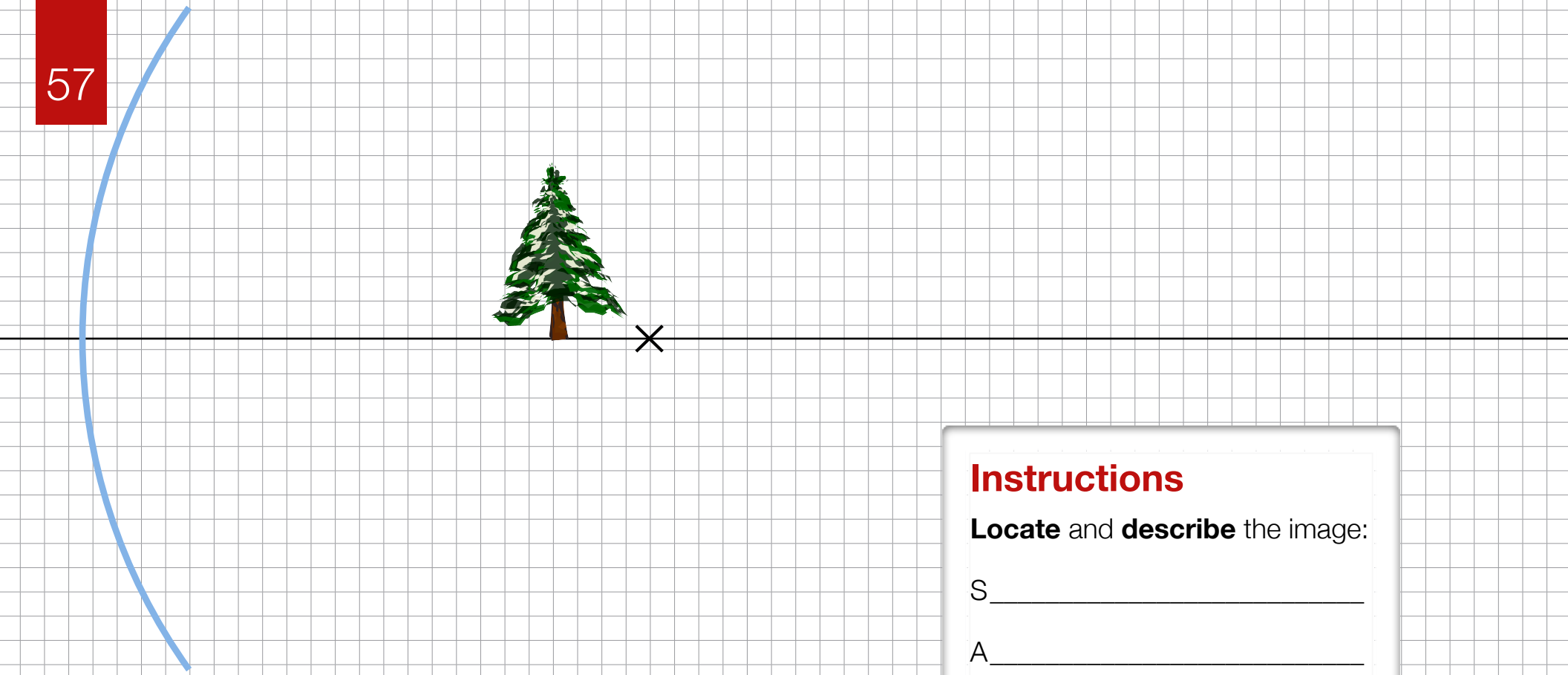
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

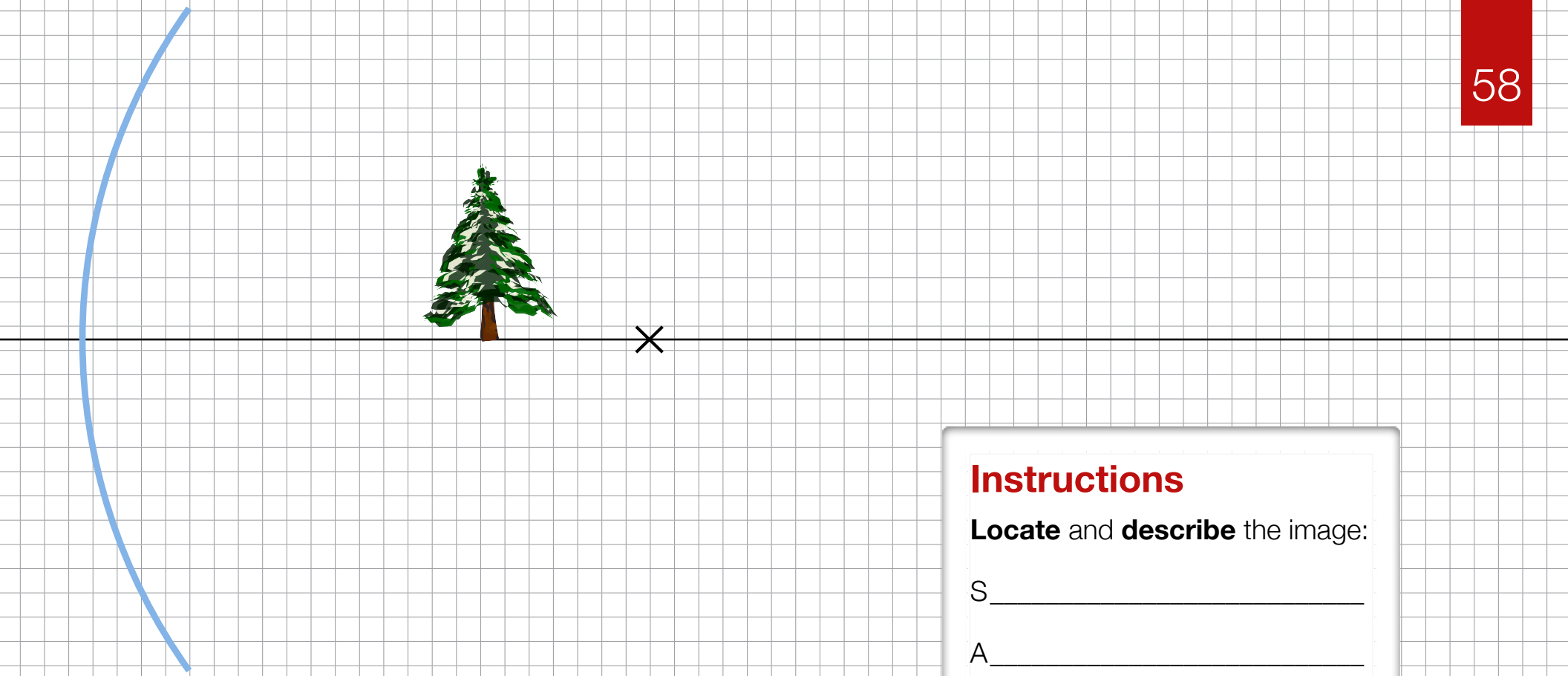
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

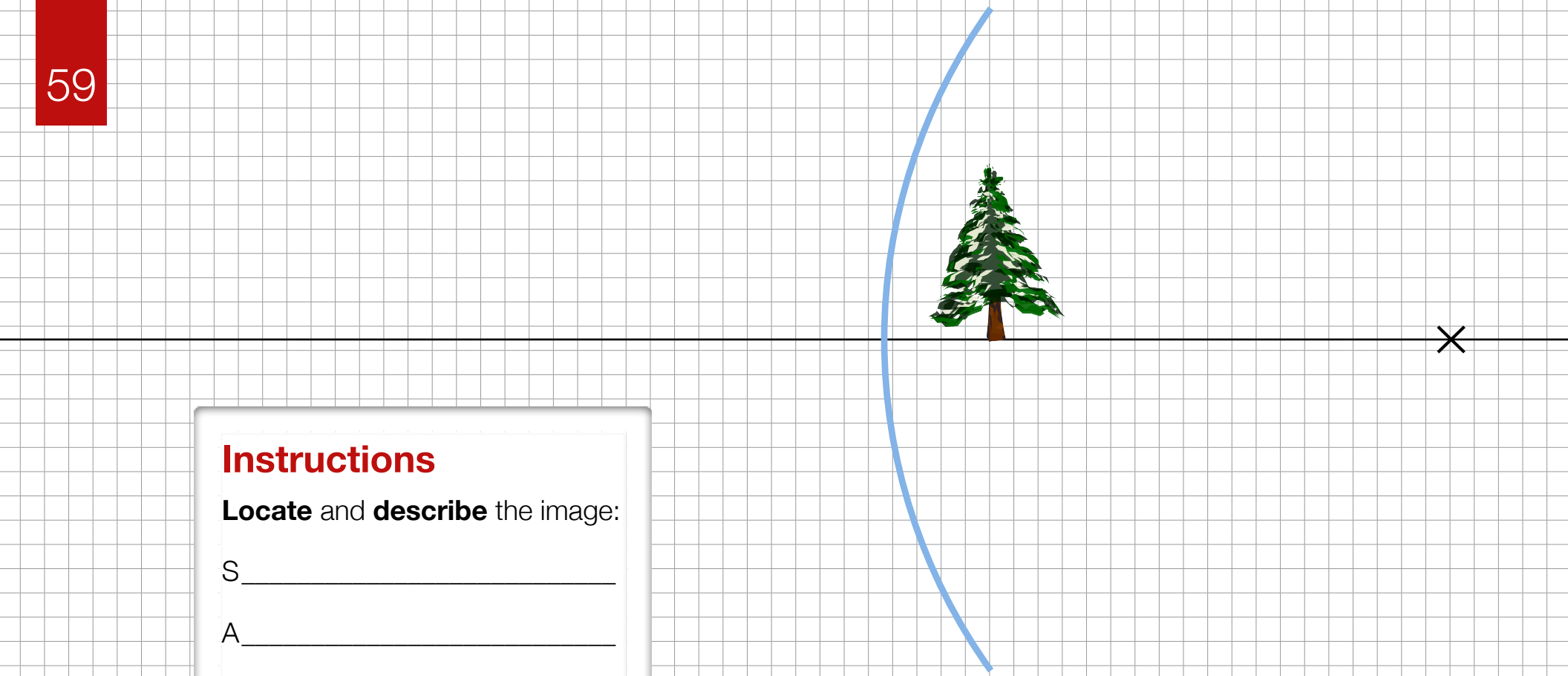
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

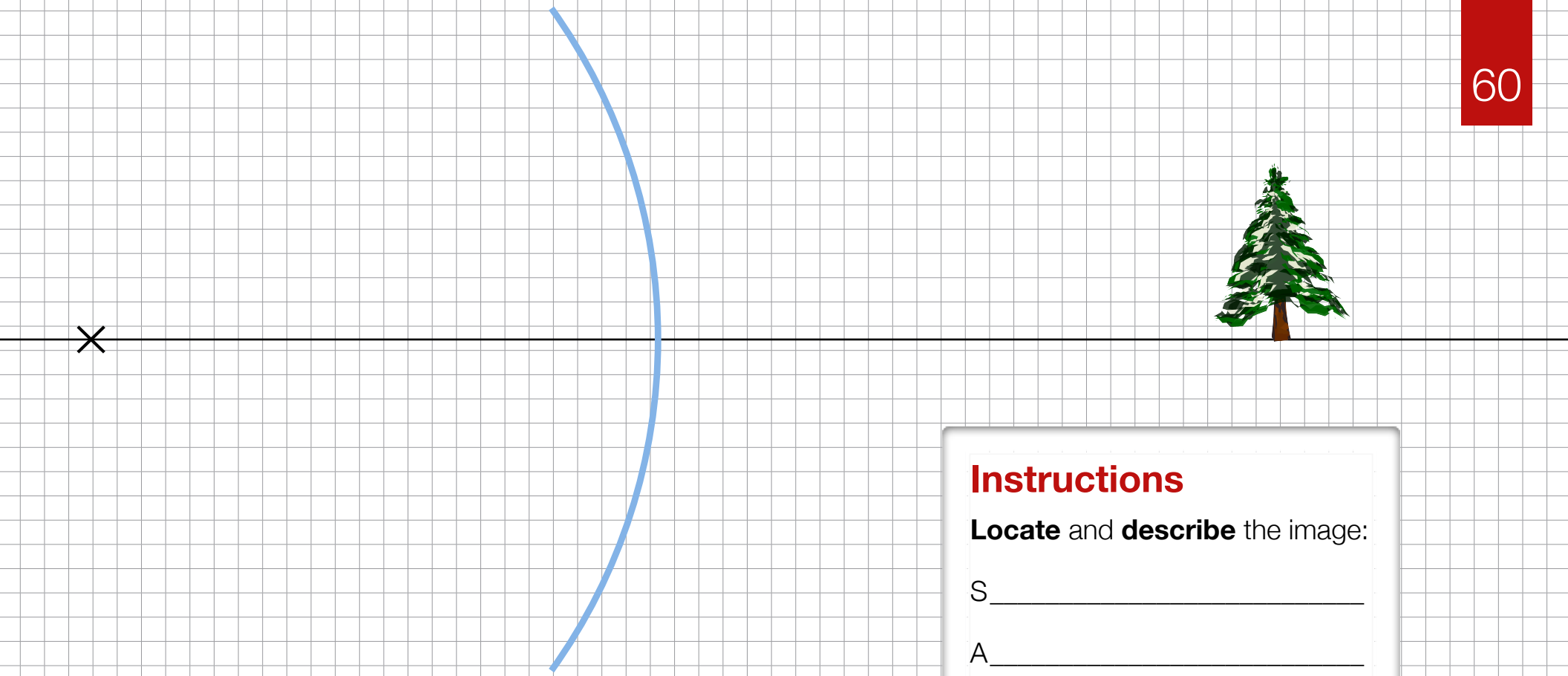
**Locate** and **describe** the image:

S _____

A _____

L _____

T _____



## Instructions

**Locate** and **describe** the image:

S _____

A _____

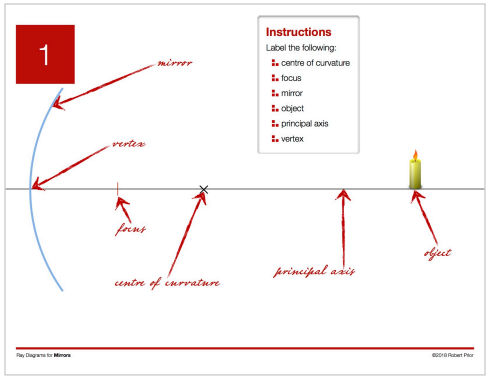
L _____

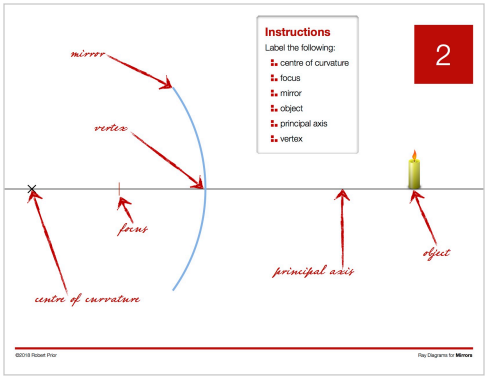
T _____

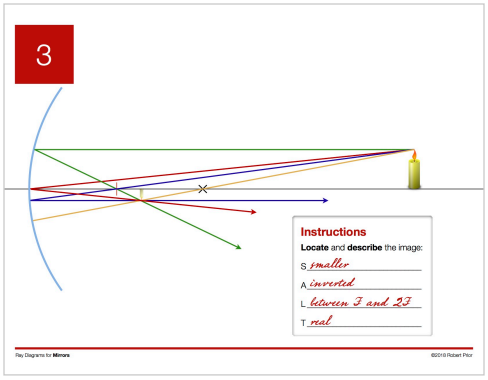
Physics

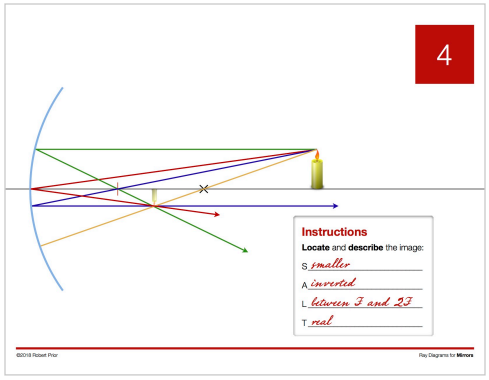
# Solutions

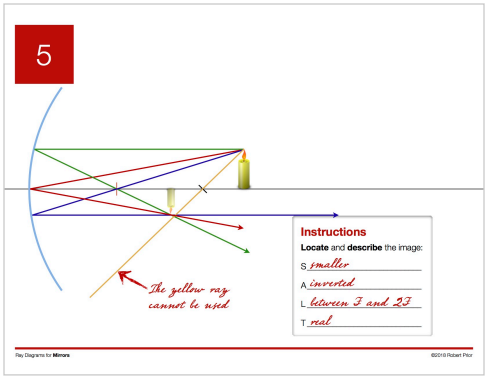
After you have finished some practice, check your answers.

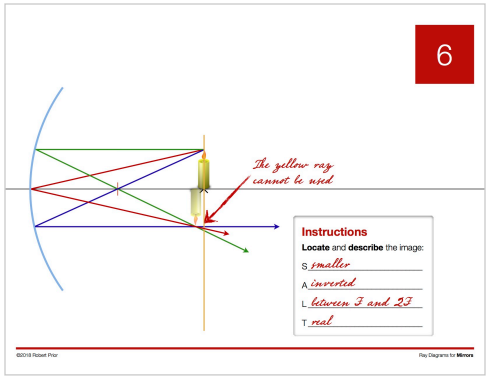


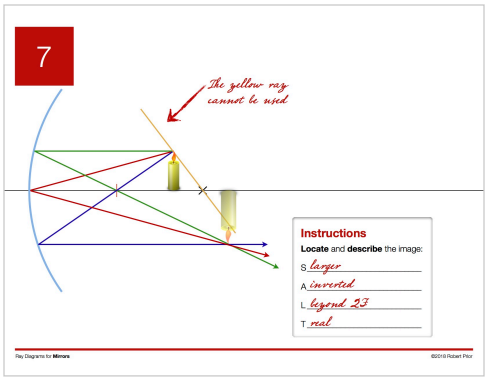



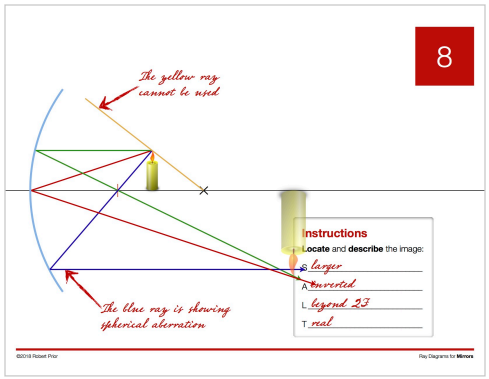



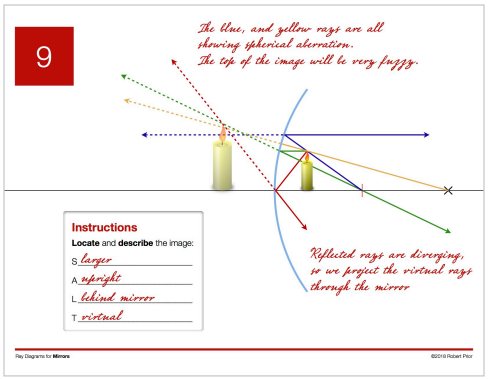



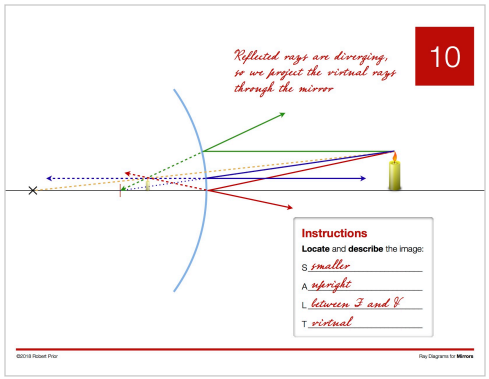



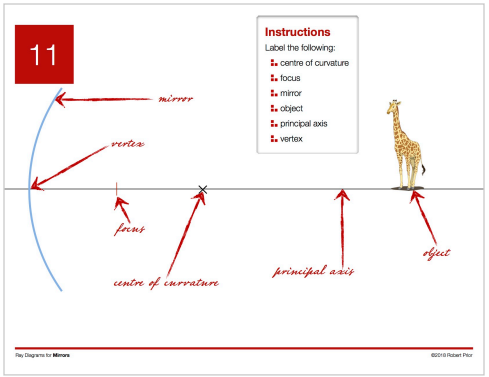



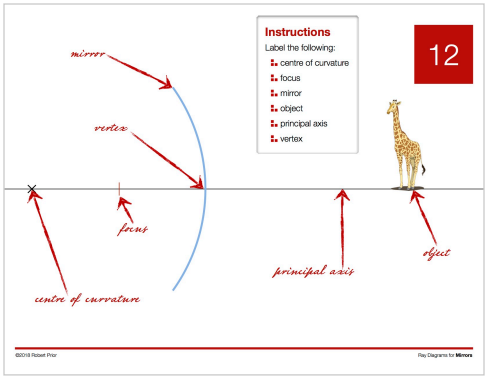



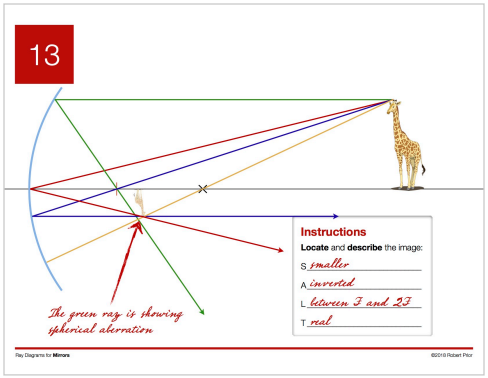
# Solutions

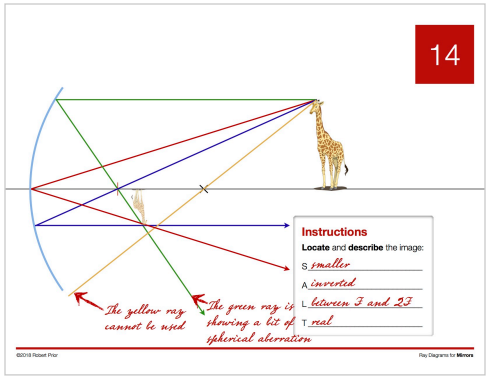
After you have finished some practice, check your answers.

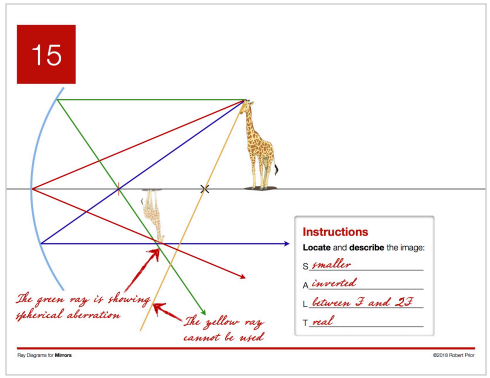
Physics

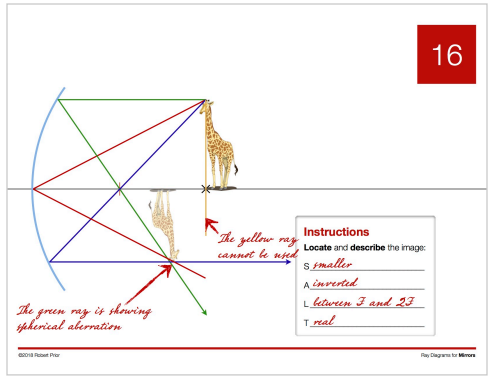


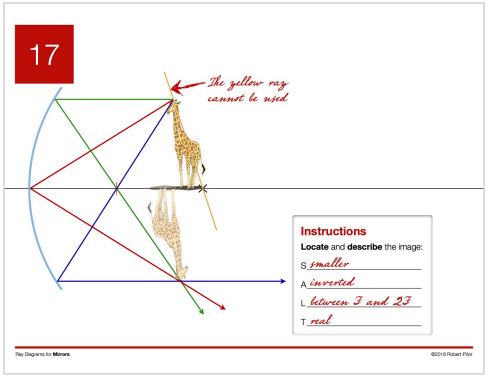



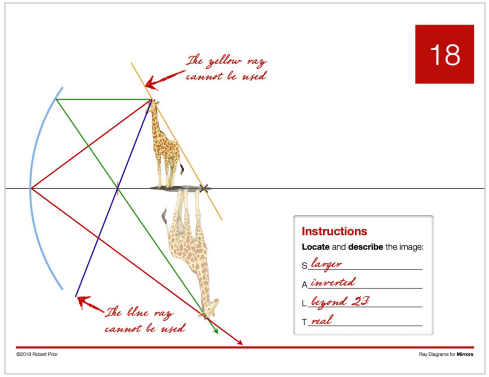



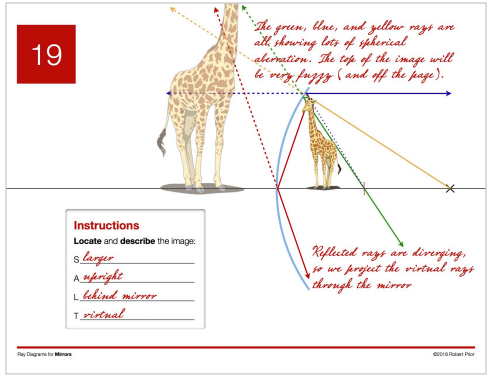



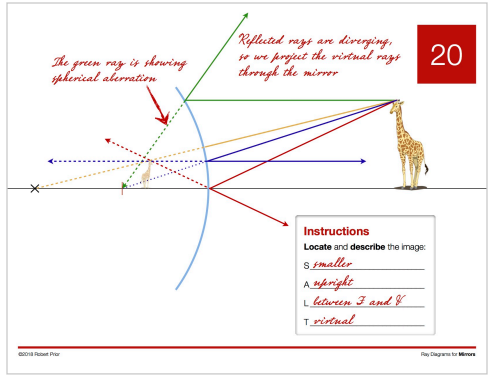



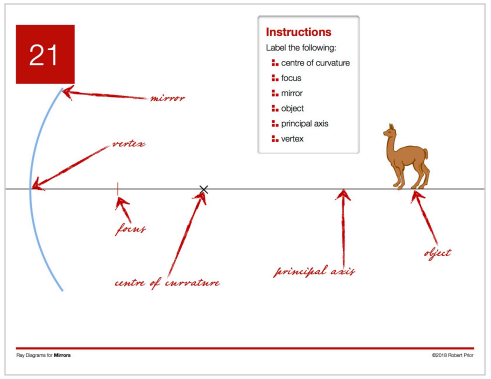



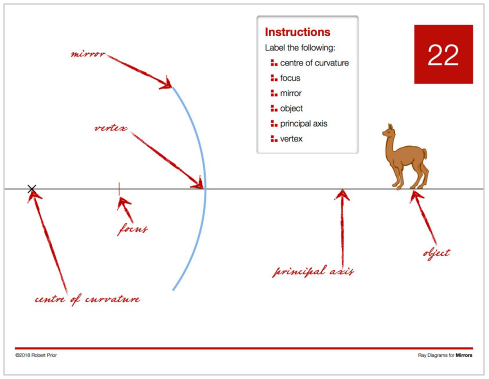



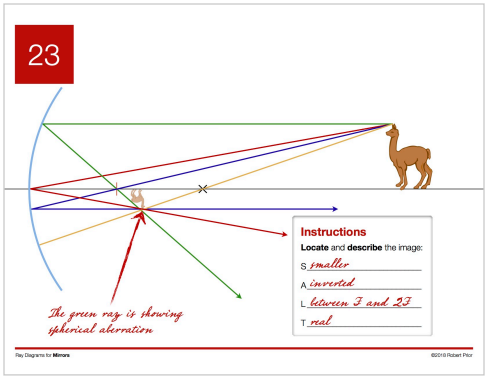
Physics

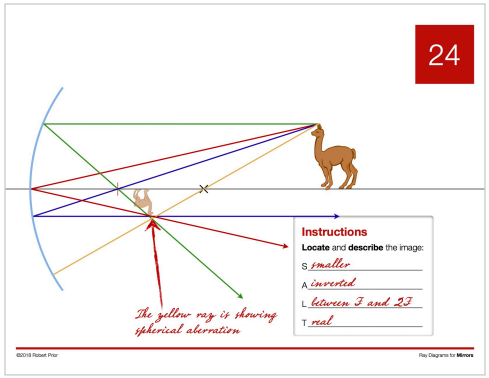


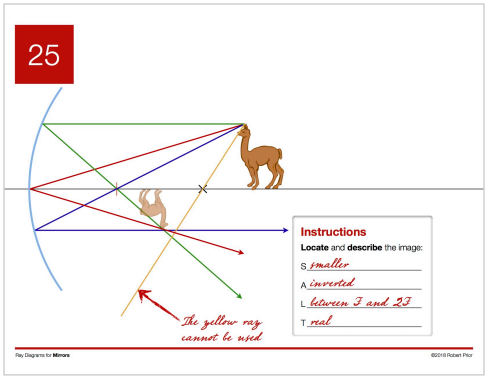



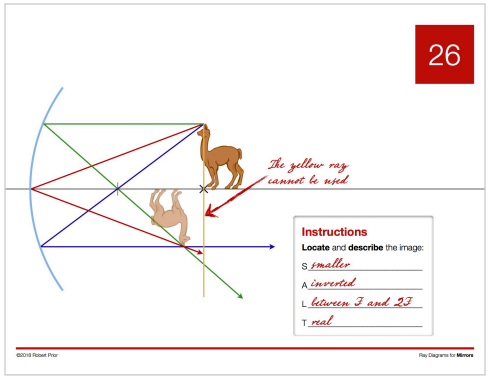

# Solutions

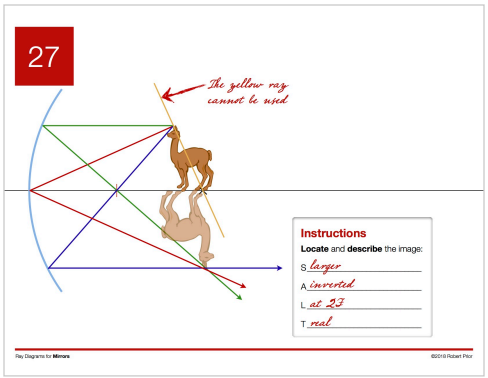
After you have finished some practice, check your answers.

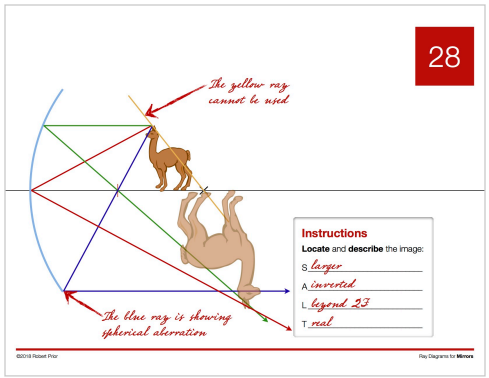


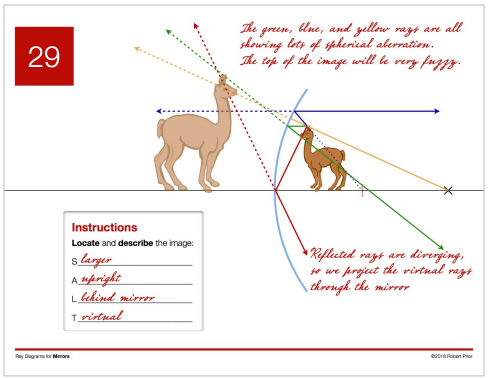



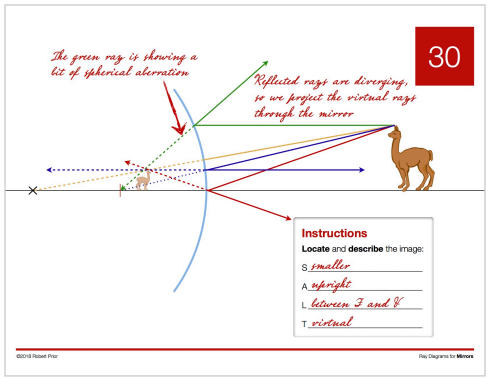



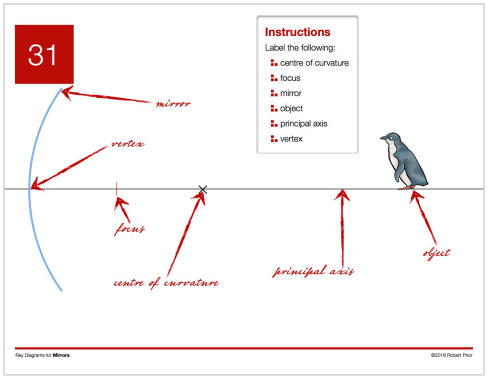



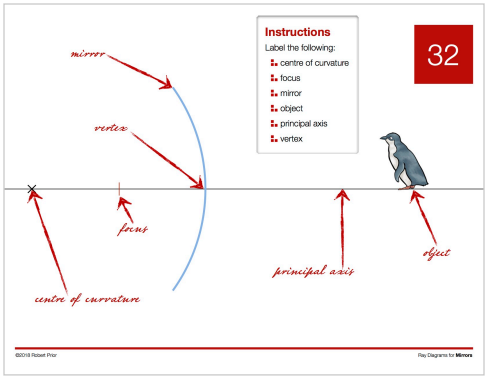



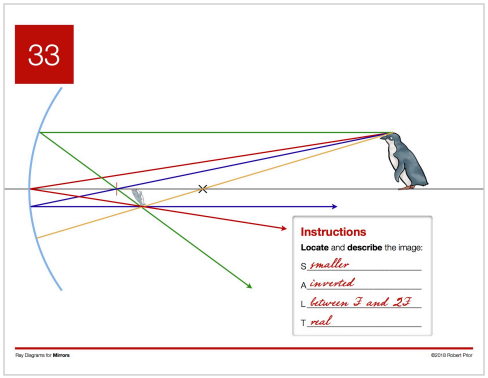
# Solutions

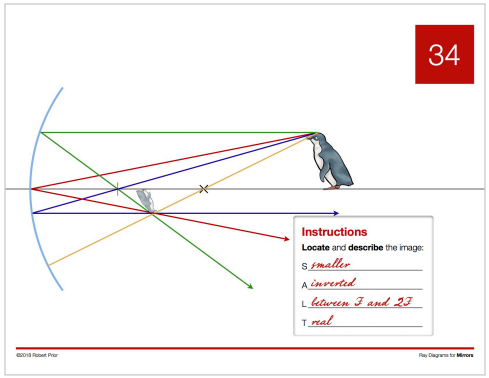
After you have finished some practice, check your answers.

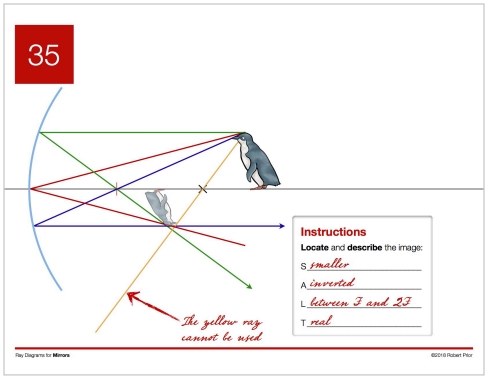
Physics

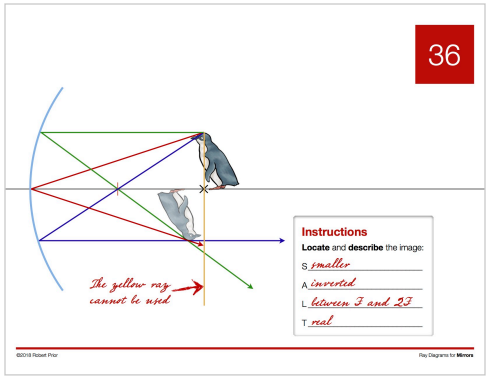


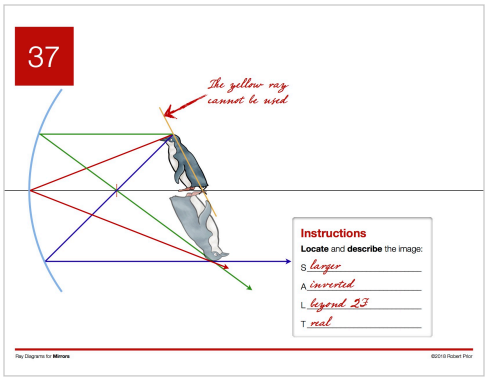



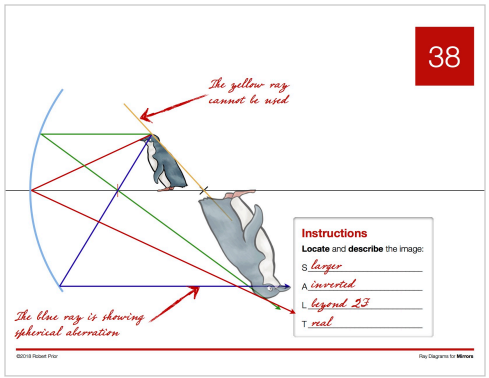



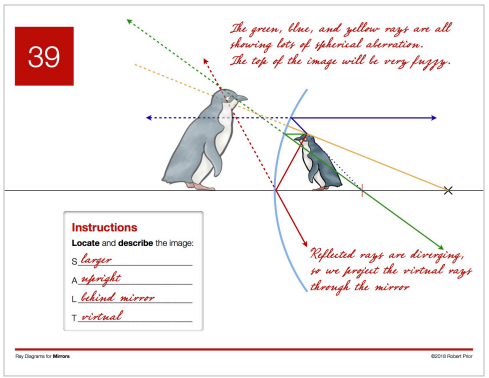



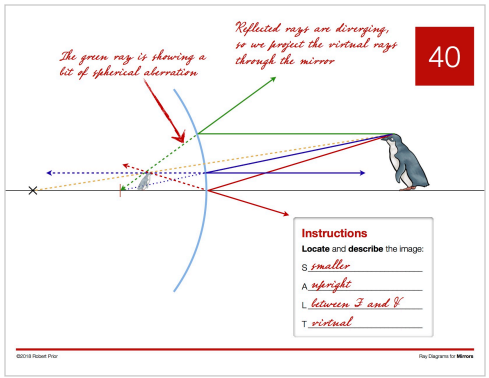



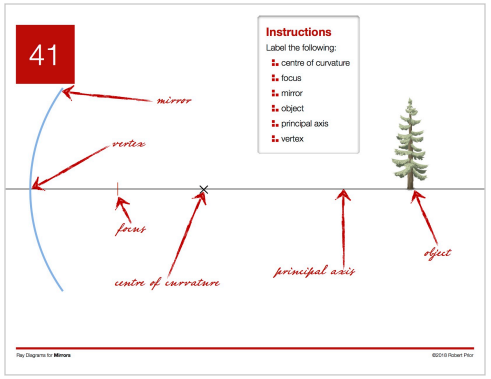



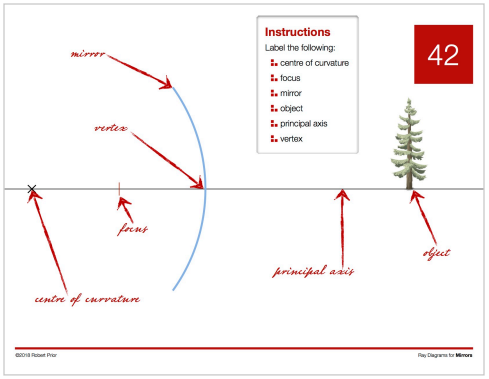



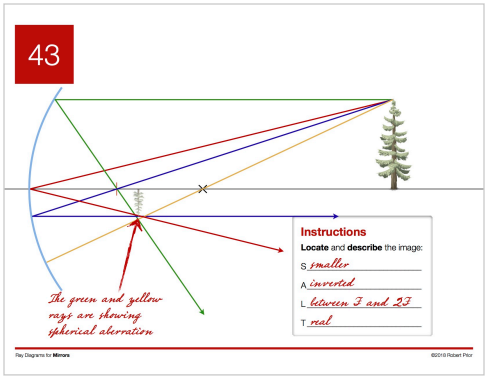
Physics

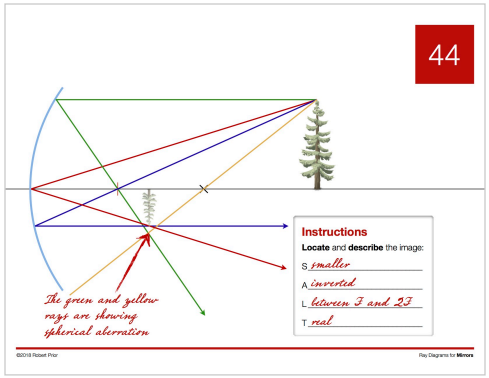


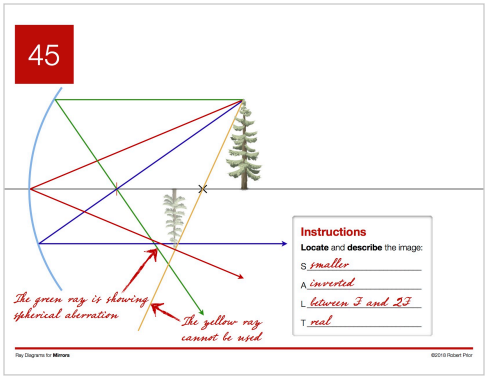



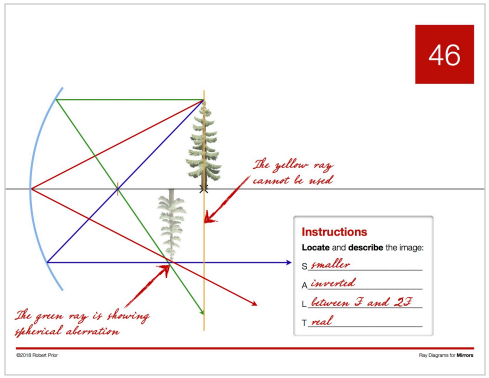

# Solutions

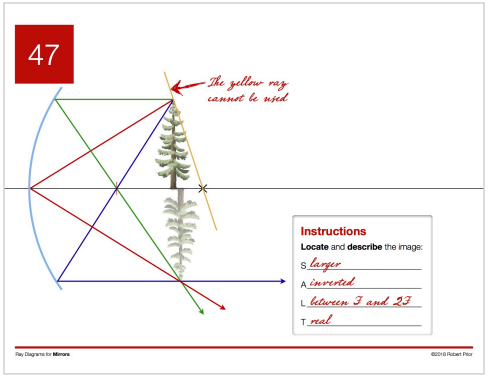
After you have finished some practice, check your answers.

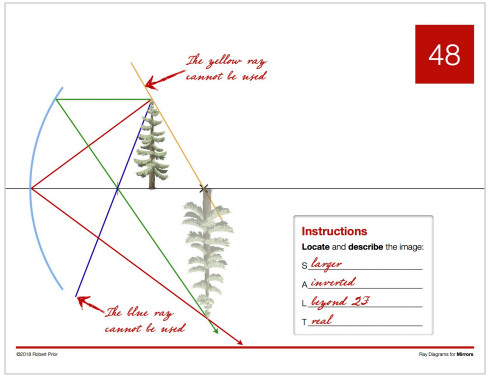


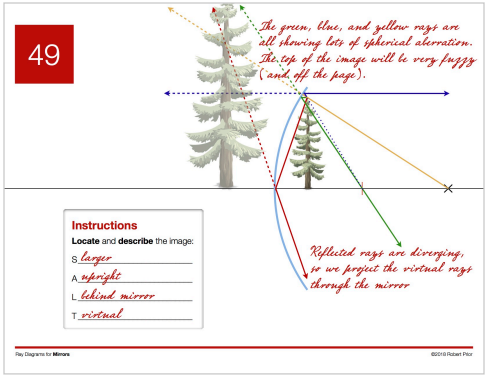



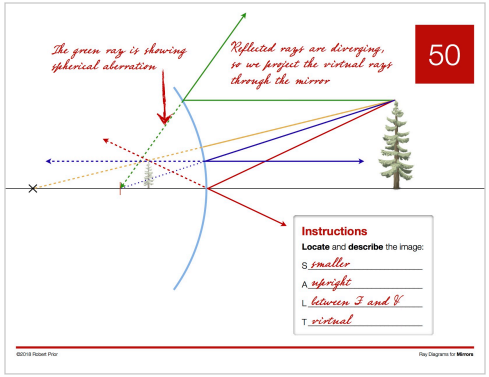



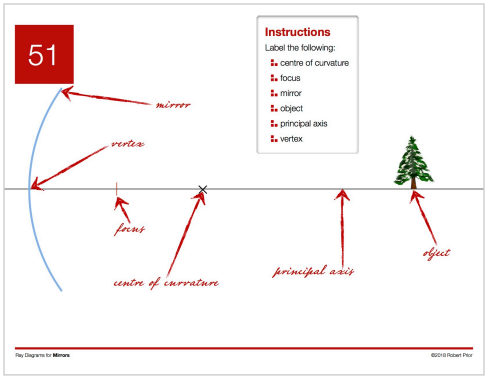



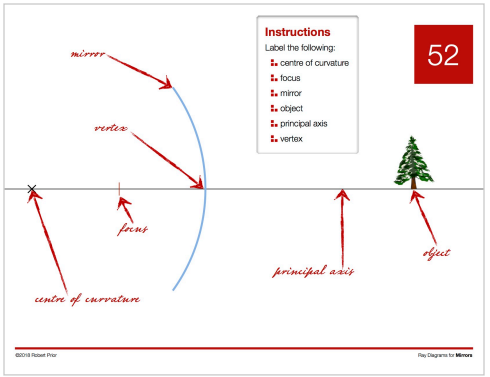



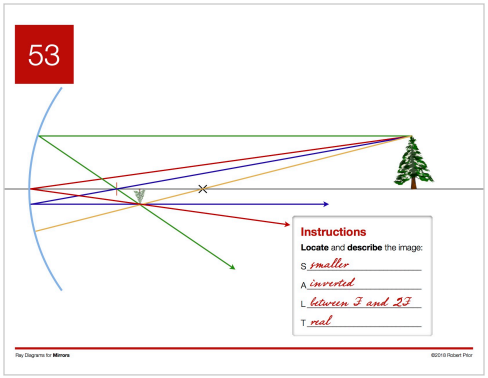
# Solutions

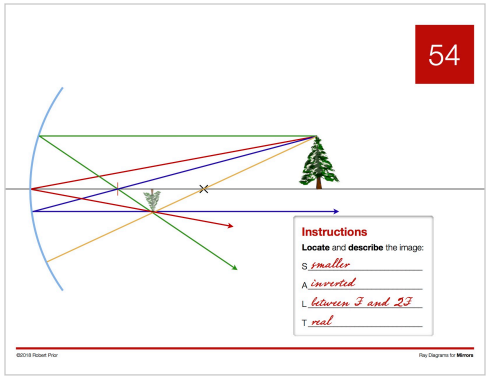
After you have finished some practice, check your answers.

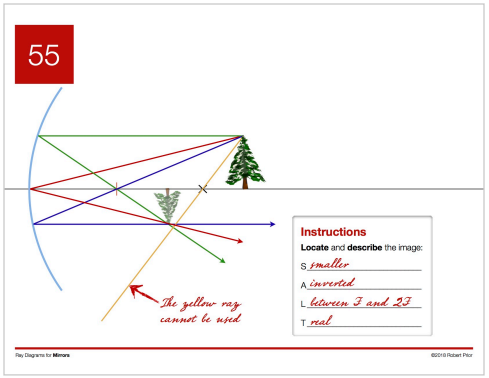
Physics

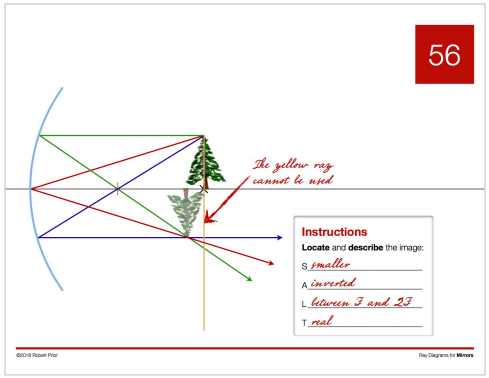


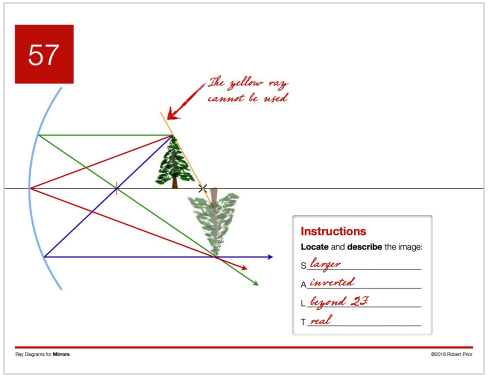



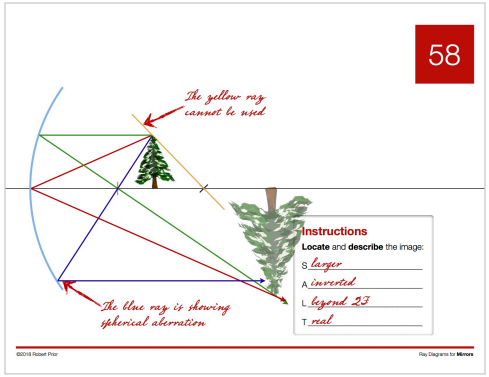



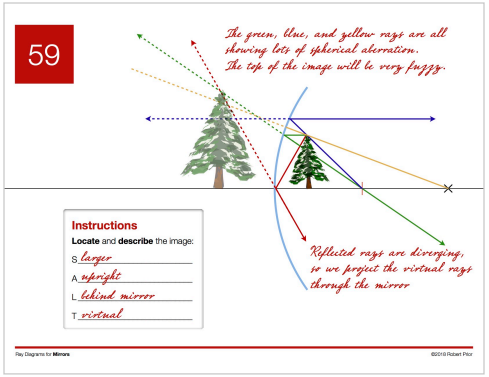



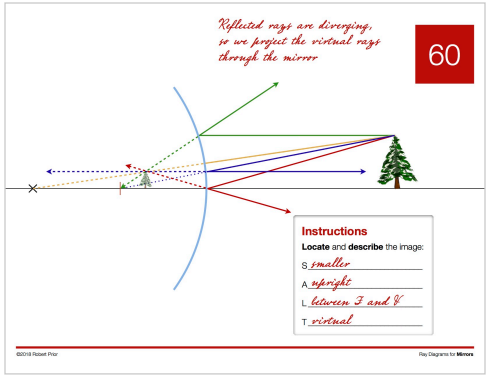



Music is the arithmetic of sounds
as optics is the geometry of light.

*Claude Debussy*