



TOPIC 9

Coordinate Geometry

enVision™ STEM Project

Overview of the Project

Rays from the sun that strike a parabolic reflector parallel to the axis of symmetry are directed to the focus of the reflector, heating it. Students will use this principle to design a parabolic solar reflector and describe its properties and purpose.

Introducing the Project

Present the situation by explaining that the Sun's rays are parallel when they arrive on Earth. If they strike a reflector shaped like a parabola, they will all be reflected to the *focus* of the parabola.

Students will use the properties of a parabola to design a parabolic solar reflector and describe its use.

The questions below can be used to guide the discussion.

- Q:** How does a parabolic solar reflector build up heat?
[Although one ray is insufficient for producing heat, hundreds of rays arriving simultaneously at the focus have a combined effect of increasing the temperature of an element placed at the focus.]
- Q:** A parabola is two-dimensional. How can its shape and properties be converted to three dimensions?
[Samples: a curved tray, a parabolic bowl]
- Q:** What may be found at the focus of a parabolic solar reflector?
[Sample: An object that is heated by the concentration of solar rays striking it, such as water in a tube.]
- Q:** What are some possible uses of a parabolic solar reflector?
[Samples: heating water, lighting fires, cooking food]

Have students read the task they will be asked to complete.

Implementing the Project



Show the Topic 9 STEM video to generate interest in the project.

You can download blackline masters for use with the project from the Teacher Resource Center.

Finishing the Project

You may wish to plan a day when students share their completed solar reflector projects. Encourage students to explain their process as well as their results.

MAKING MATHEMATICAL CONNECTIONS

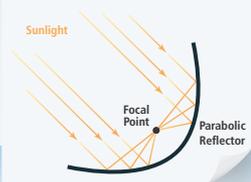
In Topic 5 you found the center of mass of a triangle.
In this Topic you use the properties of parabolas to design a parabolic solar reflector.
In Topic 10 you will use trigonometry and the geometry of circles to measure groups of circles.

AVAILABLE ONLINE

enVision™ STEM
TOPIC 9 PROJECT

Did You Know?

Solar reflectors are made of mirrors or pieces of glass in many shapes and sizes. **Parabolic reflectors** collect the sun's rays from a wide area and **focus them on a small area**, concentrating the energy.



Sunlight

Focal Point

Parabolic Reflector



258,048 mirrors



100 megawatts



20,000 homes

The world's largest power station, the SHAMS 1 in the United Arab Emirates, uses **258,048 mirrors**. That's enough to generate **100 megawatts** of electricity per day and power **20,000 homes**.

In 2016, the United States produced more than 40 billion kilowatt-hours of **solar energy**, 40 times more than it did a decade earlier.

Your Task: Design a Solar Collector

Giant solar power plants are not the only place to see parabolic trough collectors—you might find a water purifier made from a single 6 ft-x-4 ft mirror in a neighbor's back yard! You and your classmates will analyze parabolas and design a solar collector for use in your school or community.



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NG Next Generation Science Standards HS-PS3-3, HS-ETS1-2