



TOPIC 8

Trigonometric Equations and Identities

enVision® STEM Project

Overview of the Project

In this project, students will learn how speed and gravity affect a roller coaster.

Introducing the Project

Present the situation by discussing roller coasters, speed, and gravity.

The questions below can be used to guide the discussion.

Q: What makes a roller coaster ride exciting?

[Track steepness, drop height, loops, wooden frame]

Q: What is the highest point on a roller coaster track?

[The top of the first hill]

Q: A roller coaster has no engine. When do you think it is travelling faster, at the top of a hill or at the bottom of a hill? And why?

[At the bottom of a hill, because the coaster pauses at the top of a hill before it starts falling.]

Q: Suppose a roller coaster travels at an average of 75 miles per hour. How far does a rider travel if the ride lasts 1 minute 45 seconds?

[about 2.2 miles]

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

Implementing the Project

Show the Topic 8 STEM video to generate interest in the project.

It may be useful to add restrictions about the maximum drop angle or speed, but students will have to work hard to get to the point where these are measurable; the drop distance can serve as a proxy for speed. Some students may want to investigate the relative speed of roller coasters based on their drop height. This speed is also determined by the type of coaster, so a student simply looking for a regression function will not easily find one.

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 roller coaster projects. Encourage students to explain their process as well as their results.

MAKING MATHEMATICAL CONNECTIONS

In Topic 7 ...

... you analyzed the electromagnetic spectrum and designed goggles to protect the vision of a space voyager.

In this Topic ...

... you use trigonometric functions to model the curves of a roller coaster.

In Topic 9 ...

... you will use properties of conic sections to design a whispering gallery.

AVAILABLE ONLINE

TOPIC 8

PROJECT

enVision® STEM

Did You Know?

A roller coaster has no engine. The first car in the train is pulled to the top of the first hill, after which **gravity** and **momentum** take over.

Some sections of roller coasters can be modeled by **trigonometric functions**.

Materials used to build Big One steel roller coaster

1,270 pilings

2,212 tons of steel

60,000 bolts

42,000 square feet of paint

Your Task: Design a Roller Coaster

You and your classmates will design a roller coaster following a track modeled on trigonometric functions.

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