

Objective

By the end of this lesson, the student will be able to apply mathematical concepts to analyze and understand the physics of roller coasters.

Materials and Prep

- Paper and pencil
- Calculator (optional)
- Access to the internet (for research)
- Basic knowledge of algebra and geometry

Activities

1. Research and analyze the design of a roller coaster:
 - Choose a roller coaster that interests you and find information about its height, length, and speed.
 - Calculate the potential energy, kinetic energy, and total energy of the roller coaster at different points along its track.
 - Graph the energy changes on a coordinate plane.
2. Create a scale model of a roller coaster:
 - Design a roller coaster using paper and pencil.
 - Label the different parts of the roller coaster, such as the highest point, the lowest point, and any loops or twists.
 - Calculate the slope and curvature of different sections of the roller coaster.
3. Explore the forces acting on a roller coaster:
 - Identify and describe the forces acting on a roller coaster, such as gravity, normal force, friction, and air resistance.
 - Calculate the net force and acceleration of the roller coaster at different points along its track.
 - Discuss how these forces affect the motion of the roller coaster.

Talking Points

- "Roller coasters are a thrilling combination of physics, engineering, and mathematics."
- "When analyzing a roller coaster, it's important to consider the different types of energy involved."
- "Potential energy is the energy an object possesses due to its position or height."
- "Kinetic energy is the energy an object possesses due to its motion."
- "Total energy is the sum of potential energy and kinetic energy."
- "Creating a scale model of a roller coaster can help us understand its design and mathematical properties."
- "The slope of a roller coaster represents its steepness or incline."
- "Curvature refers to how sharply or smoothly the track bends."
- "Forces play a crucial role in the motion of a roller coaster."
- "Gravity is the force that pulls the roller coaster downwards."
- "Normal force is the force exerted by a surface to support the weight of an object."
- "Friction and air resistance can affect the speed and movement of a roller coaster."
- "Net force is the vector sum of all forces acting on an object."

- "Acceleration is the rate at which an object's velocity changes."