# Bungee Jumping

**Objectives**
Upon completion of this lesson, students will:

- create their own model of bungee jumping
- analyze graphs comparing acceleration, distance, and speed versus time

**Materials/Tools Needed**
Interactive Physics, calculators, pencil, worksheet

**Grouping/Target Audience**
Work in groups of 2/ 9th grade students with learning disabilities

**NCTM Standards**
*Algebra*
Use mathematical models to represent and understand quantitative relationships.

- model and solve contextualized problems using various representations, such as graphs, tables, and equations

*Communication*
Use the language of mathematics to express mathematical ideas precisely.

- Organize and consolidate their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyze and evaluate the mathematical thinking and strategies of others

**NYS Standards**
Modeling/Multiple Representation

Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships.

**Key Terms**
Force, energy, damping, tension

**Lesson Outline**

1. **Focus and Review**
   Remind students what they learned in previous lessons that will be pertinent to this lesson.

   - Raise your hand if you have ever been bungee jumping. How about anyone who has ever seen someone bungee jump?
   - It looks very exciting but also dangerous. Do you think there are any mathematics involved in bungee jumping?
   - What kind of environmental factors are involved in bungee jumping?

2. **Objectives**
   Today we are going to create our own models of bungee jumping using Interactive Physics.

3. **Teacher Input**
   Remind students of the basics of Interactive Physics. Create a simple model with them as review.

4. **Guided Practice**
   Read through task sheet together. Clarify misunderstandings and review unfamiliar vocabulary.

5. **Independent Practice**
   Allow students to work independently to create models of bungee jumping. Monitor individuals for questions and technical difficulties.

   Have students sketch the graphs that their models create. Assist in the answering of graphical questions.

6. **Closure**

   Bring the class back together for a discussion of the findings. Have students volunteer to share their models of bungee jumping. Once the students have been allowed to share what they found, summarize the results of the lesson. Conclude by discussing the differences in the graphs that were created.

# Bungee Jump!!

You have been employed to design a bungee ride at Darien Lake. Using Interactive Physics, create a model representing your plan for a bungee jump. You want to create a safe but exciting ride that draws many customers. Remember to account for various factors such as height of the tower, weight of the jumper, length of the rope, elasticity of the rope, etc.

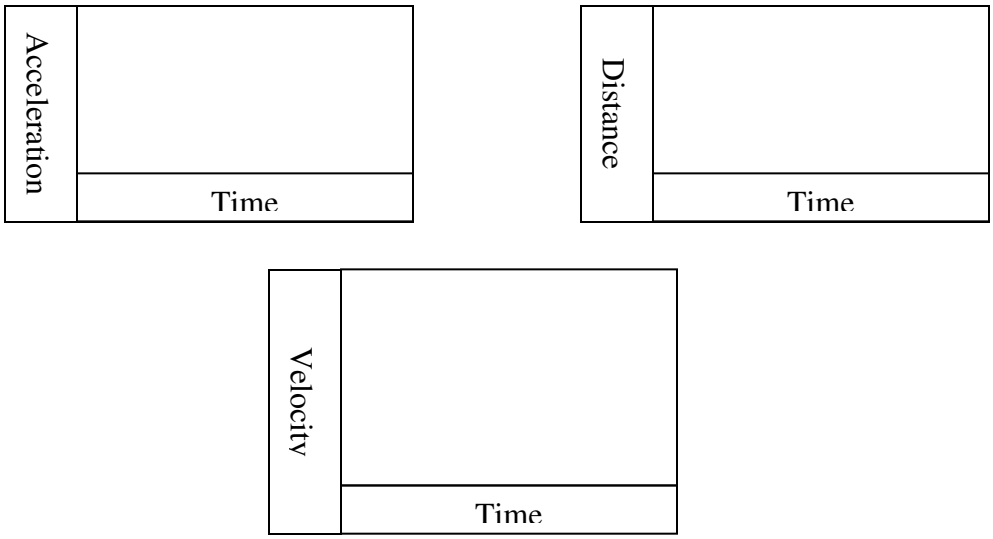
**Step 1:** Sketch your initial idea for the ride below. List some key elements that you wish to incorporate.

**Step 2:** Use Interactive Physics to create a working model of your sketch. Be sure to consider the factors listed above that may influence the success of your ride.

**Step 3:** After you are satisfied with your model, list some of the specifics below.

| | |
|---|---|
| **Tower Height (m)** | |
| **Jumper Weight (kg)** | |
| **Initial Velocity (m/s)** | |
| **Spring Length (m)** | |
| **Spring Stiffness (N/m)** | |
| **Damper (N-s/m)** | |
| **Air Resistance** | |

**Step 4:** Sketch the following graphs below. Please include an appropriate scale.




**Step 5:** Answer the following questions based on your model.

1. What other variables may affect your jumper? _____
   _____
   _____
2. When is acceleration at its maximum? What is this value?
   _____
   _____

3. When is velocity the greatest? When does it reach its maximum? Minimum? _____
   _____
   _____
4. What is the greatest distance the jumper falls? Is this safe?
   _____
   _____
5. Compare your findings with your neighbor. What kind of differences are there? Why? _____
   _____
   _____
6. What happens if you significantly change one of your variables? Explain. _____
   _____
   _____
   _____