

# ROLLER GRAPHICOASTER

## **Brief Description:**

In this exhibit you adjust the shape of a track and roll a cart along it, timing how long it takes from start to finish.

## **Objectives:**

Students explore slopes and functions with this exciting exhibit. Students can analyze their results to find the fastest possible path or to compare their average race times with the results of their classmates.

## **Links to Websites:**

<http://mathmidway.org/Training/graphicoaster.php>

<http://curvebank.calstatela.edu/index/index.htm>

## **Vocabulary:**

Brachistochrone

Cosine curve

Cycloid

Catenary curve

Cubic

Parabolic curve

## **Before:**

- ⊙ (Level 1, 2, 3) You can prepare to use the Roller Graphicoaster exhibit in the Math Midway by thinking about the question: What is the shape of the curve that will allow an object to slide from one point to another point in the least amount of time if the only force that is setting the object in motion is gravity?

The following worksheet can accompany the classroom query:

Draw a curve that you think will allow an object to get from point A to point B in the least amount of time.

● A

● B

Why do you think this particular curve will be so fast?

Draw a curve that you think will allow an object to get from point A to point B, but as slowly as possible.

● A

● B

Why do you think this particular curve will be so slow?

Draw a curve that you think would allow the object to slide from point A to point B slower than the first curve you drew but faster than the second.

● A

● B

Why do you think this curve would be between the first two?

**During:**

- ⊙ (*Levels 1, 2, 3*) Try to figure out the fastest curve  
Each student will test out a design that they think will work best.  
Record the design, time, and student's name.  
Discuss the slope, velocity, and acceleration of the fastest and slowest curves.  
Review the curve designs available at the exhibit.  
Ask students to compare their curve designs with those.

**After:**

- ⊙ (*Level 3*) The question that this exhibit is based on is called the "Brachistochrone Problem," which examines the curve that will allow an object to slide from one point to another in the least amount of time. Isaac Newton was challenged to answer this question in 1696, and he answered the question using the calculus of variations. While your students may not be ready for calculus yet, they can still think about this question.
- ⊙ (*Level 3*) Visit the National Curve Bank:  
<http://curvebank.calstatela.edu/index/index.htm> Form groups of students to research different curves or curve families and have them present their work to the class.