

## MAXIMUM VELOCITY Teaching Guidelines

**Subject:** Mathematics

**Topics:** Algebra--Patterns, Relations and Functions

**Grades:** 6 - 12

**Knowledge and Skills:**

- Can plot a point in a two-dimensional coordinate system, given the coordinates, or determine the coordinates of a given point
- Can extrapolate a graph when a pattern exists

Procedure: This activity is best done by students individually or in teams of two.

Distribute the handout and discuss it. Ask students why the maximum velocity increases when the number of solar cells increases (*more power to push the vehicle*). Discuss also why there is such a thing as maximum velocity—why doesn't the car just keep going faster and faster (*because the wind resistance increases as the velocity increases, to the point where the resistance force of the wind exactly matches the driving force of the car, and it won't accelerate any more*).

Depending on the level of your students, there are various approaches to solving the problem.

- 1) Beginning: Graph the given data points, with number of solar cells as the independent variable and maximum velocity as the dependent variable (discuss why the maximum velocity depends on the number of solar cells rather than vice versa). Then extrapolate the graph visually to answer the questions.
- 2) Advanced: Graph the data, and compare the result to various model functions

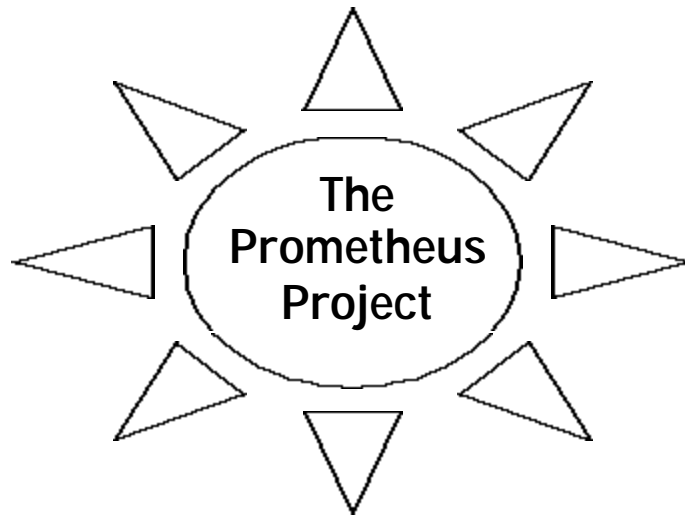
$$y = mx + b$$

$$y = kx^2$$

$$y = k\sqrt{x}$$

$$y = k\sqrt[3]{x}$$

Students will find that the last two functions seem most similar to the graph of the data. If they test each of those (by using one data point to find a value of  $k$ , then testing that value for another data point), they should find that the last model function (cube root) matches the given data, with  $k = .0035$ .



To: Design Team  
From: Testing Team  
Subject: Maximum Velocity

Here's the data from the last test run. We're thinking about adding more solar cells to the car, but we need the answers to two questions. Can you help us?

- 1) What would the maximum velocity of the car be with 700 solar cells?
- 2) How many solar cells would be required to reach a maximum velocity of 60 mpg?

# of solar cells	maximum velocity
100	30.5
200	38.5
300	44.0
400	48.4
500	52.1