THE DROP
Teaching Guidelines

Subject: Mathematics

Topics: Algebra—Expressions and Equations

Grades: 6 - 12

Knowledge and Skills:

- Can evaluate expressions by substituting values for variables
- Can simplify expressions using correct order of operations
- Can do basic operations on both sides of an equation in such a way as to preserve the equality

Answers:

1.

h (meters)	*v* (meters/sec)
15	**26.2**
40	**14.0**
35	17.1
5	**29.7**
30	19.8
50	0.0
25	22.1
20	24.2
45	9.9
10	28.0
0	**31.3**

2. 31.3 meters/sec

3. No. For the 50 foot roller coaster, the increase in velocity in the first half of the fall (from *h = 50 feet* to *h = 25 feet*) is 22.1 meters/sec. The increase in velocity in the second half of the fall (from 25 feet to 50 feet) is only 9.2 meters/second (31.3 – 22.1). So the velocity does not double when the length of the drop doubles.

The Drop

Suppose a roller coaster ride begins by climbing to a height of 50 meters, stopping briefly, and then falling rapidly to ground level (a height of 0 meters).

As it falls the roller coaster will gain speed.

If you ignore the effects of friction, then height and speed are related by this equation:

$$50 - h = v^2/19.6$$

(h = height in meters, v = velocity in meters per second).

1. Find the missing values in the table below:

h (meters)	v (meters/sec)
15	?
40	?
?	17.1
5	?
?	19.8
?	0.0
25	22.1
?	24.2
?	9.9
?	28.0
0	?

2. a) What is the velocity halfway to the bottom of "The Drop", where $h = 25$?
   b) What is the velocity at the bottom of the drop, where $h = 0$?

3. If you made the roller coaster twice as high, do you think the velocity at the bottom be twice as great? Explain your answer.