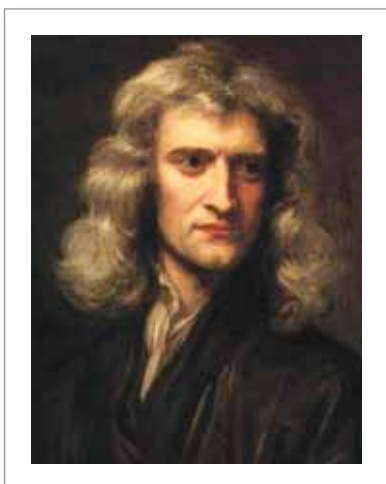


Comparing Linear, Exponential, and Quadratic Models



Earth's gravitational attraction was explained by Sir Isaac Newton's Law of Universal Gravitation. The law was published in Newton's *Principia* in 1687. It states that the force of attraction between two particles is directly proportional to the product of the masses of the two particles, and inversely proportional to the square of the distance between them.

EXAMPLE 5 Conducting an Experiment with Gravity

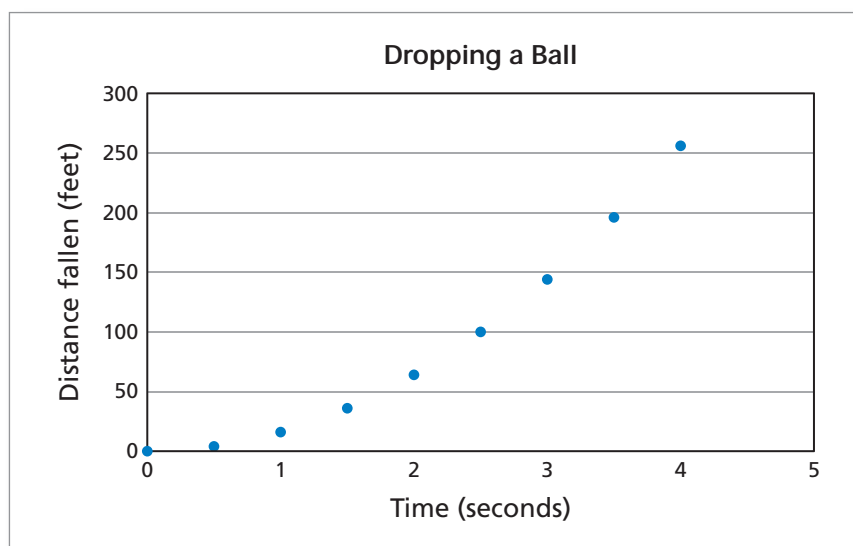
You conduct an experiment to determine the motion of a free-falling object. You drop a shot put ball from a height of 256 feet and measure the distance it has fallen at various times.

Time (sec)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Distance (ft)	0	4	16	36	64	100	144	196	256

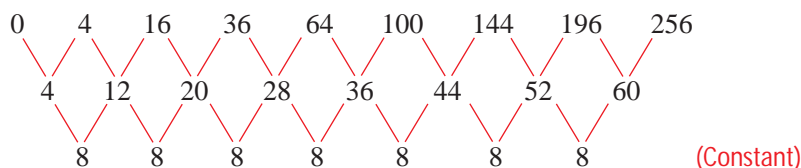
Is the pattern of the distances linear, exponential, quadratic, or none of these? Explain your reasoning.

SOLUTION

Begin by sketching a graph of the data.



- The pattern is *not* linear because the graph is not a line.
- The pattern is *not* exponential because the ratios of consecutive terms are not equal.
- The pattern *is* quadratic because the second differences are equal.



✓ Checkpoint

Help at Math.andYOU.com

A classic problem in physics is determining the speed of an accelerating object. Estimate the speed of the falling shot put ball at the following times. Explain your reasoning.

- a. 0 sec b. 1 sec c. 2 sec d. 3 sec e. 4 sec