

Beach Ball

A beach ball is thrown into the air and then begins bouncing up and down on the floor at a gym. As the ball is bouncing, it is also advancing away from the point from where it was thrown. Now the following table records the first 4 highest points the ball reached. (Even though this is not reasonable, in order to simply the reasoning process, ignore the size of the beach ball from this point on.)

height of the ball when it is at the highest point (feet)	10	8	6.4	5.12
horizontal distance from the point the ball was thrown when it is at its highest point(meters)	2	6	10	14

- (a) On a graph, plot each highest point where the beach ball reached. Use the horizontal distance from the point where the ball was thrown as the x-axis and the height of the ball where it was at the highest point as the y-axis to construct the coordinate plane.
- (b) Based on the first 4 records given, construct a conjecture statement for how the height of the beach ball will be when it reaches its successive highest points
- (c) Based on the first 4 records given, construct a conjecture statement for how the horizontal distance of the beach ball from the point it was thrown will advance when it reaches its successive highest points.
- (d) If the ball continues to bounce, use your conjectures from (b) and (c) to predict the coordinates of the beach ball when it reaches its fifth highest point.
- (e) Assume every bounce is a parabola, and the point where the ball was first thrown was at the origin of the coordinate plane described in (a). Find the function that describes the trajectory of the ball before it touches the ground the first time after it was thrown.
- (f) At the end of the gym there is an array of lockers which is 3 feet tall from ground up. If the horizontal distance from the point where the ball was thrown until it reaches the end of the room is 19 meters and the ball does not change its bouncing pattern until it hits the wall at the end of the room, will the ball hit any of the lockers? Use the trajectory of the ball to justify your answer.
- (g) Samuel is 3.3 feet tall. He was on the bouncing ball's path and 15 meters away from where the ball was thrown. Hannah predicts that the ball will fly over Samuels head and will not hit him; therefore he does not need to move away from the path where the ball is bouncing. Is Hannah's prediction valid? Use the trajectory of the ball to prove or disprove Hannah's prediction.

