Two-Dimensional Motion and Vectors

Math Skills

Projectile Motion

After a snowstorm, a boy and a girl decide to have a snowball fight. The girl uses a large slingshot to shoot snowballs at the boy. Assume that the girl fires each snowball at an angle θ from the ground and that the snowballs travel with an initial velocity of v_0.

1. In terms of the initial velocity, v_0, and the launch angle, θ, for what amount of time, Δt, will a snowball travel before it reaches its maximum height above the ground? (Hint: Recall that $v_f = 0$ when an object reaches its maximum height.)

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2. What is the maximum height, h, above the ground that a snowball reaches after it has been launched?

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3. What is the horizontal distance, x, the snowball has traveled when it reaches its maximum height?

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4. The range, R, is the horizontal distance traveled in *twice* the time it takes for an object to reach its maximum height. Using your answers from items 1 and 3, write an expression for the range in terms of v_0, θ, and g.

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5. If the initial velocity, v_0, equals 50.00 m/s, find the maximum height and range for each of the launch angles listed in the table below.

Launch angle	Maximum height (m)	Range (m)
15°		
30°		
45°		
60°		
75°		