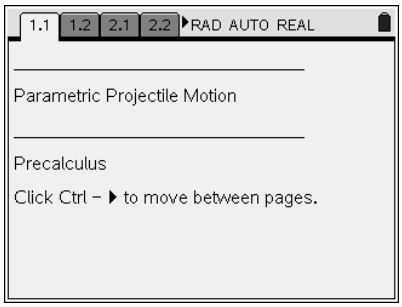
Parametric Projectile Motion
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Parametric_Projectile_Motion*.

In this activity, you will explore the relationship between the initial velocity and initial angle of a projectile and the parametric equation for the path of the projectile.



Move to page 1.2.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Press the "Start animation" button and observe the trajectory of the ball. The calculator will show "Score!" when you make a basket. Point *V* changes the initial velocity vector that gives the initial speed and the initial angle.

Reset the animation and move point *V* to change the initial speed and/or the initial angle. Observe the effect of the changes, and continue to adjust the vector to score a basket.

Press ▲ to change to a new problem. The height of the player and the distance from the basket will both change.

1. What do you notice about the path of the ball when the velocity is large and the angle is small?

2. What do you notice about the path of the ball when the velocity is large and the initial angle is large?

3. How can you change your initial conditions to make the ball go very high?

4. How can you change your initial conditions to make the ball go very far?

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5. Find the *x*-component (horizontal component) of the vector V_0 and the *y*-component (vertical component) of the vector V_0. Note: V_0 is the initial velocity, *V*x is the *x*-component of the vector, and *V*y is the *y*-component of the vector.

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6. What is the vertical component of the vector with initial velocity of 10 meters/second and initial angle of 60^{o}?

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7. What is the horizontal component of the vector with initial velocity of 10 meters/second and initial angle of 60°?

8. The distance the ball travels in the horizontal direction (neglecting air resistance) is given by the *x*-component (rate in the *x*-direction) multiplied by time (*t*). Find the distance the ball travels in the horizontal direction as a function of time.

9. The distance the ball travels in the vertical direction is given by the *y*-component multiplied by time (*t*) plus the initial height (*h*) minus the gravitational pull due to gravity given by $4.9t^2$. Find the height of the ball as a function of time.

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10. Find the parametric equation for the path of the ball that makes a basket if the player's height is 2 meters and the player is 7 meters from the basket. Graph the parametric equation of the path of the ball that will go through the basket.

To enter the parametric equation press ctrl G.

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11. Practice making a basket using the parametric equation graphed and changing the initial conditions. Push the up arrow to change to a new problem.

Press ctrl G and delete the parametric equations to challenge yourself and see if you can score.