Activity 1: Building a Sandbox

The Cano family is building a rectangular sandbox one foot deep. Diana has decided to use lumber that is one foot wide. She collected 30 feet of lumber to enclose the sandbox.

1. Sketch a few possible sandboxes.

2. Fill in the table with some possible dimensions:

Width	Length	Depth	Volume

3. Predict: what do you think a scatter plot of (width, volume) will look like?

4. Enter the table values into lists in your calculator, using expressions where appropriate. Create a scatter plot of (width, volume) in your calculator in an appropriate window and sketch:

5. Write the expression in the lists that you used for volume.

6. Enter the expression for volume into the function grapher. Sketch the graph over the scatter plot above.

Using your function for volume:

7. If the width of the sandbox is 3.25 feet, find the volume of sand necessary to fill the box. Solve, using your calculator:

Graphically With a Table

8. What dimensions would allow for the greatest volume of sand? Solve, using your calculator:

Graphically With a Table

9. The family decides they can afford to buy 50 ft^3 of sand. What dimensions should they build the sandbox? Solve, using your calculator:

Graphically With a Table

Activity 2: Projectile Motion

It can be shown that after being thrown straight up into the air with a velocity of 80 ft/sec, a ball's height t seconds after being thrown can be represented by $h = -16t^2 + 80t$ (ignoring air resistance).

1. Find an appropriate viewing window for $h = -16t^2 + 80t$ for this problem situation. Sketch the graph. Justify your window choice.

2. How high is the ball after 2 seconds?

Graphically With a Table

3. When was the ball 64 feet above the ground?

Graphically With a Table

4. When did the ball hit the ground?

Graphically With a Table

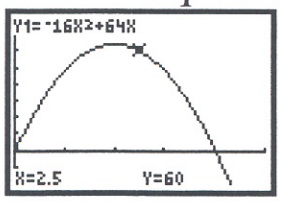
5. What is the maximum height that the ball reached?

Graphically With a Table

6. The ball was thrown from a height of 0 ft. In Exercise 4, you found that the ball hit the ground, height = 0, at _____ sec.
   a. Based on this information, how can you find the time at which the ball reached its maximum height? Explain your strategy.
   b. Evaluate the function to find the maximum height.
   c. What is this point (time, maximum height) called on the parabola, $h = -16t^2 + 80t$?

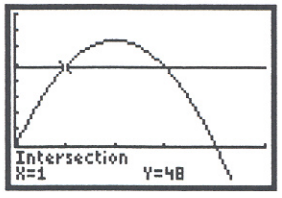
Reflect and Apply

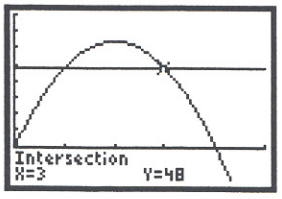
1. Write an equation and its solution for the following screens.

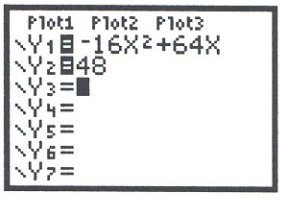


a. _____ _____

equation solution

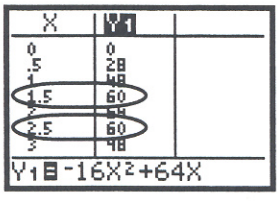






b. _____ _____

equation solution



c. _____ _____

equation solution

2. The following equation represents the height of an object after t seconds when thrown straight up from the ground: $h = -16t^2 + v_0 t$. At what initial velocity, v_0, would you have to throw the ball to get it to a maximum height of 144 feet? (Hint: Use your graphing calculator to find v_0 such that maximum height the ball reaches is about 144 feet. Graph $h = -16t^2 + v_0 t$ in the window [0, 6] [0, 150], guessing and checking values for v_0 until the maximum height is 144 feet.)