NAME ____ DATE ____________ PERIOD _____

8 Graphing Calculator Investigation

Second Degree Polynomial Functions

(Use with Lesson 8-4.)

Many real world problems can be modeled using polynomial functions. The **TABLE** function can be used to evaluate a function for multiple values.

Example **An object is dropped from the top of a 179-foot cliff to the water below. The height of the object above the water can be modeled by $h(t) = -16t^2 + 179$ where t is time in seconds.**

a. Determine the height of the object after 0.5 second, 1 second, 1.5 seconds, and 2 seconds.

Enter the function into **Y1**. Use **TBLSET** to set up the calculator to display values of t in 0.5 second intervals. Display the table and record the results.

Examine the table. When $x = 0.5$, $y = 175$. This means that $h(0.5) = 175$, or that after 0.5 second, the object is 175 feet above the water. Thus, $h(1) = 163$ feet, $h(1.5) = 143$ feet, and $h(2) = 115$ feet.

X	Y1
0	179
.5	175
1	163
1.5	143
2	115
2.5	79
3	35

X=0

b. After how many seconds does the object hit the water? Round to the nearest hundredth.

Scroll through the table. Notice that the y-values change from positive to negative between $x = 3$ and $x = 3.5$. Examine this interval more closely by resetting the table using **TblStart=** 3 and **△Tbl=** 0.1. Look for the change in sign.

X	Y1
3	35
3.1	25.24
3.2	15.16
3.3	4.76
3.4	-5.96
3.5	-17
3.6	-28.36

X=3

Further examine the interval from $x = 3.3$ to $x = 3.4$ using **TblStart=** 3.4 and **△Tbl=** 0.01.

X	Y1
3.3	4.76
3.31	3.7024
3.32	2.6416
3.33	1.5776
3.34	.5104
3.35	-.56
3.36	-1.634

X=3.3

The y-value closest to zero occurs when $x = 3.34$. Thus, the object hits the water after about 3.34 seconds.

Exercises

1. An object is dropped from the top of a building that is 412 feet high. The distance, in feet, above the ground at x seconds is given by $P(x) = -16x^2 + 412$.

a. After how many seconds will the object be 100 feet above the ground? Round to the nearest tenth.

b. To the nearest tenth, how many seconds will it take the object to reach the ground?

2. A bungee jumper free falls from the Royal Gorge suspension bridge over the Arkansas River, 1053 feet above the river. The height h of the bungee jumper above the river, in feet, after t seconds can be represented by $h = -16t^2 + 1053$. Two seconds after the first bungee jumper falls, another person jumps down with an initial velocity of 80 feet per second. The position of the second jumper can be represented by $h = -16(t - 2)^2 - 80(t - 2) + 1053$.

a. If the bungee cords are designed to stretch just enough so that the jumpers touch the water before springing back up, which jumper will touch the water first? How long does it take each jumper to touch the water?

b. Does the second jumper catch up to the first jumper? If so, how far are they above the river at this point and how long does it take each jumper to reach this point?