

Summarize

continued

A new equation with a constant term is introduced in the Getting Ready for Problem 4.2 in the next problem. It can be used as a final summary to this problem and as a launch to Problem 4.2.

ACE Assignment Guide for Problem 4.1



Core 1–4

Other Connections 31, 32; Extensions 51–53; unassigned choices from previous problems

Adapted For suggestions about adapting Exercise 4 and other ACE exercises, see the CMP *Special Needs Handbook*.

Answers to Problem 4.1

- A. 1. The height of the ball increases from 0 feet (ground level) to a maximum height of 64 feet at time equal to 2 seconds and then decreases in a way which is symmetric to the increase until the ball hits the ground at 0 feet at the end of 4 seconds. The differences between successive heights decrease from a difference of 15 after the first 0.25 second and then during each successive 0.25 second until it reaches its maximum height. For example, for each 0.25 second from 0 to 2 seconds the differences in the heights are 15, 13, 11, 9, 7, 5, 3, 1, 0. For each time interval the difference is 2 feet less than the previous difference.
2. The shape of the graph is an upside down U or a parabola with a maximum point. Its intercepts are $t = 0$ and $t = 4$. The maximum height is 64 feet which is reached after the ball has been in the air 2 seconds. The graph is symmetric around a line through $t = 2$. Be sure to use this data in class to make a sketch of the graph.
3. The data does represent a quadratic function. At this time the only evidence that students can give is its shape and possibly its pattern of change which is similar to those discussed in the last investigation.

B. 1.



WINDOW
 $X_{\min}=0$
 $X_{\max}=5$
 $X_{\text{sc}}=1$
 $Y_{\min}=0$
 $Y_{\max}=80$
 $Y_{\text{sc}}=10$
 $X_{\text{res}}=$

2. The graph matches the description. (Note: Students may have adjusted their window setting to show parts of the graph beyond the given data.)
3. $t \approx 1.4$ seconds and $t \approx 2.6$ seconds; The ball is at a height of about 58 feet when $t \approx 1.4$ seconds and when $t \approx 2.6$ seconds. If $t = 1.4$, then $h = -16(1.4)^2 + 64(1.4) = 58.24$ ft and if $t = 2.6$ seconds, then $h = -16(2.6)^2 + 64(2.6) = 58.24$ ft.
4. $t = 1.6$ seconds; When $t = 1.6$ seconds, $h = -16(1.6)^2 + 64(1.6) = 61.44$ ft.
5. The ball will reach the ground at 4 seconds because that is when the height is zero. This is assuming that when you throw the ball up in the air you started the throw at ground level. This can be seen from the table. Also when 4 is substituted into the equation $h = -16t^2 + 64t$ for t , we get $-16(4)^2 + 64(4) = 0$ ft for the height. The factored form of $h = -16t^2 + 64t$ is $h = -16t(t - 4)$. We can predict the x -intercepts from this form; $16t = 0$ or $t = 0$, and $t - 4 = 0$ or $t = 4$.