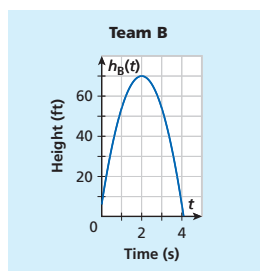
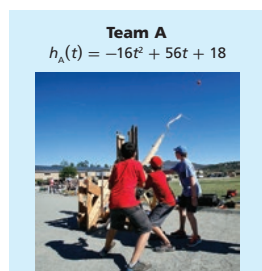


Teacher Answer Key

Project a Pumpkin: How Far Will It Go?

The ability to compare functions given different representations is helpful for comparing a variety of key features of real-world situations.

- 3** Two teams are launching pumpkins. The height h_A (in feet) of Team A's pumpkin is given by the equation shown, where t is the time (in seconds) since launch. The height of Team B's pumpkin is shown by the graph. How do the maximum height and time in air of the two teams' pumpkins compare?



Method 1 – Use the Given Representations

Team A: The function is quadratic. The maximum height occurs at its vertex. The vertex of a quadratic function $f(x) = ax^2 + bx + c$ occurs at $x = -\frac{b}{2a}$. For $h_A(t)$, $-\frac{b}{2a} = \frac{7}{4}$.

A. How was this value calculated?

$$h_A\left(\frac{7}{4}\right) = -16\left(\frac{7}{4}\right)^2 + 56\left(\frac{7}{4}\right) + 18 = -49 + 98 + 18 = 67 \quad \text{A, B. See Additional Answers.}$$

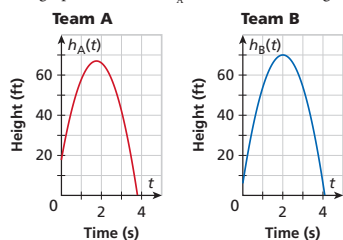
The maximum height reached by Team A's pumpkin is 67 feet.

Team B: Only an approximation of the maximum height can be made from the graph. The graph shows that the maximum height is approximately 70 feet.

Team B's pumpkin reaches a greater maximum height.

Method 2 – Use a Common Representation

The graph of function h_A can be created using its equation.



B. How can you visually determine a difference in the maximum heights shown by the graphs?



Turn and Talk If the pumpkins are launched at the same time, how can you determine when the pumpkins reach the same height? **See margin.**

- Task 3** **MP Use Tools** Students use different representations of functions to compare the heights and flying times of pumpkins launched into the air by two different teams.

Students should be able to reason that the maximum height of a pumpkin's travel doesn't necessarily correspond to the distance the pumpkin travels.

Sample Guided Discussion:

- Q** How was the value $\frac{7}{4}$ calculated? For the function h_A , the value of b is 56 and the value of a is -16 . Using those two values, the expression $-\frac{b}{2a}$ becomes $-\frac{56}{2(-16)}$, which simplifies to $\frac{7}{4}$.
- Q** How can you visually determine a difference in the maximum heights shown by the graphs? Look at the vertex of each graph with relation to the horizontal grid line for $h(t) = 70$. The vertex for Team B looks to be at that line (or at least very close), while the vertex for Team A is clearly below that line. This is enough to determine that Team B's pumpkin went higher.



Turn and Talk Encourage students to think about how to represent the pumpkins having the same height algebraically and graphically. **Possible answer:** Place each graph on the same coordinate plane and determine where the graphs intersect. This finds a solution to $h_A(t) = h_B(t)$.

Teacher Answer Key

Project a Pumpkin: How Far Will It Go?

5. Listed are the circumferences, in inches, for prize-winning pumpkins in 2 locations over the past 10 years.

Location 1 Circumferences (in.)
122, 100, 115, 120, 140, 100, 125, 128, 140, 144

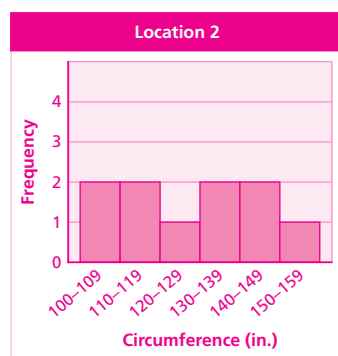
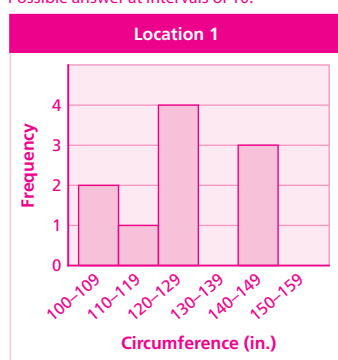
Location 2 Circumferences (in.)
104, 151, 112, 126, 137, 144, 142, 118, 107, 139



- Create histograms for the winning pumpkin circumferences in both locations.
- How are the distributions alike and how are they different?
- Which location has a greater mean circumference?
- Create box plots to compare the data sets.
- Which location has a greater median circumference?
- Which location has circumferences that are less spread out?

ANSWERS

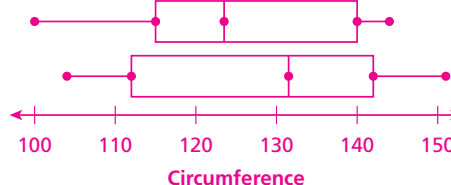
- 5.A. Possible answer at intervals of 10:



- 5.B. Possible answer: The distributions are alike in ranging from approximately 100 to 150 inches in circumference. Both also have two values in the smallest interval and never exceed four values for the intervals that I chose. The distributions are different in clustering: the data from Location 2 is much less clustered than is the data from Location 1.

- 5.C. Location 2 has a greater mean circumference.

- 5.D.



- 5.E. Location 2 has a greater median circumference.

- 5.F. Location 1 has more consistent circumferences based on its smaller IQR.