

Summarize

continued

- What are other examples of situations in which the maximum value is important?

Summary Transparency 4.2B displays four equations and their graphs that students have studied in the unit.

- Let's look back at some of the situations we have studied so far. Here are four equations, their graphs, and the related situation. What seems to determine whether the graph of a quadratic relationship is a parabola with a minimum point or parabola with a maximum point?

ACE Assignment Guide for Problem 4.2



Core 5–8, 11–17

Other Applications 9,10; Connections 33–35; Extensions 54; and unassigned choices from previous problems

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

Connecting to Prior Units 33: *Covering and Surrounding, Stretching and Shrinking*; 34, 35: *Filling and Wrapping*

Answers to Problem 4.2

- A. 1. Note the graphs below are shown with x -axes in increments of 0.1.

Frog

Time (seconds)	Height (ft)
0.0	0.2
0.1	1.24
0.2	1.96
0.3	2.36
0.4	2.44
0.5	2.2
0.6	1.64
0.7	0.76
0.8	−0.44
0.9	−1.96
1.0	−3.8

Flea

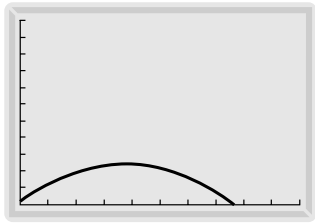
Time (seconds)	Height (ft)
0.0	0.0
0.1	0.64
0.2	0.96
0.3	0.96
0.4	0.64
0.5	0.0
0.6	−0.96
0.7	−2.24
0.8	−3.84
0.9	−5.76
1.0	−8

Basketball Player

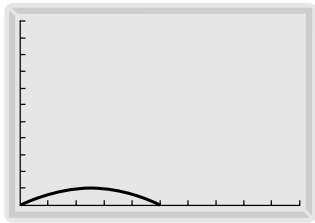
Time (seconds)	Height (ft)
0.0	6.5
0.1	7.94
0.2	9.06
0.3	9.86
0.4	10.34
0.5	10.50
0.6	10.34
0.7	9.86
0.8	9.06
0.9	7.94
1.0	6.5

Graphs of:

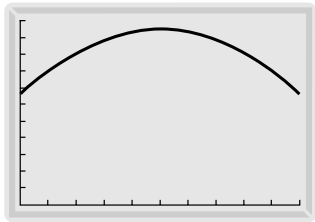
$$h = -16t^2 + 12t + 0.2$$



$$h = -16t^2 + 8t$$



$$h = -16t^2 + 16t + 6.5$$

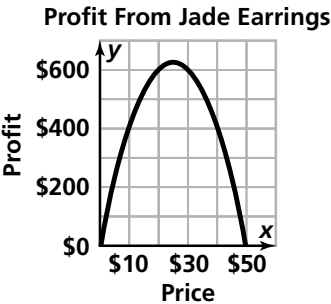


2. Maximum heights: Frog: 2.45 feet (after 0.375 seconds);
flea: 1.0 feet (after 0.25 seconds);
Basketball player: 10.5 feet (after 0.5 seconds).
3. Time each jump lasts: frog: about 0.76 seconds; flea: 0.5 seconds;
basketball player: about 1.3 seconds

4. The constant is the jumper's height. The frog is 0.2 feet tall (about 2.4 inches); the basketball player is 6.5 feet tall (about 6 feet 6 inches). In the graph, this information corresponds to the y-intercept.
5. For all the jumpers, the change in height for each 0.1-second increment decreases as the jumper approaches the maximum height and then increases as the jumper returns to the ground. This pattern is reflected in the tables in that the change in consecutive values for height decreases until the maximum height, and then increases until the height reaches its initial value. In the graphs, the parabola rises steeply, leveling out at the maximum point, and then decreases.

B. 1. Profits From Jade Earrings

Price	Profits
\$0	\$0
\$5	\$225
\$10	\$400
\$15	\$525
\$20	\$600
\$25	\$625
\$30	\$600
\$35	\$525
\$40	\$400
\$45	\$225
\$50	\$0



2. The table shows that profit reaches its maximum of \$625 when the price is \$25. This can also be seen in the graph, as the maximum point occurs at (25, 625). The equation is similar to the equation for the height of the flea; if this is a quadratic equation, it should have a maximum value. This would mean that as price increases, profit would grow to a point and then, when the price gets too high for customers, the number of customers falls and the profit would start to fall.
3. The price of \$25 will bring the greatest profit.
4. The equation is similar to those for predicting maximum height of frogs, fleas, and the basketball player in that it contains a term that involves the square of the variable preceded by a negative coefficient and a term that involves the variable multiplied by a constant amount. Like the equation for the height of a flea, this equation does not contain a constant term. Like the other equations in this unit, the graph of this equation is a parabola.