Name_____ Date _____

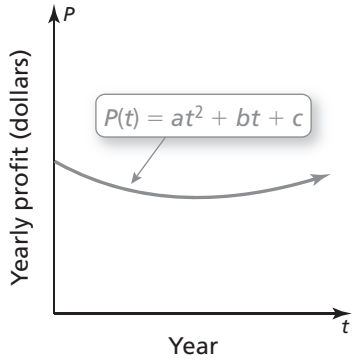
2.4 Modeling with Quadratic Functions

For use with Exploration 2.4

Essential Question How can you use a quadratic function to model a real-life situation?

1 EXPLORATION: Modeling with a Quadratic Function

Work with a partner. The graph shows a quadratic function of the form $P(t) = at^2 + bt + c$ which approximates the yearly profits for a company, where $P(t)$ is the profit in year t.



a. Is the value of a positive, negative, or zero? Explain.

b. Write an expression in terms of a and b that represents the year t when the company made the least profit.

c. The company made the same yearly profits in 2004 and 2012. Estimate the year in which the company made the least profit.

d. Assume that the model is still valid today. Are the yearly profits currently increasing, decreasing, or constant? Explain.

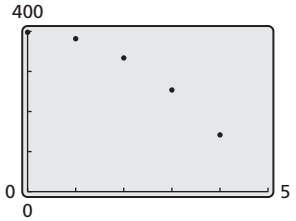
2 EXPLORATION: Modeling with a Graphing Calculator

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. The table shows the heights h (in feet) of a wrench t seconds after it has been dropped from a building under construction.

Time, *t*	0	1	2	3	4
Height, *h*	400	384	336	256	144

a. Use a graphing calculator to create a scatter plot of the data, as shown at the right. Explain why the data appear to fit a quadratic model.



2 EXPLORATION: Modeling with a Graphing Calculator (continued)

b. Use the *quadratic regression* feature to find a quadratic model for the data.

c. Graph the quadratic function on the same screen as the scatter plot to verify that it fits the data.

d. When does the wrench hit the ground? Explain.

Communicate Your Answer

3. How can you use a quadratic function to model a real-life situation?

4. Use the Internet or some other reference to find examples of real-life situations that can be modeled by quadratic functions.

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2.4 Notetaking with Vocabulary

For use after Lesson 2.4

In your own words, write the meaning of each vocabulary term.

average rate of change

system of three linear equations

Core Concepts

Writing Quadratic Equations

Given a point and the vertex (h, k)	Use vertex form: $y = a(x - h)^2 + k$
Given a point and *x*-intercepts *p* and *q*	Use intercept form: $y = a(x - p)(x - q)$
Given three points	Write and solve a system of three equations in three variables.

Notes:

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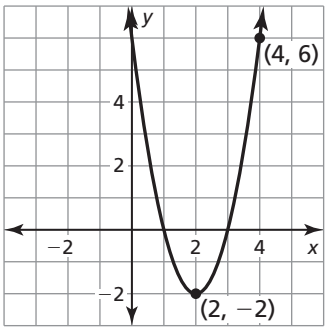
2.4 Notetaking with Vocabulary (continued)

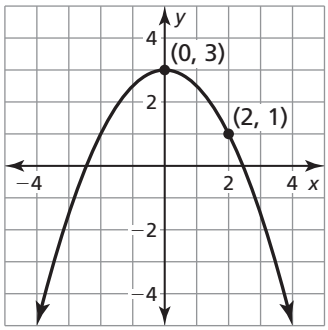
Extra Practice

In Exercises 1–4, write an equation of the parabola in vertex form.

1.



2.

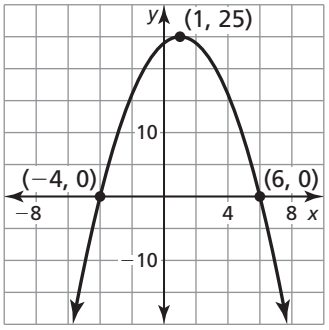


3. passes through $(-3, 0)$ and has vertex $(-1, -8)$

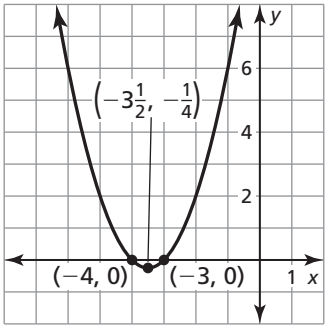
4. passes through $(-4, 7)$ and has vertex $(-2, 5)$

In Exercises 5–8, write an equation of the parabola in intercept form.

5.



6.



7. x-intercepts of -5 and 8; passes through $(1, 84)$

8. x-intercepts of 7 and 10; passes through $(-2, 27)$

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2.4 Notetaking with Vocabulary (continued)

In Exercises 9–11, analyze the differences in the outputs to determine whether the data are *linear*, *quadratic* or *neither*. If linear or quadratic, write an equation that fits the data.

9.

Time (seconds), *x*	1	2	3	4	5	6
Distance (feet), *y*	424	416	376	304	200	64

10.

Time (days), *x*	0	3	6	9	12	15
Height (inches), *y*	36	30	24	18	12	6

11.

Time (years), *x*	1	2	3	4	5	6
Profit (dollars), *y*	5	15	45	135	405	1215

12. The table shows a university's budget (in millions of dollars) over a 10-year period, where $x = 0$ represents the first year in the 10-year period.

Years, *x*	0	1	2	3	4	5	6	7	8	9
Budget, *y*	65	32	22	40	65	92	114	128	140	150

a. Use a graphing calculator to create a scatter plot. Which better represents the data, a line or a parabola? Explain.

b. Use the *regression* feature of your calculator to find the model that best fits the data.

c. Use the model in part (b) to predict when the budget of the university is \$500,000,000.00.