



UNDERSTAND

7. **Communicate Precisely** Create a flow chart to show the process to determine whether a given data set represents a function that is linear, quadratic, exponential, or none of these.
8. **Generalize** Calculate the 2nd differences for data in each table. Use a graphing calculator to find the quadratic regression for each data set. Make a conjecture about the relationship between the a values in the quadratic models and the 2nd differences of the data.

x	y
0	0
1	3
2	12
3	27
4	48

x	y
1	0.5
2	2
3	4.5
4	8
5	12.5

x	y
0	4
1	16
2	36
3	64
4	100

x	y
3	58.5
5	162.5
7	318.5
9	526.5
11	786.5

9. **Error Analysis** What is the error in the student's reasoning below? Describe how to correct the statement.

The data can be modeled with a linear function because the first differences are constant.

x	y
-3	-8
-1	-2
0	4
1	10
3	16

X

10. **Higher Order Thinking** A savings account has a balance of \$1. Savings Plan A will add \$1,000 to an account each month, and Plan B will double the amount each month.
- Which plan is better in the short run? For how long? Explain.
 - Which plan is better in the long run? Explain.

PRACTICE

Determine whether a linear, quadratic, or exponential function is the best model for the data in each table. SEE EXAMPLE 1

11.

x	y
0	-9
1	-7
2	-1
3	17
4	71

12.

x	y
0	1
1	2
2	7
3	16
4	29

13.

x	y
0	56
1	57
2	50
3	35
4	12

14.

x	y
0	-6
1	-3
2	0
3	3
4	6

Do the data suggest a linear, quadratic, or an exponential function? Use regression to find a model for each data set. SEE EXAMPLE 2

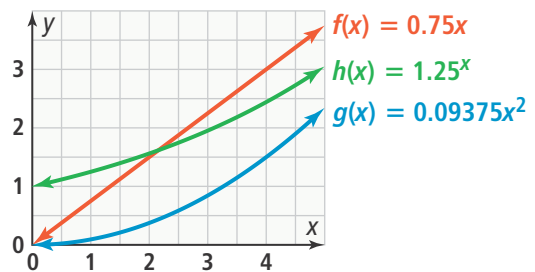
15.

x	0	1	2	3	4
y	-20	-17.5	-15.1	-12.5	-10

16.

x	6	7	8	9	10
y	-19	-12	-7	-4	-3

17. Use the functions shown. SEE EXAMPLE 3



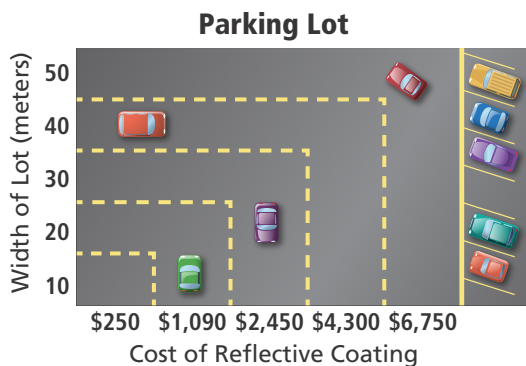
- Evaluate each function for $x = 6$, $x = 8$ and $x = 12$.
- When will function h exceed function f and function g ?

APPLY

18. Model With Mathematics The data in the table show the population of a city for the past five years. A new water plant will be built when the population exceeds 1 million. Will the city need a new water plant in the next ten years? Use a function model to justify your answer.

Year	2016	2017	2018	2019	2020
Population	794,000	803,000	814,000	822,000	830,000

19. Construct Arguments The graphic shows costs for rectangular lots of different widths. Each lot is twice as long as it is wide.



To coat a parking lot 300 m long and 150 m wide, a developer budgeted \$20,220, or three times the cost of a lot 50 m wide. Will the budget be sufficient? Justify your answers using a function model.

20. Construct Arguments Carmen is considering two plans to pay off a \$10,000 loan. The tables show the amount remaining on the loan after x years.

Plan A		Plan B	
Year	Amount Remaining	Year	Amount Remaining
0	10,000	0	10,000
1	9,000	1	9,500
2	8,100	2	9,000
3	7,290	3	8,500
4	6,561	4	8,000

Which plan should Carmen use to pay off the loan as soon as possible? Justify your answer using a function model.

ASSESSMENT PRACTICE

- 21.** Function f has constant second differences. Which of the following are true? Select all that apply.
- (A) The graph of f is a parabola.
 - (B) The graph of f is a straight line.
 - (C) The ratios of the y -values increase as x increases.
 - (D) The function f is an exponential function.
 - (E) The function f has constant first differences.

22. SAT/ACT At what point will $f(x) = 3^x$ exceed $g(x) = 2x + 5$ and $h(x) = x^2 + 4$?

- (A) (1, 7)
- (B) (1.8, 7.3)
- (C) (2, 9)
- (D) (2.4, 9.8)

23. Performance Task Ella wrote three different computer apps to analyze some data. The tables show the time in milliseconds y for each app to analyze data as a function of the number of data items x .

App A		App B		App C	
x	y	x	y	x	y
4	11	4	4,042	4	4,400
5	173	5	5,040	5	5,375
6	659	6	6,038	6	6,550
7	2,117	7	7,036	7	7,925
8	6,491	8	8,034	8	9,500

Part A Use regression on a graphing calculator to find a function that models each data set. Explain your choice of model.

Part B Make a conjecture about which app will require the most time as the number of data items gets very large. How could you support your conjecture?