# Data Model Detectives

*Fit linear, quadratic, and exponential functions.*

HIGH SCHOOL · HSS-ID.B.6a

**CCSS.Math.Content.HSS-ID.B.6a** "Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models."

NAME ____________________ DATE __________

## SPOT THE PATTERN

When x-values are equally spaced, constant first differences suggest a linear model, constant second differences suggest a quadratic model, and a constant multiplier suggests an exponential model. Use the pattern and the situation to choose a function, then substitute an x-value to make a prediction.

### WORKED EXAMPLE

The points (6, 31), (8, 39), and (10, 47) follow a linear pattern. Fit a linear function, then find y when x = 12.

1. The change in y is 8 while the change in x is 2, so m = 8/2 = 4.
2. Use (6, 31): 31 = 4(6) + b, so b = 7.
3. The function is y = 4x + 7.
4. When x = 12, y = 4(12) + 7 = 55.

**Answer: y = 4x + 7; when x = 12, y = 55**

## PRACTICE 6 problems

**1** The points (13, 21), (14, 23), and (15, 25) fit a linear function. Write the function and find y when x = 16.

**ANSWER** ____________________

**2** The points (-2, 5), (-1, 2), (0, 1), (1, 2), and (2, 5) fit a quadratic function. Write the function and find y when x = 5.

**ANSWER** ____________________

**3** The table shows an exponential pattern: x = 0, 1, 2 and y = 5, 15, 45. Write the function and find y when x = 3.

**ANSWER** ____________________

**4** The table shows x = 13, 14, 15 and y = 81, 27, 9. Is the model linear, quadratic, or exponential? Write a function for the data.

**ANSWER** ____________________

**5** A linear model y = 9x + 2 gives total points y after x games. Find y when x = 11.

**ANSWER** ____________________

**6** The points (16, 19), (17, 20), and (18, 23) fit a quadratic function. Write the function in vertex form and find y when x = 20.

**ANSWER** ____________________

## APPLY IT
Show your work

**1** A student starts a concert-ticket fund with $2. At week 3, the fund has $17. At week 5, the fund has $27. Assume the fund continues to grow in a linear pattern. Write a model for the amount y after x weeks, then find the amount after 11 weeks.

WORK SPACE

**ANSWER** ____________________

**2** For a video project, a tossed prop has heights of 21 meters at 0 seconds, 34 meters at 1 second, and 37 meters at 2 seconds. Assume the height follows a quadratic model h = at^2 + bt + c. Write the model and predict the height at 3 seconds.

WORK SPACE

**ANSWER** ____________________

## CHALLENGE
One step up

**CHALLENGE**

The data points (0, 81), (1, 27), (2, 9), and (3, 3) are shown. Explain why an exponential model fits better than a linear model. Write the model and find y when x = 5.

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ANSWER KEY **Data Model Detectives** HIGH SCHOOL · HSS-ID.B.6a

## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | The points (13, 21), (14, 23), and (15, 25) fit a linear function. Write the function and find y when x = 16. | **y = 2x - 5; when x = 16, y = 27** |
| 2 | The points (-2, 5), (-1, 2), (0, 1), (1, 2), and (2, 5) fit a quadratic function. Write the function and find y when x = 5. | **y = x^2 + 1; when x = 5, y = 26** |
| 3 | The table shows an exponential pattern: x = 0, 1, 2 and y = 5, 15, 45. Write the function and find y when x = 3. | **y = 5(3^x); when x = 3, y = 135** |
| 4 | The table shows x = 13, 14, 15 and y = 81, 27, 9. Is the model linear, quadratic, or exponential? Write a function for the data. | **Exponential; y = 81(1/3)^(x - 13)** |
| 5 | A linear model y = 9x + 2 gives total points y after x games. Find y when x = 11. | **101** |
| 6 | The points (16, 19), (17, 20), and (18, 23) fit a quadratic function. Write the function in vertex form and find y when x = 20. | **y = (x - 16)^2 + 19; when x = 20, y = 35** |

## PART 2 · APPLY IT

1. **y = 5x + 2; after 11 weeks, the fund has $57.** The fund increases by $10 over 2 weeks, so the rate is $5 per week. Use the starting amount of $2, then evaluate 5(11) + 2.
2. **h = -5t^2 + 18t + 21; at 3 seconds, the height is 30 meters.** The second difference is -10, so a = -5. The value at 0 gives c = 21, and the value at 1 gives b = 18; then evaluate the model at t = 3.

## CHALLENGE

**An exponential model fits because the y-values are multiplied by 1/3 for each increase of 1 in x, not changed by a constant amount. The model is y = 81(1/3)^x, and y = 1/3 when x = 5.**

Accept algebraically equivalent forms of each function. For contextual answers, require the predicted value and appropriate units.