

2.6 Competing Function Model Validation

2.6 Practice

AP Precalculus

1. The salary of a high school teacher typically increases as they have more experience. Below is a list of teacher salaries for one district based on their years of experience.

Years taught t	0	4	10	15	25	30
Annual Salary S	\$53,300	\$61,500	\$68,800	\$72,150	\$77,600	\$79,900

- a. Find a linear regression curve. Round to three decimal places.

$$S(t) = 822.826x + 57355.435$$

- b. Use your model from part *a* to find the error at $t = 4$.

$$S(4) = 60,646.739$$

$$60,646.739 - 61,500 = -853.261$$

- c. Is the value predicted an overestimate or underestimate of the actual value?

Underestimate

2. The altitude of the Sun is simply a measurement of how high it appears above the horizon, in terms of an angular measurement. On Halloween, Mr. Bean does his best to measure the sun's altitude throughout the day. The measurements in hours h since sunrise and the angle a in degrees are given below.

Hours h since sunrise (input)	0.5	3	7	10	11
Altitude a in degrees (output)	6	32	41	12	0

- a. Find a quadratic regression curve. Round to three decimal places.

$$a(h) = -1.458h^2 + 16.164h - 2.195$$

- b. Use your model from part *a* to find the error at $h = 10$.

$$a(10) = 13.645$$

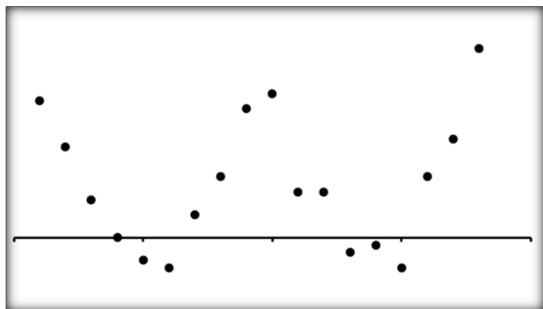
$$13.645 - 12 = 1.645$$

- c. Is the value predicted an overestimate or underestimate of the actual value?

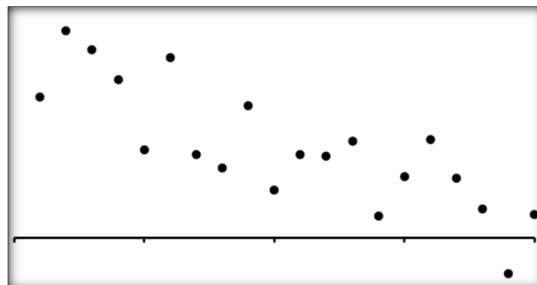
Overestimate

3. A student creates a model for a data set. Which of the following could be an appropriate residual plot for their **linear** regression? More than one answer may apply.

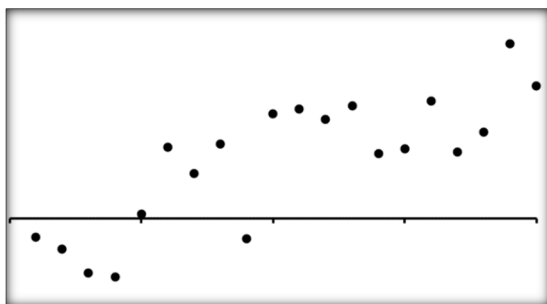
I.



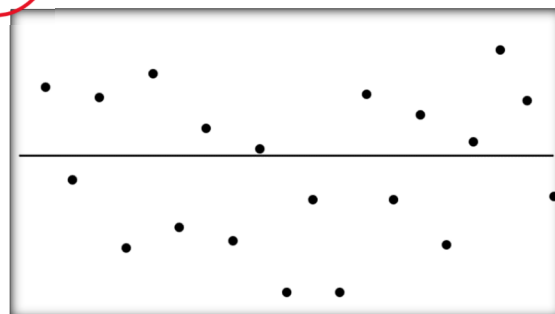
II.



III.

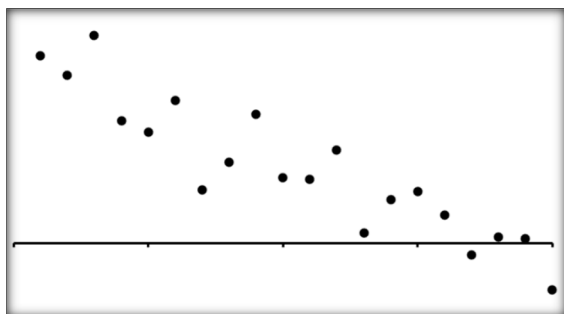


IV.

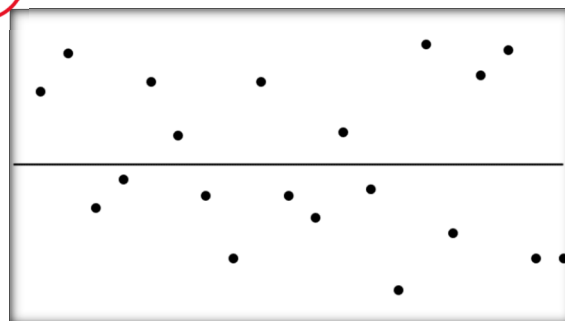


4. A student creates a model for a data set. Which of the following could be an appropriate residual plot for their **quadratic** regression? More than one answer may apply.

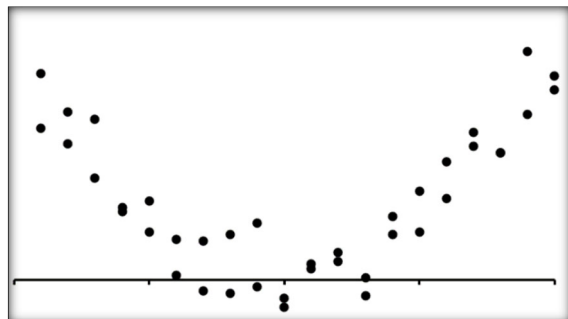
I.



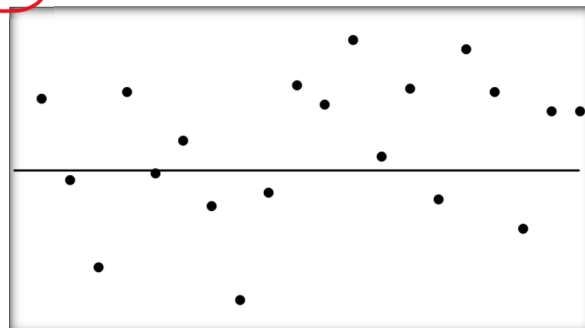
II.



III.

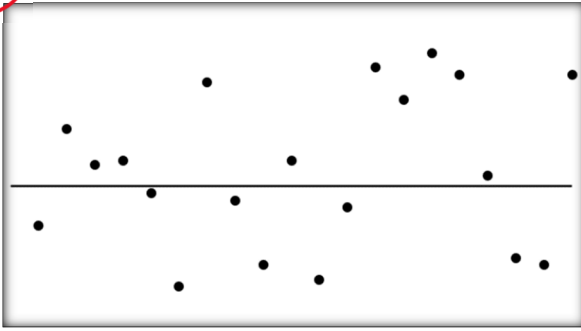


IV.

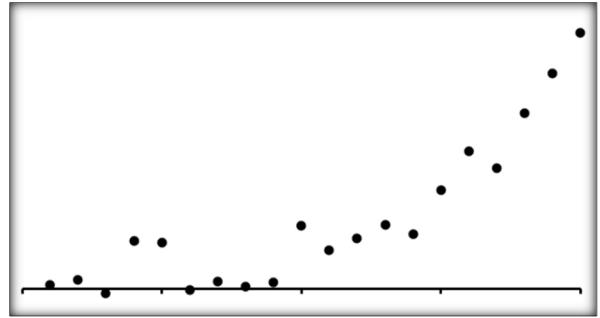


5. A student creates a model for a data set. Which of the following could be an appropriate residual plot for their **exponential** regression? More than one answer may apply.

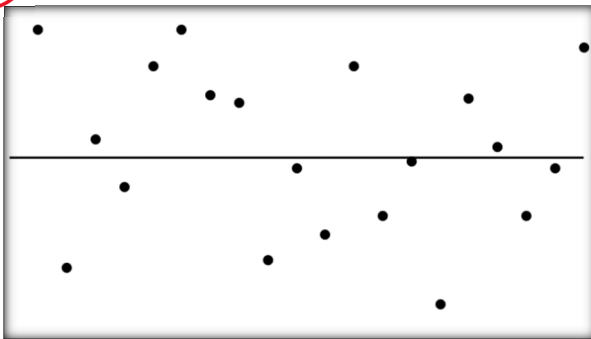
I.



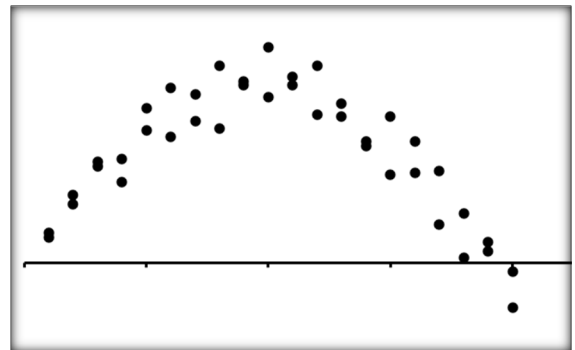
II.



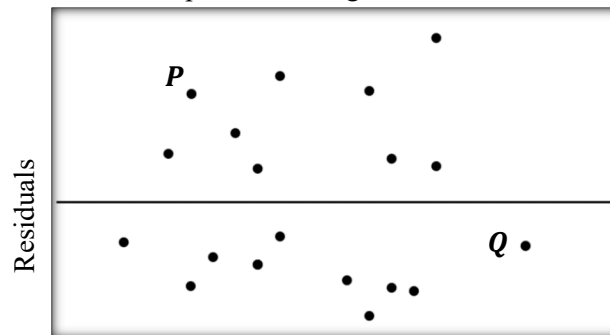
III.



IV.



6. Students from an AP Precalculus class were brought to the gym to shoot free throws, but only the students with little-to-no basketball experience were allowed to shoot. Each student was given 60 seconds to shoot as many free throws as possible. A regression model was calculated with the student's height (in inches) as input values and the number of shots made as the output values. The residual plot for the regression model and data points is below.



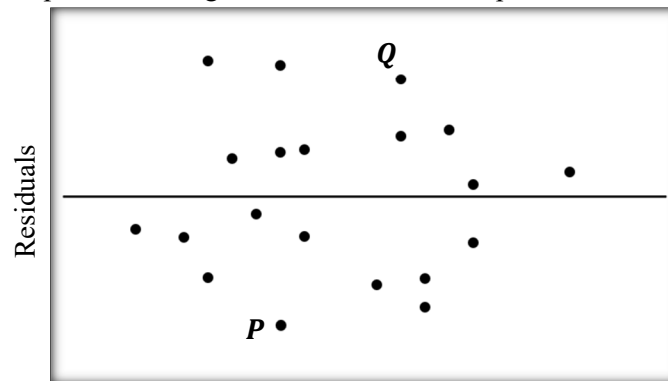
- a. The given residual plot has a point labeled P at the coordinate $(62, 4.7)$. What does point P indicate in the context?

Because point P is above the x -axis, for the student with a height of 62 inches, the model underestimates the actual number of shots made by 4.7.

- b. The point labeled Q is at the coordinate $(74, -2.4)$. What does point Q indicate in the context?

Because point Q is below the x -axis, for the student with a height of 74 inches, the model overestimates the actual number of shots made by 2.4.

7. After getting a driver's license, the reality of monthly insurance costs (premiums) sets in for many people. Insurance companies charge less for insurance the more years of experience a driver has. A local high school statistics class collects information from several insurance companies regarding their monthly insurance premiums. A regression model was calculated with the driver's experience (in years) as input values and the monthly premiums (in dollars) as the output values. The residual plot for the regression model and data points is below.



- a. The given residual plot has a point labeled P at the coordinate $(6, -102.5)$. What does point P indicate in the context?

Because point P is below the x -axis, for the driver with 6 years of driving experience, the model overestimates the monthly insurance premium by \$102.50.

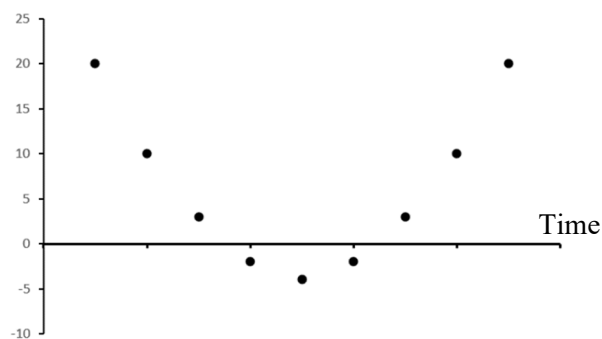
- b. The point labeled Q is at the coordinate $(10, 97.34)$. What does point Q indicate in the context?

Because point Q is above the x -axis, for the driver with 10 years of driving experience, the model underestimates the monthly insurance premium by \$97.34.

2.6 Competing Function Model Validation

2.6 Test Prep

8. Mr. Brust started a new online business selling Brust-merch. He made estimates about his revenue, and used an exponential regression to develop a model for sales over time. The figure shows the graph of the residuals of the exponential regression. Which of the following statements about the exponential regression is true?



- (A) The exponential model is appropriate because there is a clear pattern in the graph of the residuals.
- (B) The exponential model is appropriate because there are data points both above and below the x -axis.
- (C) The exponential model is not appropriate, because there is a clear pattern in the graph of the residuals.
- (D) The exponential model is not appropriate because the residuals are not in an exponential pattern.