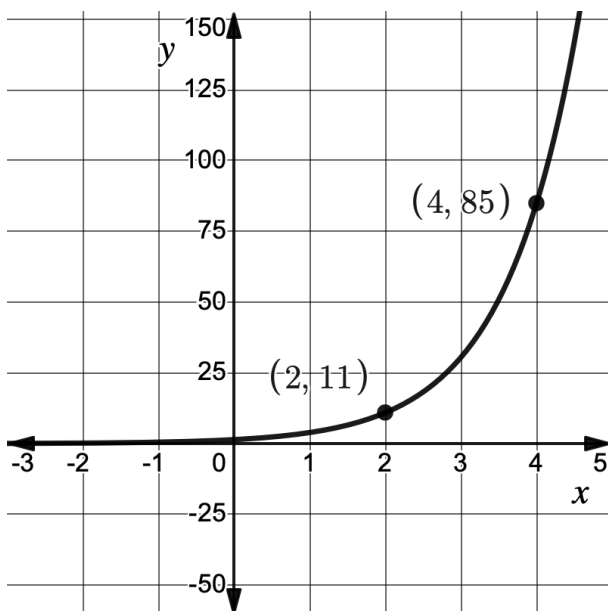


A. Tigers are an endangered species. In 2015 there were approximately 3200 tigers worldwide. Because tigers were verging on extinction, many countries began protecting them. This helped to increase the population by 40% over the 7 years since 2015.

- Approximate the number of tigers in 2022.
- Write an equation with a fractional exponent giving the tiger population for any year during the 7-year growth period, where $t(n)$ is the number of tigers and n is the number of years after 2015.
- Using your equation, predict the number of tigers in 2018. Round to the nearest whole number.



B. The graph of a function f is shown. Write an equation that could be used to model f .



C. The mass of a sample of Phosphorus-32, a radionuclide commonly used in biochemical research, can be modeled by the function $M(t) = 175 \left(\frac{1}{32}\right)^{\frac{t}{71.5}}$ where $M(t)$ is the mass of the sample after t days. What is the half-life of Phosphorus-32?

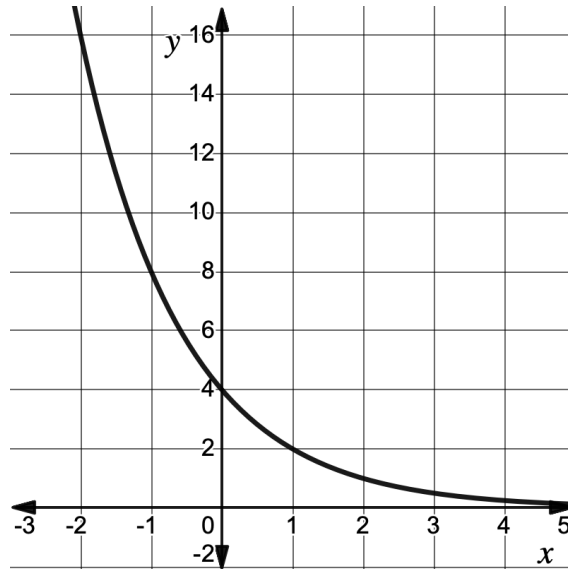


D. A family of six mice can multiply into a family of 60 mice in a mere three months. Write an equation for $M(t)$, the number of mice in the family after t months where $M(0) = 6$.



E. The graph of a function f is shown. Which of the following equations represent f ? Choose all that apply.

- I. $f(x) = \left(\frac{1}{2}\right)^x$
- II. $f(x) = 4 \cdot 2^x$
- III. $f(x) = 4 \cdot \left(\frac{1}{2}\right)^x$
- IV. $f(x) = 8 \cdot \left(\frac{1}{2}\right)^{x+1}$
- V. $f(x) = \left(\frac{1}{2}\right)^{x+2}$
- VI. $f(x) = \left(\frac{1}{2}\right)^{x-2}$
- VII. $f(x) = \frac{4}{2^x}$
- VIII. $f(x) = -4 \cdot 2^{-x}$



 CALC MEDIC

F. The minimum wage in the state of New York has increased exponentially. In 1981, the minimum wage was \$3.35 an hour and in 2016, the minimum wage was \$9.00 an hour.

- a. Calculate the annual rate of growth in the minimum wage. Round to the nearest thousandth of a percent.
- b. Write an equation for $M(t)$, the minimum wage in the state of New York t years after **1980**.
- c. Use your equation in part b to predict the minimum wage in New York in 2022.
- d. The actual minimum wage in 2022 was \$13.20. How does this compare with your prediction?

 CALC MEDIC

G. Aphids are very small, soft-bodied insects found on most plants in yards or gardens and that have an astounding reproductive capacity. A population of aphids gains $\frac{7}{8}$ of its size every 2.5 days. Mara counts 53 aphids on a vegetable plant in her yard. Write an equation for a function A , that gives the aphid population in Mara's yard, $A(t)$, after t days.



H. Katarina works at an ice cream shop. She notices that on days when the temperature is higher, the store sells more ice cream. She tracks this data over the summer and notices a linear pattern that can be modeled by the least squares regression line $\hat{y} = -183.97 + 31.82x$, where \hat{y} is the daily predicted sales, in dollars, when the temperature is x° Celsius. On one day when the temperature is 27° Celsius, the total ice cream sales are \$720. Calculate and interpret the residual for this day.

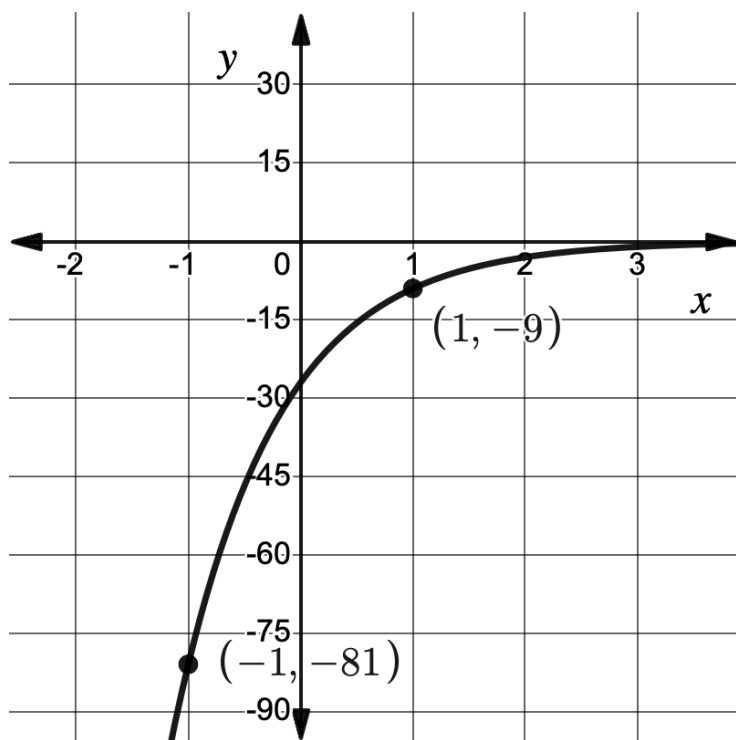


I. The half-life of Rf-265, an isotope of the element Rutherfordium, is 13 hours.

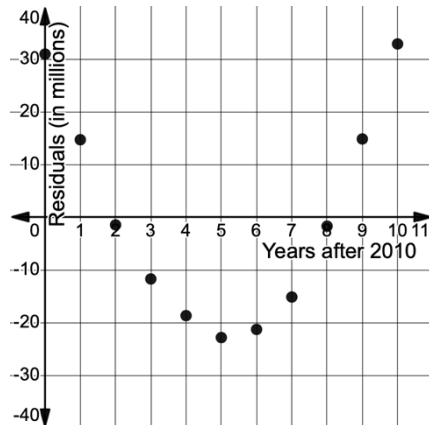
- Write an equation for $R(h)$, the amount of Rf-265 remaining from a 500-gram sample after h hours.
- Write an equation for $R(d)$, the amount of Rf-265 remaining from a 500-gram sample after d days.



J. The graph of $y = g(x)$ is shown. Write an equation for $g(x)$.



K. A group of high school students started studying the number of Twitter followers of their favorite pop star. A linear regression was used to develop a model for the number of Twitter followers of the pop star in the years since 2010. The figure shows a graph of the residuals of the linear regression. Is a linear model appropriate for the data? Explain why or why not.



 CALC MEDIC

L. If S dollars are placed in an account earning 1.85% interest, compounded continuously, write an expression that can be used to determine the amount of money in the account after 15 years.

 CALC MEDIC

M. An exponential function of the form $y = ab^x$ passes through the points (2, -3) and (5, -24). Find the values of a and b .



N. A patient receives a medication through an IV when arriving at the hospital. The amount of the medication in the patient, in milligrams, after t hours can be modeled by the function by

$$A(t) = 12 - 12e^{-\frac{t}{3}}.$$

- a. How many milligrams of the medication are in the patient after 2 hours? Round to the nearest thousandth.
- b. Use the graph of A to describe how the amount of medication in the patient is changing.
- c. What is the maximum dosage of this medication that the patient can receive?

