Module 2: Analyzing Structure

TOPIC 2: CHARACTERISTICS OF POLYNOMIAL FUNCTIONS

This topic opens with a study of power functions of the form $P(x) = ax^n$. Students are then introduced to polynomial functions and their transformations. They build cubic functions both graphically and algebraically and then close the topic by analyzing polynomial functions and applying polynomial functions to a variety of real-world situations. Throughout, students use their prior knowledge of function characteristics and transformations to generalize to polynomial functions.

Where have we been?

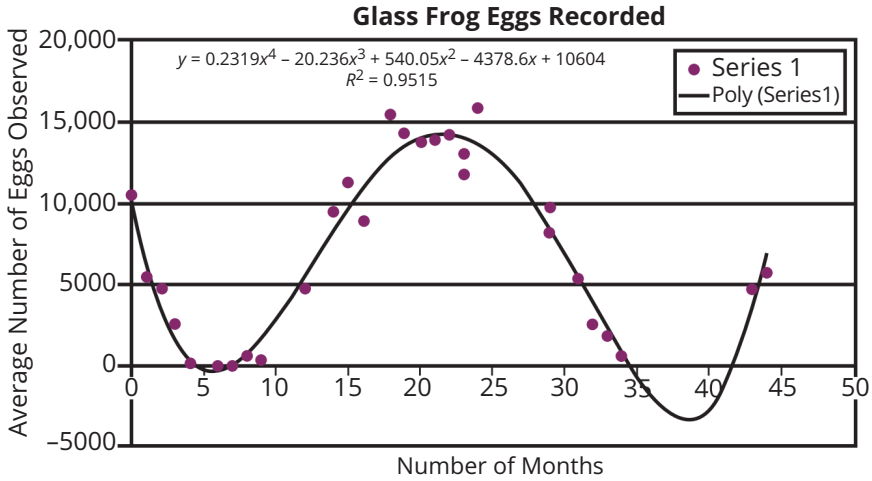
Students have extensive experience analyzing nonlinear functions, such as quadratic functions, identifying their key characteristics, and graphing their transformations. They have used functions to model situations and data and have built functions from other functions. Students have manipulated and solved basic polynomial equations.

Where are we going?

Students will work with polynomial functions and equations closely in the next two topics. Polynomial functions are used throughout the sciences and in engineering to model complex real-world situations and data sets.

Polynomial Functions Representing Data

You can use polynomial functions to represent real-world data.



The data shown represent the average number of frog eggs over the span of 44 months in a population of a rare, endangered species of frog called the glass frog. A quartic polynomial function can be graphed to fit these data.

The Double Helix

Children typically resemble their parents because of the inheritance of genes from parents to offspring. Scientists know of over 200 hereditary traits that are transmitted across generations of families. The genes that carry these traits are in specific strands of DNA. When you look at a species, you can determine or predict what the offspring may look like. The same thing is true for polynomials! If you know certain characteristics about the polynomial, you can predict what the graph will look like, as well as other key characteristics.

Talking Points

Polynomial functions can be an important topic to know about for college admissions tests.

Here is a sample question:

Let $C(x) = ax^4 + x^3 - bx^2 - 4x + c$.
If $C(x) \to \infty$ as $x \to \infty$, then describe the change in $C(x)$ as $x \to -\infty$.

Since the function has an even degree, it is an even function, which means that it has a symmetry about the *y*-axis.

So, as *x* approaches negative infinity, $C(x)$ approaches infinity.

Key Terms

symmetric about a line
If a graph is symmetric about a line, the line divides the graph into two identical parts.

symmetric about a point
A function is symmetric about a point if each point on the graph has a point the same distance from the central point, but in the opposite direction.

absolute minimum
A function has an absolute minimum if there is a point that has a *y*-coordinate that is less than the *y*-coordinates of every other point on the graph.

absolute maximum
A function has an absolute maximum if there is a point that has a *y*-coordinate that is greater than the *y*-coordinates of every other point on the graph.