5.4

Modeling Gig
Modeling Polynomial Data

LEARNING GOALS

In this lesson, you will:

- Model a problem situation with a polynomial function.
- Solve problems using a regression equation.

Americans watch a lot of movies. The first ever movie was made in the 1870s, but it wasn't until the early 20th century that movie theaters were invented. Americans lined up to pay a quarter to see black and white productions with no sound. As audio-visual technology advanced, so did the quality of movie productions. Changes in technology not only improved the quality of movies, they also led to changes in the entire industry.

The Video Home System (also known as VHS), developed in the 1970s, allowed consumers to rent or purchase movies and watch them on their TVs at home. With the invention of the remote control, people could even fast forward to their favorite parts, without even getting off the couch! Video stores were a huge business, leading way to newer technology that allowed customers to stream movies from their computers at home.

How do you think movies will change throughout the 21st Century? Do you think people will still go to "old-fashioned" movie theaters to watch movies?

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PROBLEM 1 **Strut Down the Statwalk**

The CALC_U-Now Company sells a variety of calculators. The table shows the relationship between the price of various models of graphing calculators and the monthly profit earned from the sale of the calculators.
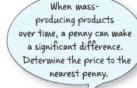
1. Analyze the data in the table of values.

Price of Calculators (dollars)	Monthly Profit (dollars)
65	15,950
70	17,600
75	19,060
80	19,300
85	19,290
90	19,240
95	18,000
100	17,150
105	15,300

a. What patterns do you notice in the data?

b. Describe the polynomial function that best models this data. Explain your reasoning.

2. Use a graphing calculator to determine the regression function that best models this data.

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3. Write inequalities to represent the prices for which CALC-U-Now would lose money? Explain your reasoning.

When mass-producing products over time, a penny can make a significant difference. Determine the price to the nearest penny.

4. CALC-U-Now must make budget cuts! As a financial contractor, you must determine which calculator price will generate the most profit. Write a statement to support your decision including all relevant mathematics.

PROBLEM 2   3,2,1…. Polynomial Modeling Action!

Inflation has influenced the price of a movie ticket over the years. The first movie theater opened in the year 1900, charging $.05 per ticket. The data provided shows how the average price of a movie ticket has increased over the years.
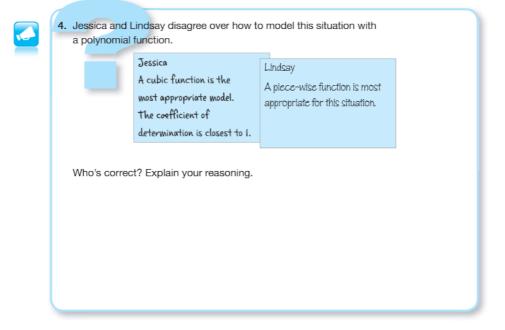
Years	Average Price of a Movie Ticket (dollars)
1900	0.05
1948	0.36
1958	0.68
1971	1.65
1983	3.15
1995	4.35
2003	6.03
2007	6.88
2009	7.50

Remember the function that best models the data has a coefficient of determination closest to 1.

1. Determine a regression function that best models this data.

2. Use your regression equation to predict when the average price of a movie ticket will reach $15.00. Explain your reasoning.

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3. Use your regression equation to predict the cost of a movie ticket in the year 2100. Explain your reasoning.

4. Jessica and Lindsay disagree over how to model this situation with a polynomial function.

Jessica
A cubic function is the most appropriate model. The coefficient of determination is closest to 1.

Lindsay
A piece-wise function is most appropriate for this situation.

Who's correct? Explain your reasoning.

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PROBLEM 3 "Polynomial Models" for $500, Please!

The Math Club sponsors an event each year to raise money for their trip to the Quiz Bowl. As the president of the Math Club, you propose having a movie night fundraiser. You survey the students to see how many students will attend. The number of students varies depending on the ticket price.

Ticket Price (dollars)	Students Who Will Attend
1.25	120
1.75	105
2.25	95
2.75	83
3.25	77
3.75	64
4.25	58
4.75	40
5.25	30

Take note of what information is given and how you can use this information to determine the amount of money raised for each ticket price.

Write a short letter to your principal about your findings. Include details about the exact ticket price that raises the most money as well as the approximate number of students who will attend.

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Be prepared to share your solutions and methods.