

Name:

IN THIS LESSON, YOU WILL:

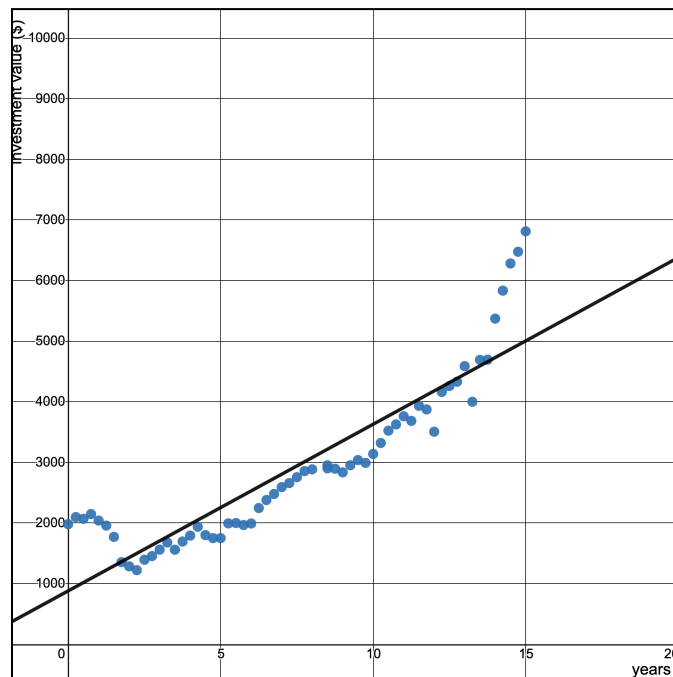
- Use technology to find the exponential function that best fits a data set
- Analyze how well a regression model fits a data set using r^2 values
- Use regression models to summarize trends and make predictions
- Analyze long-term trends in the stock market
- Use exponential regression to summarize trends for different portfolios, funds, and asset types



INTRO

GRAPH: Fahad's Investment

The data points below represent the value of Fahad's investment account over the last 15 years. Fahad wants to summarize the trends in his account, so he finds the line of best fit.



1. Based on his regression, Fahad wrote the equation for the line of best fit: $y = 275x + 881$.
 - a. What is the slope of the line of best fit?
 - b. What does the slope represent in this scenario?

2. Estimate Fahad's investment value after 15 years...

- Using the data points.
- Using the line of best fit.

3. Do you think the line of best fit gives you a good prediction? Why or why not?



LEARN IT

Measuring Goodness of Fit

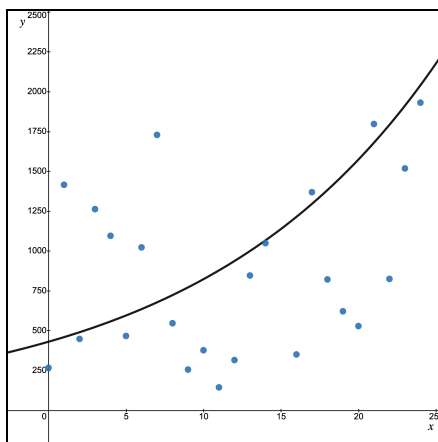
We can measure how well a model, like Fahad's line of best fit, matches the data points given by using a statistical measure called " r^2 ". Read the notes below and answer the questions that follow.

What is r^2 ?

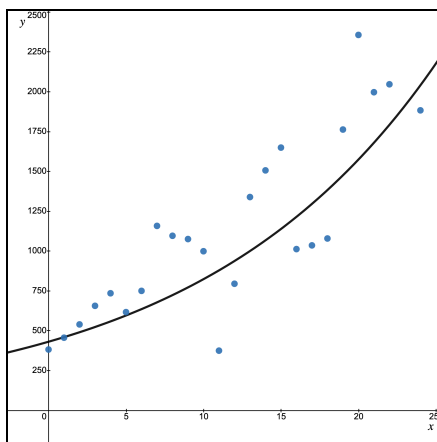
We can use a value called r^2 (read as "r-squared") as one measure of how well a model fits the data.

- r^2 is a number between 0 and 1
- r^2 measures how well the model can predict the data points. This is sometimes called the model's "goodness of fit".

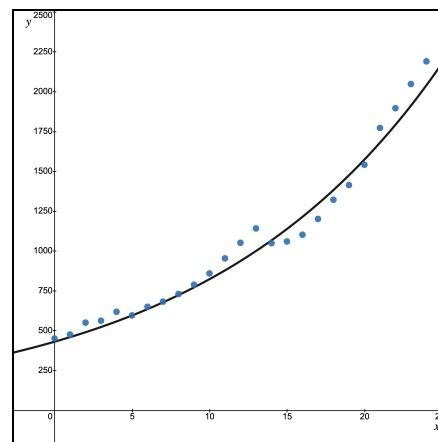
Low r^2
 $r^2 = 0.25$



Medium r^2
 $r^2 = 0.71$



High r^2
 $r^2 = 0.98$



1. In your own words, what does r^2 tell you?

2. Summarize: Looking at a graph, how might you know if a model had an r^2 value close to 1?



PRACTICE IT

Part I: Matching

1. Match each regression model with a corresponding r^2 value from the answer bank.

$$r^2 = -0.21$$

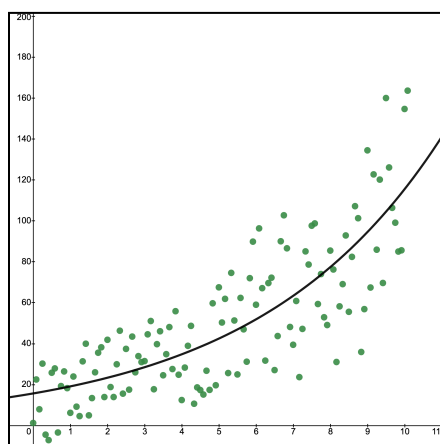
$$r^2 = 0.10$$

$$r^2 = 0.45$$

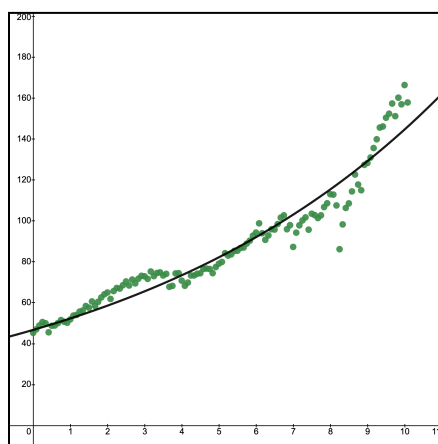
$$r^2 = 0.65$$

$$r^2 = 0.93$$

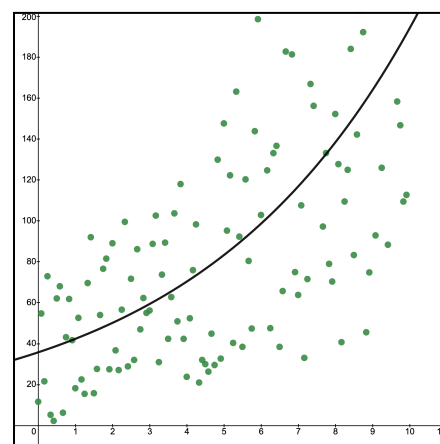
Model A: $r^2 =$ _____



Model B: $r^2 =$ _____



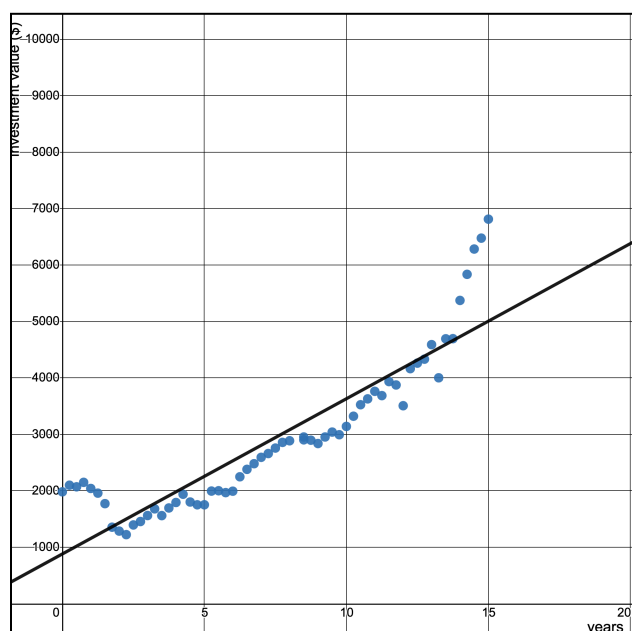
Model C: $r^2 =$ _____



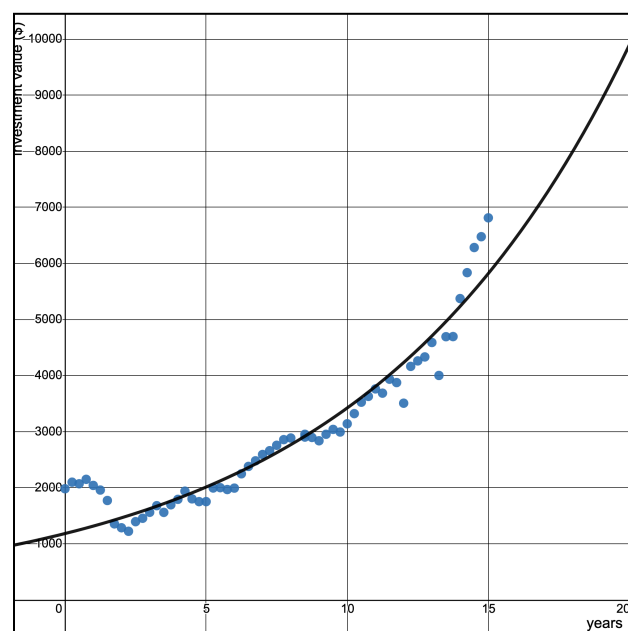
Part II: Fahad's Investments and r^2

Let's return to Fahad's investment from the start of the lesson. Fahad used a linear regression model to explain his investment's value, but we could also use an exponential model. Compare the models and answer the questions.

Linear Model



Exponential Model



$y_1 \sim mx_1 + b$ STATISTICS $r^2 = 0.8144$ $r = 0.9024$ PARAMETERS $m = 275.007$ $b = 881.17$		$y_1 \sim a \cdot b^{x_1}$ ☐ Log Mode ? STATISTICS $R^2 = 0.9181$ PARAMETERS ? $a = 1183.32$ $b = 1.11205$	
RESIDUALS e_1 plot		RESIDUALS e_2 plot	

1. What is the r^2 value of the linear model? What does that tell you?
2. Write the equation for the exponential model by substituting in the provided values for a and b. Round to the nearest hundredth.
3. Predict Fahad's investment value after 20 years...
 - a. Using the linear model.
 - b. Using the exponential model.
4. Which model is a better fit for the data set? Justify your response.



LEARN IT

DESMOS: Exponential Regression in Investing

In earlier lessons, you learned how to find the line that best fits a data set using a linear regression model. We can do the same thing with exponential functions. Follow your teacher's instructions to complete this Desmos activity.



APPLY IT

Follow your teacher's directions to complete the Application Problems.

Teachers, you can find the Application problems linked in the Lesson Guide.

