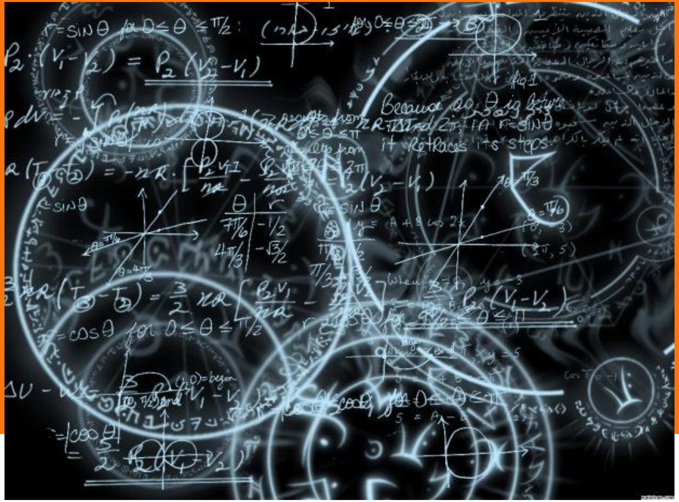
school@home

Algebra 1



Week: May 4-8

Announcements

Grades continue to be taken this week!

Be sure to email your teacher if you REDO or complete an assignment late.

Lesson Overview

We will... write, with and without technology, A.4(C) linear functions, A.8(B) quadratic functions & A.9(E) exponential functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems; A.4(A) calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity as a measure of the strength of the linear association.

I will... use Desmos to graph scatter plots, determine which type of function fits best, and then write the best-fit equation to model the data.

So that I can... precisely *describe* various features of the real world.

Table of Contents

Directions: Complete the following activities in order at your own pace.

Warm Up: The Functions of Algebra 1 Recap

1) **Watch** this video.

1) **Create** a classifying map that shows how to recognize each type of function (**Linear, Exponential & Quadratic**) from an equation, table and graph.

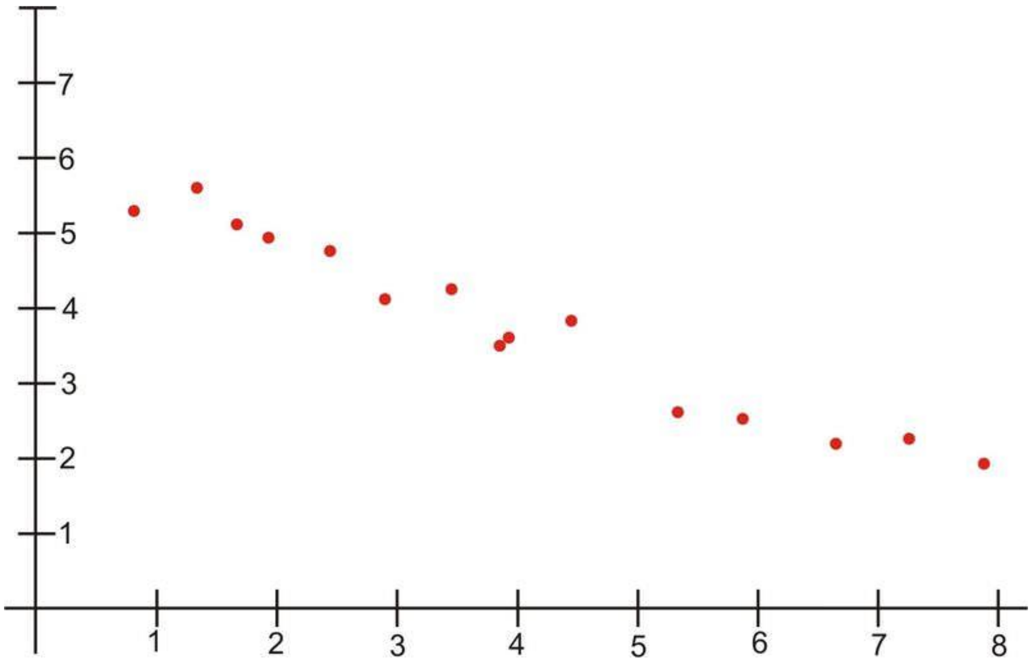
Regression (All Forms)

Directions:

1. Go through the slides of this presentation or watch the video.
2. Take notes as you go either in your journal or on a sheet paper.

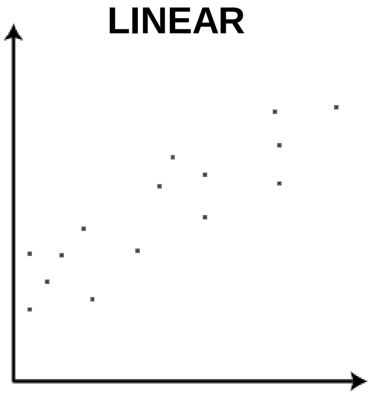
Mathematical Models v Reality

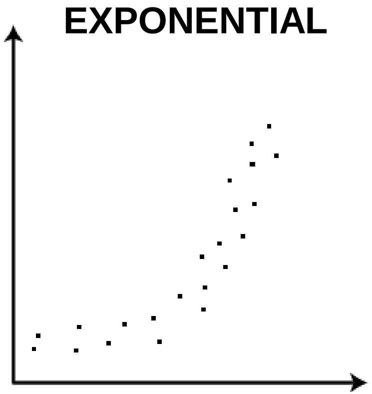
Which of the 3 mathematical function models we've studied (**linear, quadratic or exponential**) does this real life scatter plot most resemble? Why do you think that?

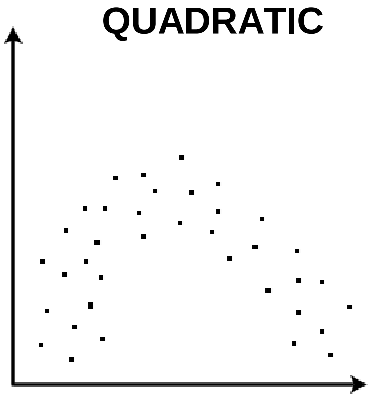


Mathematical Models v Reality

If Pinterest fails have taught us anything its...







Another difference between real life and function models is that a function, by definition, has no repeated *x*-values. This is not always, or even often, the case in the real world.

Mathematical Models v Reality (So why?)

- Mathematicians use models to **represent** how the real world works.
- The model is not the same as the real thing, but hopefully it is good enough to be **useful**.
- Mathematical models can also be used to **make predictions.**
- Mathematical models can get very **complex**, and so the mathematical rules often **involve technology**.
  - Weather prediction
  - Economic models (predicting interest rates, unemployment, etc)
  - Models of how large structures behave under stress (bridges, skyscrapers, etc)
  - And so many more …

If you become an expert in any of those you will have a job for life!

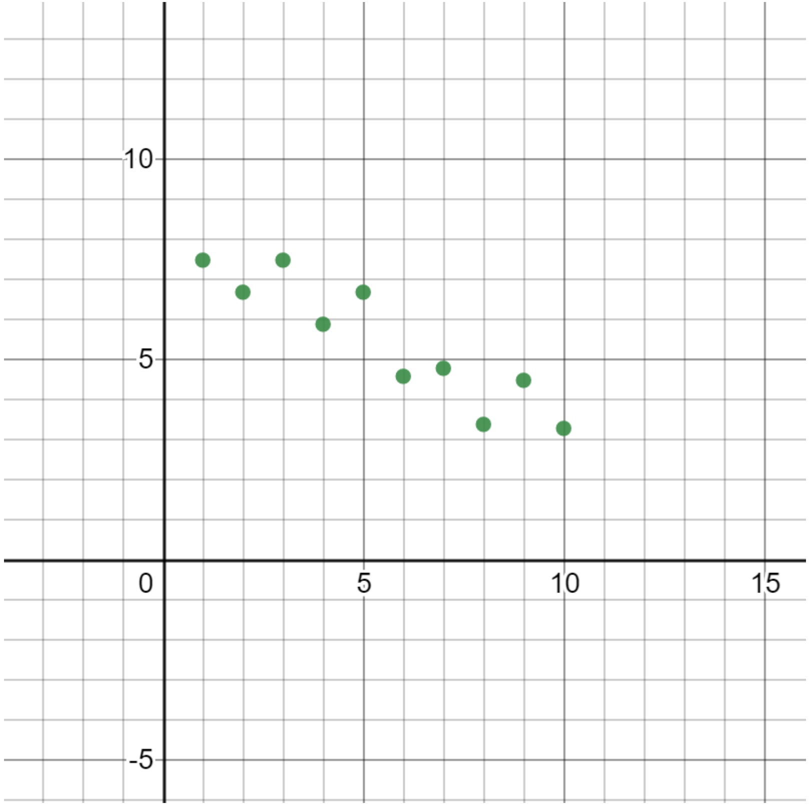
Example 1: Let's Examine Some Data

- Use Desmos to graph the data shown.
- Copy & paste the data from here
- ***OR*** manually entering the data by "+" a table
    - What type of graph (linear, exponential, or quadratic) does it **most resemble**?

x	y
1	7.5
2	6.7
3	7.5
4	5.9
5	6.7
6	4.6
7	4.8
8	3.4
9	4.5
10	3.3

Let's Write An Equation

- In order for our model to be **useful**, we have to tell our technology what kind of **model** to use (linear, quadratic or exponential).
- Light work! Of course, you recognized that this data most resembles a **linear** function.
- Depending on the technology you are using you can write a linear equation in any form (standard, point slope, slope-intercept), but **all** of them like **slope intercept**, so let's use that.



Let's Write An Equation

- To find the **linear** equation that fits that data the best, we can type in: **y1 ~ mx1 + b**
  - The **'~'** symbol tells Desmos to calculate the **regression equation** or **"best-fit"** function for that data.
  - The **"subscript",** y_1 & x_1, tell Desmos which data set to use. We know there is only one data set, but it doesn't.

Statistics, Parameters, ~~Residuals~~! Oh My!

2

$$y_1 \sim mx_1 + b$$

STATISTICS

$r^2 = 0.8393$

$r = -0.9162$

RESIDUALS

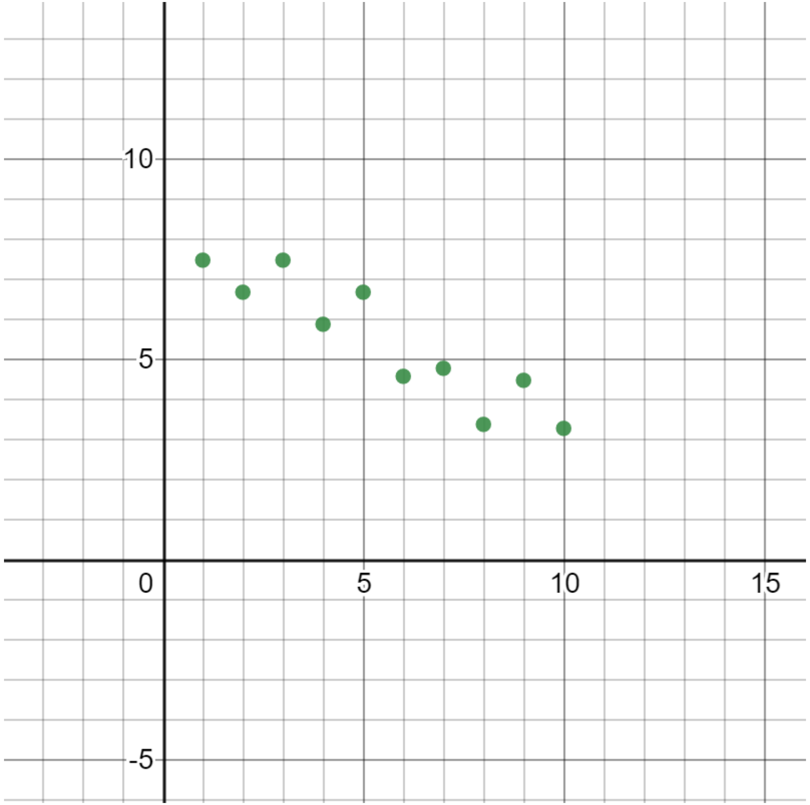
e_1 plot

PARAMETERS

$m = -0.479394$ $b = 8.12667$

SLOPE
approx (~) -0.5

y-intercept
approx (~) 8



Statistics, Parameters, ~~Residuals~~! Oh My!

2

$$y_1 \sim mx_1 + b$$

STATISTICS

$r^2 = 0.8393$

$r = -0.9162$

RESIDUALS

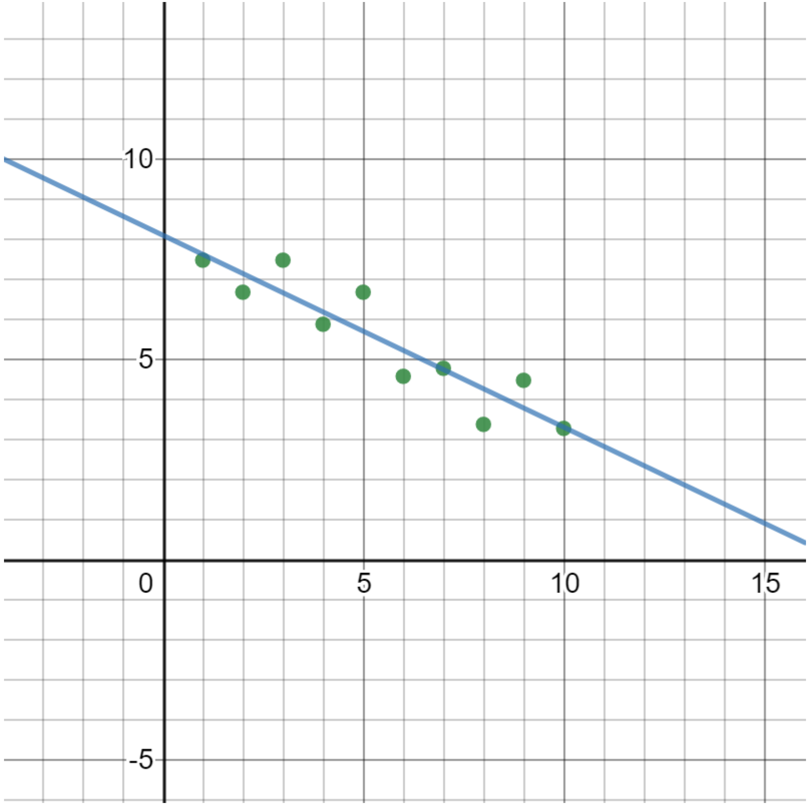
e_1 plot

PARAMETERS

$m = -0.479394$ $b = 8.12667$

We can use these parameters to write & graph the equation:

y = -0.5x + 8



Statistics, Parameters, ~~Residuals~~! Oh My!

2

$$y_1 \sim mx_1 + b$$

STATISTICS

$r^2 = 0.8393$

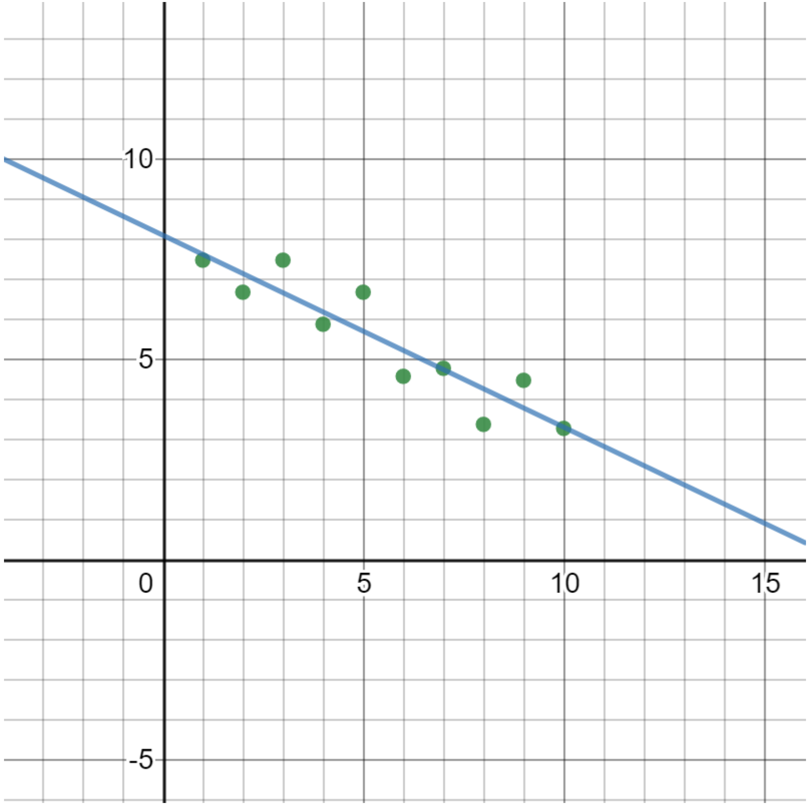
$r = -0.9162$

RESIDUALS

e_1 plot

The statistics **describe how well the line fits the data**.

See how some of the data is not exactly on the line? That means this line is not a perfect fit.



Statistics, Parameters, ~~Residuals~~! Oh My!

2

$$y_1 \sim mx_1 + b$$

STATISTICS

$r^2 = 0.8393$

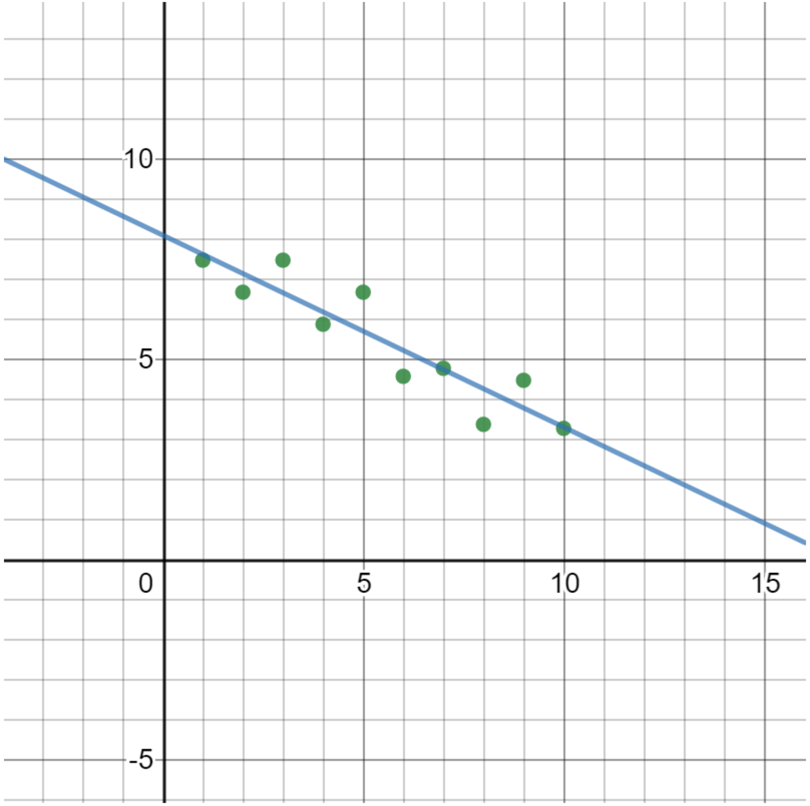
$r = -0.9162$

RESIDUALS

e_1 plot

The **r-value** is called the **correlation coefficient**. It tells us 2 thing:

1) This is a **very good, but not perfect fit**, because on a scale from -1 to 1, it's almost as far from 0 as it can get. Further from 0 means a "tighter" spread of data.
2) This line has a **negative slope**, because the r is negative.



Example 2: Let's Examine Some Data

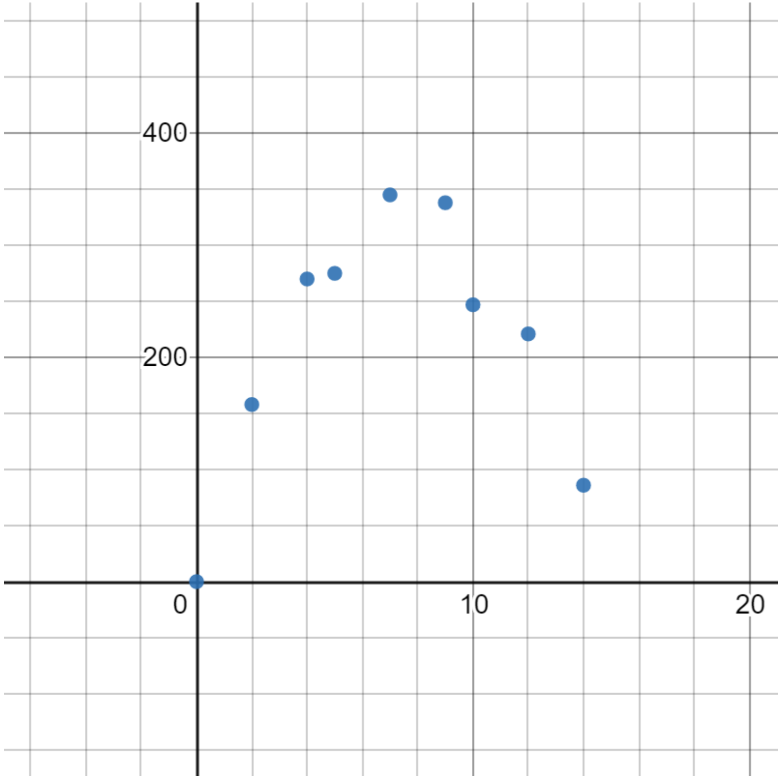
- Copy & paste the data from here into Desmos.
- You may have noticed the numbers are quite a bit bigger than the first data set. We may need to zoom out to get a good picture of the graph.
- What type of graph (linear, exponential, or quadratic) does it **most resemble**?

x	y
0	0
2	158
4	270
5	275
7	345
9	338
10	247
12	221
14	86

Let's Write An Equation

Since this data is **quadratic**, we'll use the standard form of a quadratic equation

$$y \sim ax_1^2 + bx_1 + c$$



Let’s Write An Equation

$$y_1 \sim a x_1^2 + b x_1 + c$$

STATISTICS

$R^2 = 0.9673$

RESIDUALS

e_1 plot

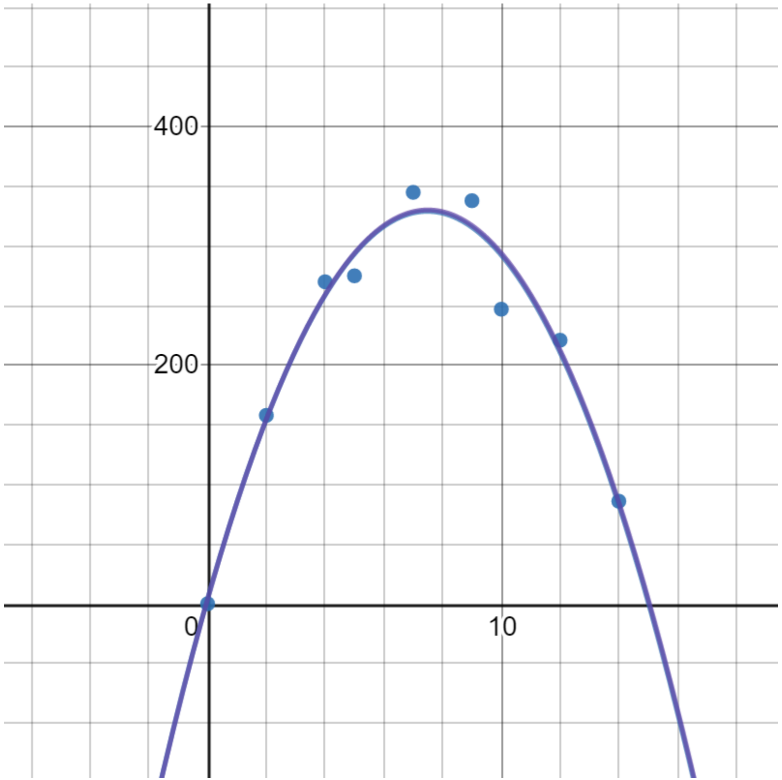
PARAMETERS

$a = -5.79898$ $b = 86.7835$

$c = 4.33518$

We can substitute our approximate a, b & c values to write the equation:

$y = -5.8x^2 + 87x + 4$



Example 3: Let's Examine Some Data

The data collected by a biologist showing the growth of a colony of bacteria at the end of each hour are displayed in the table.

Use Desmos to write an **exponential regression equation** to model these data. Round all values to the nearest thousandth.

Assuming this trend continues, **use this equation to estimate, to the nearest ten, the number of bacteria in the colony at the end of 7 hours.**

Time (in hrs), x	Population y
0	250
1	330
2	580
3	800
4	1650
5	3000

Let's Write An Equation

2

$y_1 \sim ab^{x_1}$

Log Mode

STATISTICS

$R^2 = 0.9946$

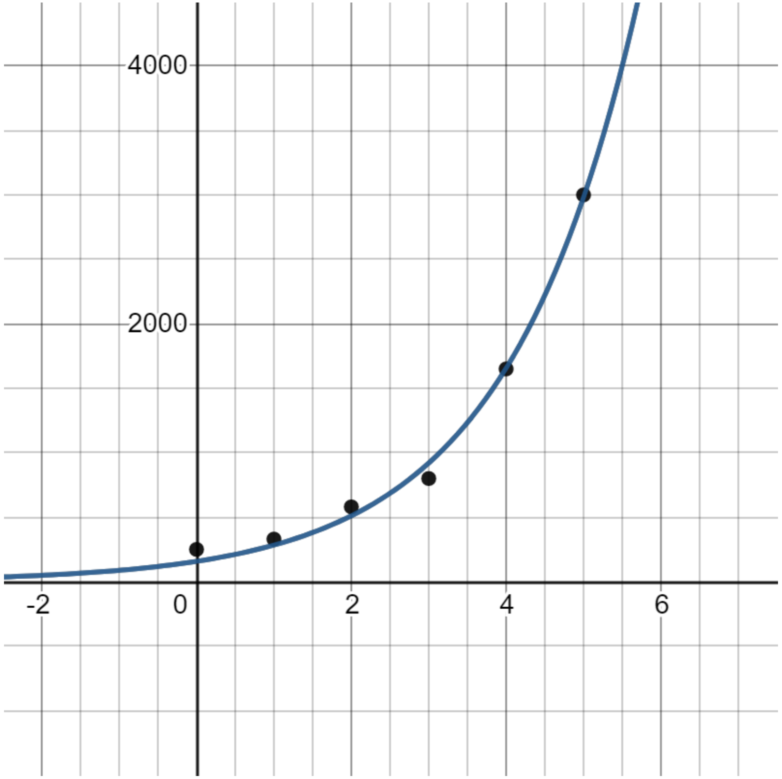
RESIDUALS

e_1 plot

PARAMETERS

$a = 157.754$

$b = 1.79998$



We can substitute our approximate a & b values to write the equation:

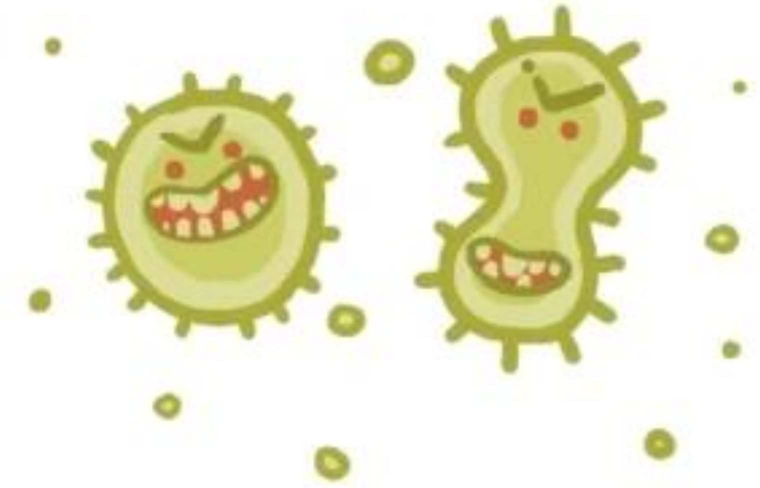
$$\mathbf{y = 157.75(1.80)^x}$$

Now Let's Use The Equation To Predict

Let's use our equation to estimate, to the nearest ten, the number of bacteria in the colony at the end of 7 hours.

$$\mathbf{y = 157.75(1.80)^7}$$

After 7 hours there will be approximately 9,660 bacteria.



Engage & Practice

- [ ] **Complete the Desmos Activity.**

  - Make sure to sign in with either Google or desmos (you will need to create a Desmos account). This will allow you to save your work and return where you left off.

  - Desmos is in real-time. There is nothing you have to do to turn in the assignment.

  - Be sure all slides are completed. Respond to any feedback your teacher provides.

Create & Submit

- ❑ Go to the link in Google Classroom to join.

- ❑ Remember, you can complete the Quizizz quiz as many times as you like.

Additional Supports

- Content Mastery is still available to ALL students. Add the CM Google Classroom using class code **ortquqk**

- Reach out to your teacher or any of the Algebra teachers for additional supports.

- We are all in this together!

Extend Your Learning

Use Desmos to create a regression model from real world data found here. Then share it with your teacher.