**What’s the Big Deal About COVID-19?**

**Exponential Regression: A Real-World Application**

**High School Math Lesson – Algebra 2 and above**

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Data taken from The COVID Tracking Project (covidtracking.com)

**Supplies Needed:** the data and questions on this page, pencil, graphing calculator with regression capabilities such as a TI-84 or this online version <https://www.meta-calculator.com/statistics-calculator.php>

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| --- | --- | --- |
| Day | Date | Cumulative Cases |
| 1 | Wed, 3/4/2020 | 118 |
| 2 | Thurs, 3/5/2020 | 176 |
| 3 | Fri, 3/6/2020 | 223 |
| 4 | Sat, 3/7/2020 | 341 |
| 5 | Sun, 3/8/2020 | 417 |
| 6 | Mon, 3/9/2020 | 584 |
| 7 | Tues, 3/10/2020 | 778 |
| 8 | Wed, 3/11/2020 | 1053 |
| 9 | Thurs, 3/12/2020 | 1315 |
| 10 | Fri, 3/13/2020 | 1922 |
| 11 | Sat, 3/14/2020 | 2450 |
| 12 | Sun, 3/15/20202 | 3173 |
| 13 | Mon, 3/16/2020 | 4019 |
| 14 | Tues, 3/17/2020 | 5723 |
| 15 | Wed, 3/18/2020 | 7731 |
| 16 | Thurs, 3/19/2020 | 11723 |
| 17 | Fri, 3/20/2020 | 17038 |
| 18 | Sat, 3/21/2020 | 23203 |
| 19 | Sun, 3/22/2020 | 31888 |

If you have a TI83/84 enter the days into L1 and the cumulative cases into L2 by using the stats button and then the edit button. Make sure these columns are empty before you start. Now push the window button and set the x min to 0 and the x max to 30 with a scale of 1. Set the y min to 0 and the y max to 40000 with a scale of 5000. Push the graph button to view the graph using this data. (Make sure stats plot 1 is on)

If you do not have a TI 83/84 calculator, use this link <https://www.desmos.com/calculator/vrecbflyfx> to view the graph that uses the above date.

1. What type of graph does this appear to be (linear, quadratic, cubic, quartic, logarithmic, exponential, square root)?

Exponential

2. Why do you think it is that type of graph? the shape of the graph, it starts off slow and starts increasing at a faster rate

If you have a TI 83/84, press the stats button and arrow over to the CALC column. Scroll down to line 0 and it should say ExpReg. Make sure Xlist is set to L1 and Ylist is set to L2. Press enter until you have gone through all the lines. It will then calculate the coefficients for an exponential regression.

List those coefficients here (round to 3 decimal places): y=a\*bx

 a = \_\_\_\_\_91.18\_\_\_\_\_\_\_\_\_\_ b = \_\_\_\_\_\_\_\_1.35 r2 = .998 r = \_\_\_\_.999\_\_\_\_\_

If you need to use an online calculator use the above link for meta-calculator. Select the plus button and choose the regression analysis calculator. Select the exponential regression. Enter the number of days in the xi column and the total number of cases in the fi column. Press the analyze button and list the following:

 Regression equation: \_\_91.18\*1.35x\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Co-efficient of co-relation (r): \_\_\_\_\_\_\_\_\_\_.999\_\_\_\_\_\_\_\_\_

 Co-efficient of determination (r2): \_\_\_\_\_\_.998\_\_\_\_\_\_\_\_\_\_\_\_

There is a button for plot graph at the bottom if you want to see the graph. Set X-min to 0, X-max to 30, Y-min to 0, Y-max to 40000, x-scale to 1, and y-scale to 5000.

2. Using your exponential regression equation, how many cases of coronavirus would you expect there to be on:

 Day 20: 36,862 What date would this be? \_\_3/23/2020\_\_\_\_\_\_\_\_

 Day 25: 165,289 Date: \_\_3/28/2020\_\_\_\_\_\_\_\_\_\_

 Day 30: 741,161 Date: \_\_\_4/2/2020\_\_\_\_\_\_\_\_\_

 Day 40: 14,902,197 Date: \_\_\_ 4/12/2020\_\_\_\_\_\_\_

 Day 50: 299,631,875 Date: \_\_\_4/22/2020\_\_\_\_\_\_\_\_\_

3. Using your total number of infections from days 20, 25, 30, and 50, what is the percentage of the U.S. population that will be infected? Assume a U.S. population of 317,170,000 million people. Round to two decimals. (# infected/total population) \* 100

 Day 20: \_\_\_\_\_\_.02%\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Day 25: \_\_\_\_\_\_.05%\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Day 30: \_\_\_\_\_\_.24%\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Day 40: \_\_\_\_\_\_4.70%\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Day 50: \_\_\_\_\_\_94.47%\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

So why did you write down the r-value? The r-value measures how closely your equation matches the data. An r-value of 1 means it is a perfect match. Anything from .85 to 1 is considered a strong correlation, .75 - .85 is a moderate correlation and anything below .60 is a weak correlation. Is your equation a good model for the data? Why or why not? This equation is a good model for the data because the r-value is almost 1 which means the model fits the data extremely well.