Name: _____

AP Calculus BC
The Big Gamel Commercial Exploration

Given the data representing the average cost of a 30 second commercial for The Big Game for each year since the The Big Game started, you need to determine differential equations and solution equations that goes with the flow of the data.

Open the file I sent you to get this data already entered into your calculator.

Year	Average Cost of 30 second Commercial
1967	40000
1968	54000
1969	67500
1970	78200
1971	72000
1972	86000
1973	103500
1974	107000
1975	110000
1976	125000
1977	162000
1978	185000
1979	222000
1980	275000
1981	324300
1982	345000
1983	400000
1984	450000
1985	500000
1986	550000
1987	575000
1988	600000

1989	675000
1990	700000
1991	800000
1992	800000
1993	850000
1994	900000
1995	1150000
1996	1085000
1997	1200000
1998	1292000
1999	1600000
2000	2100000
2001	2200000
2002	2200000
2003	2150000
2004	2302000
2005	2400000
2006	2500000
2007	2385000
2008	2700000
2009	3000000
2010	2974000
2011	3100000
2012	3500000
2013	4000000
2014	4200000
2015	4400000
2016	4800000
2017	5000000

1. For the years 1968 through 2016 find the symmetric difference quotients, $\triangle C/\triangle y$, where C is cost and y is years.

Why can't you do this for 1967 and 2017?

2. Compute $(\triangle C/\triangle y)/C$ for each difference quotient in #1?

What is it that you are finding when you find $(\triangle C/\triangle y)/C$?

What is the average of these numbers?

3. Use the data provided to find an exponential differential equation. Plot the slope field for your differential equation along with the data on a graphs page.

4. What is the solution of your exponential differential equation?

Plot your solution on the same graph page as the slope field and the data.

5. Do you think this data really is exponential? Why or why not?

6. Do you think the data might be logistic? Why or why not?

7. Use the data to find a logistic differential equation. Make a new graphs page and graph the slope field of your logistic differential equation as well as the data.

8. What is the solution of your logistic differential equation?

Plot it on the same graphs page as the slope field and the data.

9. Put your data on a Data and Statistics page. Use the regression function to come up with an exponential fit.

What is the the regression equation?

What is the r value for this equation if there is one?

What is the r square value for this equation if there is one?

10. Put your data on a DIFFERENT Data and Statistics page. Use the regression function to come up with an logistic fit.

What is the the regression equation?

What is the r value for this equation if there is one?

What is the r square value for this equation if there is one?

11. Go back to your FIRST Data and Statistics page. Plot the residual graph.

Repeat the process for your SECOND Data and Statistics page.

What do you notice about each of these residual plots?

From the plots can you determine whether the exponential or the logistic is the best?

12. What is the point of inflection of the Logistic fit? How do you find this point?

13. How many years will it take before your logistic fit is within $1000 of YOUR maximum?

14. When is your logistic fit increasing at a decreasing rate?

When is your logistic fit increasing at an increasing rate?

15. Use Euler Method on your exponential differential equation to find the cost of a 30 second commercial in 2020 using $\frac{1}{2}$ year as a value for dy along with the data at 2017.

16. Use Euler Method on your logistic differential equation to find the cost of a commercial in 2020 using $\frac{1}{2}$ year as a value for dy alone with the data at 2017.

17. What did you learn as a result of this exploration?