Math 170, Lab 2: Equations and Inequalities in WolframAlpha

Names _____

With your partner(s), read through the instructions and do the activities described. Discuss your questions, ideas, and findings with each other. Write your results and/or answers on this worksheet. You may attach graphs and/or printouts if they are explained and are useful to your report. Only one report should be submitted from each group. This report is due Wednesday.

1. **Solving Inequalities**. For each inequality, use WolframAlpha to (1) graph the expressions on each side of the inequality on a single set of axes, and (2) solve the inequality**.** State the solution using interval notation, inequality notation, and a number line graph; sketch the graph by hand; and explain how the graph indicates the solution set. Use decimal approximations with two decimal digits.

   $3x^3 - 8x^2 - 5x + 6 \le 0$

   $3x^2 - x + 6 < 2x^3 - x^2 + 3x - 4$

$3\sqrt{3x+14} > 15 - 2|x-2|$

$|x-4| > |2x|$

Validate your solution to $|x-4| > |2x|$ algebraically by solving the inequality using the distance representation of absolute value, i.e., $|a-b| =$ (distance from a to b).

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2. **Linear Equations**. Plot the points (2, 2), (3, 6), and (4, 10). Draw a straight line through the points. Find three equations for the line in the following forms: $y = mx + b$, $y = m(x - c)$, and $y - y_0 = m(x - x_0)$ where $x_0 = 3$. Compare your answer with WolframAlpha's response to entering `linear fit (2,2) (3,6) (4,10)`, which finds the linear model that minimizes the sum of the squared errors to the data.

3. **Modeling Data.** (Source: Demana, Waits, Foley, Kennedy, *Precalculus: Functions and Graphs*, fifth edition.) The table below shows the number of cellular phone subscribers in the U.S. and their average local monthly bill in the years 1988 to 2001.

Year	Subscribers (millions)	Average Local Monthly Bill ($)
1988	1.6	95.00
1989	2.7	85.52
1990	4.4	83.94
1991	6.4	74.56
1992	8.9	68.51
1993	13.1	67.31
1994	19.3	58.65
1995	28.2	52.45
1996	38.2	48.84
1997	48.7	43.86
1998	60.8	39.88
1999	76.3	40.24
2000	97.0	45.15
2001	118.4	45.56

a. Let x = the number of years after 1988. By hand on graph paper, draw scatter plots of (1) the number of subscribers as a function of time, and (2) the average local monthly bill as a function of time. There should be two scatter plots.

b. One scatter plot suggests a linear model with equation $y = mx + b$. Draw a straight line that, in your opinion, best displays the trend of the data. Find the equation of the line. Use *WolframAlpha* to find the linear model that minimizes the sum of the squared errors to the data. Compare your linear model with WolframAlpha's model.

c. The other scatter plot clearly suggests a quadratic model with formula $y = ax^2 + b$. Use the data point at $x = 0$ to solve for b. Then use the data point at $x = 9$ to solve for a. Show your work here.

d. Superimpose the graph of the quadratic model onto the scatter plot. Does the fit appear to be good? Why or why not?

e. Use WolframAlpha to find the quadratic model that minimizes the sum of the squared errors to the data. Compare your quadratic model with WolframAlpha's model.

f. Using the models that you developed above, try to predict what the number of subscribers and average monthly bill would have been in the year 2003.

g. Discuss the economic forces suggested by the two models above and speculate about the future by analyzing the graphs.

Be sure to attach the two scatter plots with superimposed models to this report.