

Math 170, Lab 1: Using 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 Monday.

1. Introduction to WolframAlpha.

Start-up: Open an internet browser and navigate to <http://www.wolframalpha.com/>.

Fun stuff and graphs: Enter each of the following phrases. Look at the kind of information included in the response. For each graph that is displayed, record here the dependent and independent variables.

- Height and weight
- Goshen College
- Goshen Indiana weather
- IBM
- Carbon
- A group member's name

Simple calculations: Enter each of the following calculations and record the answers. Make sure you understand why these answers are given.

- $3*4 + 1$
- $5 + 3 * 2$
- $10/8$
- 5^2
- $18^{-(1/2)}$
- $\cos(3)$
- $(a+b)^2$

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2. **Graphs.** Enter each of the following.

- graph $(x^2 - x) / (x^2 + 1)$
- graph $(x^2 - x) / (x^2 + 1)$ with x from -1 to 2
- graph $(x^2 - x) / (x^2 + 1)$ with x from -100 to 100
- graph $(x^2 - x) / (x^2 + 1)$ with x from -15 to 15 and y from -0.3 to 1.3

Describe the features of the graph of

$$y = (x^2 - x) / (x^2 + 1)$$

that are revealed by the last graph. State the features that are not revealed by the second and third graphs. Describe the output for the first graph, which did not explicitly give a viewing window.

A graph of an equation is a *complete graph* if it suggests all points of the graph and all of the important features of the graph. Use WolframAlpha to obtain a complete graph of

$$y = x^3 + 408x^2 - 123x + 59$$

Sketch by hand the graph you obtained. Estimate the solution(s) of

$$x^3 + 408x^2 - 123x + 59 = 0$$

from your graph.

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3. **Solving Equations Graphically.** An equation of the form

$$f(x) = c$$

can be solved by identifying where the graph of

$$y = f(x)$$

crosses the horizontal line

$$y = c$$

WolframAlpha accepts the word *solve* to find solutions and provide a graph. For each of the following equations, find all real-value solutions to at least four significant digits. Sketch by hand a graph that displays all solutions. Label the scales on the axes and the solutions.

a. $x^3 - 65x + 10 = 0$

b. $x^4 - 3x^3 - 6x + 5 = 0$

c. $x^3 - 2x^2 + 3x = 5$

d. $x^3 - 3x^2 = -4$

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e. $x^3 - 4x^2 + x + \frac{172}{25} = 0$

f. $x^3 + 408x^2 - 123x + 59 = 0$

4. **Reading graphs.** Obtain a complete graph of

$$|x^2 - 4|$$

Look at your graph and consider the equation

$$|x^2 - 4| = c$$

Record the following.

- Find a value of c for which this equation has four solutions.
- Find a value of c for which this equation has three solutions.
- Find a value of c for which this equation has two solutions.
- Find a value of c for which this equation has no solutions.
- Is there any other possible number of solutions of this equation? Explain.

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5. **Simplification.** For each of the following expressions, command WolframAlpha to simplify, expand, and factor. Record the responses and explain why each response is reasonable.

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

$$(x^2 + x - 3)(x^2 + x + 1)$$

$$\frac{2}{x^2 - 1} - \frac{5}{x^2 - 3x - 4}$$