Mathematical Exponent Relationships using www.desmos.com/calculator

This assignment is designed to show you how changing the base and exponents can affect numbers. You will visualize this relationship by looking at their numerical and graphical expressions.

Part I – Keeping a base constant and varying the exponent.

1. Input the expressions: 2^x, $(1/2)^x$, 6^x, and $(1/6)^x$; equations like this keep the same base and evaluate the expression using many different exponent values.
    a. What affect does changing the base from a 2 to a 6 have on the graph values? (it will be easier to hide the other equations)
    b. What affect does changing the base from 1/2 to 1/6 have on the graph values?
    c. What affect does changing the base from 2 to 1/2 have on the graph values?
    d. Where would 3^x lie on the graph? Check your answer to confirm.
2. Delete the above graphs and then write: $(-2)^x$
    a. Describe what happens.
    b. View the table of values (under the graph settings). Now describe what you see.
    c. How would the pattern from (b) continue for x = 3, 4, 5, and 6? Why do the dots go from positive – to – negative in a continuing pattern?
    d. How come the dots only appear for integer numbers? (hint: evaluate $(-2)^{2.5}$ with the program or a calculator)

Part II – Varying the base while keeping the exponent constant.

1. Clear any previous expressions and input the equations: x^2, x^3, x^4, x^5; equations like this keep the same exponent but evaluates the expression using different base values.
    a. What affect does changing the exponent from 2 to a 5 have on graph values – use as much detail as possible.
    b. Predict what x^8 and x^{11} would look like; input the graphs to check your answers.

Part III – Exploring Polynomial Functions (math expressions with exponents)

1. Clear any previous expressions and input the following: (x + a)(x + b). Select "a" and "b" to be sliders. Click on the graph and you should see a "U" shaped line and two sliders where you can vary the values of "a" and "b" (which are defaulted to 1)
    a. Set a = 1 and b = -1 and observe what happens.
    b. Write down, in general, what happens when you slide "a" to different values.
    c. Reset a = 1 and vary b. Write down what happens.
    d. How do the values relate to where the line crosses the horizontal axis (called the x-axis)?
2. Clear the previous expressions.
    a. Input the three different expressions: (x – 5)(x + 5), (x – 5)(x + 5)(x + 3), and (x – 5)(x + 5)(x + 3)(x – 3)
    b. What do all three graphs have in common? What is unique about the third graph?
    c. In each expression, count the number of x's. Compare that to the number of times each graph crosses the x-axis – write down that relationship. What do you think is the highest exponent on x in each expression if they were to be rewritten without the terms multiplying?
    d. What is the relationship between the number of x's and how many peaks and bottoms in each graph?
    e. Clear the previous graphs. Write an expression that crosses the x-axis at -6, -3, and +5. Save the graph as an image and show me.
    f. Create your own expression that crosses the x-axis six (6) times. Save it and show me.