

Reaction Rates Create for Class

We are going to create a presentation for Chemistry Class. The screen #1 to the right will be the text screen that will tell the students what we are going to do for the class. Slide #2 is the list of numbers that we are going to use to make the graphs. These two pages are already made for you with page 1.3 a graph page ready to work with.

To start with we are going to show the scatter plots. To make to do this we will press **(menu)** and then go down to graph type. We will pick 3 scatter plot. We will press enter on the x box and arrow down to Time as the list that we want to use for x. Then we will arrow to the right for the y list. Again press enter and arrow down to the NO₂ and press enter. The graph in figure 4 appears.

Figure #4 also has us move the label for (Time, NO₂) up into the left corner to be near the beginning of the NO₂ graph.

In figures 6 and 7 we are doing the same thing for S₂, the scatter plot for NO. Figure 8 will be the graph with both NO₂ and NO. Figure 10 is the end of doing the scatter plot for O₂.

After setting up the three scatter plots we will go to **(menu)** #2 View, #6 Hide entry line. If we decide we want to adjust the window we can do that at this time also. This is done by going to **(menu)** #4 Window, #1 Window Setting.

Next we will go back to page 1.2 by pressing **(ctrl)** and the Right Arrow. Then press **(menu)** and go to #4 Statistics, #1 Statistics Calculations, #7 Cubic Regression. I have done some of the other regressions and the cubic has the best R² value for this data.

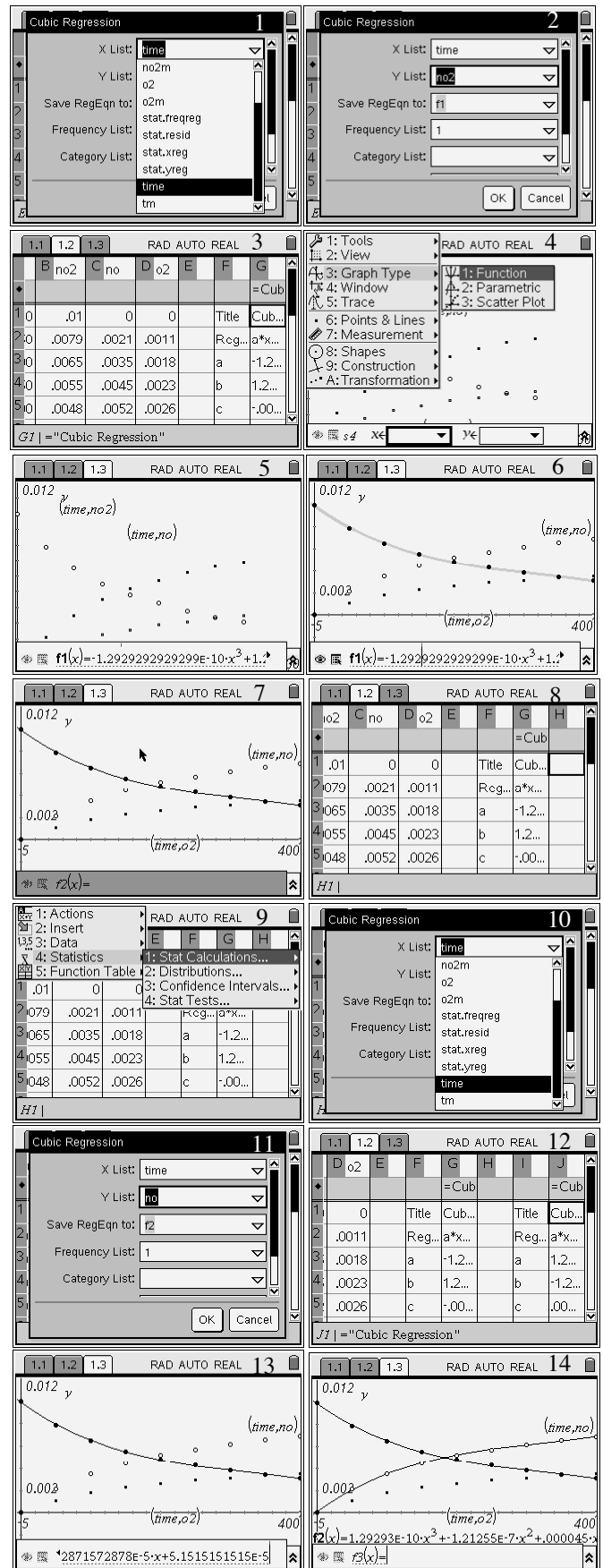
In the next page we will see what we will have to do to get this done.

The screenshots show the following steps:

- Slide 1:** Text screen titled "Reaction Rates" describing the decomposition of nitrogen dioxide: $2\text{NO}_2(\text{g}) \rightarrow 2\text{NO}(\text{g}) + \text{O}_2(\text{g})$. It includes a table of data.
- Slide 2:** A table of data with columns labeled A (time), B (no2), C (no), D (o2), E, and F.
- Slide 3:** A scatter plot of NO₂ concentration vs. time.
- Slide 4:** The same scatter plot with the label "(time, no2)" moved to the top-left corner.
- Slide 5:** A scatter plot of NO concentration vs. time.
- Slide 6:** A scatter plot of O₂ concentration vs. time.
- Slide 7:** A scatter plot showing both NO₂ and NO concentrations vs. time.
- Slide 8:** A scatter plot showing both NO₂ and NO concentrations vs. time.
- Slide 9:** A scatter plot showing both NO₂ and NO concentrations vs. time.
- Slide 10:** A scatter plot showing both NO₂ and NO concentrations vs. time.
- Slide 11:** The "Tools" menu with "1: Graphing View" selected.
- Slide 12:** The "Window Settings" dialog box with XMin: 0, XMax: 500, YMin: 0, and YMax: 0.012.
- Slide 13:** The "Statistics" menu with "1: Statistics Calculations" selected.
- Slide 14:** The "Statistics Calculations" menu with "7: Cubic Regression" selected.

With the cubic regression working all you have to do is answer a couple of questions. You will start with the list for x. Arrow down until you get to time (figure 1) then press enter and tab down to the y list. Arrow down to the NO₂ (figure 2) list and press enter. Then arrow down to the ok and press enter. You will notice the equation will automatically be entered into f1(x) in a graph screen.

After you have pressed enter on the ok you will get the equation in the spread sheet. To be able to put the line in the graph screen we will have to bring back the Entry Line. Press **2nd** and then #2 View and #6 Show Entry Line (figure 4). You might have to change the graphic page back to a function graph. Press **2nd** again this time #3 Graph Type, #1 Functions. You will then see the end of the f1(x) line or f2(x). If you are on f2(x) then arrow up one to f1(x). Press enter (figure 5) and you will be able to see the graph (figure 7). Since we also want to do this again for NO we do the same thing again by moving over to the first blank to the right of the Cubic (figures 8-14).



The only difference with the cubic regression for O₂ is you will be asked the question in (figure 1). You will have to go down to variable reference and press enter (figure 2). Go to f3(x) and press enter and you will have all three sets of data set up with regression equations that have R² values of over .999.

To clean up page 1.3 press **(esc)** and then when you are on top of the f3(x) equation and press enter and then Clear button. The equation will be erased. do the same to for the equation f2(x) and f1(x) if they are there (figure 3 & 4). We will not need the Entry Line any more so we are going to hide it again by pressing **(menu)** and then #2 View, #6 Hide Entry Line (figure 5) The page will look like (figure 6).

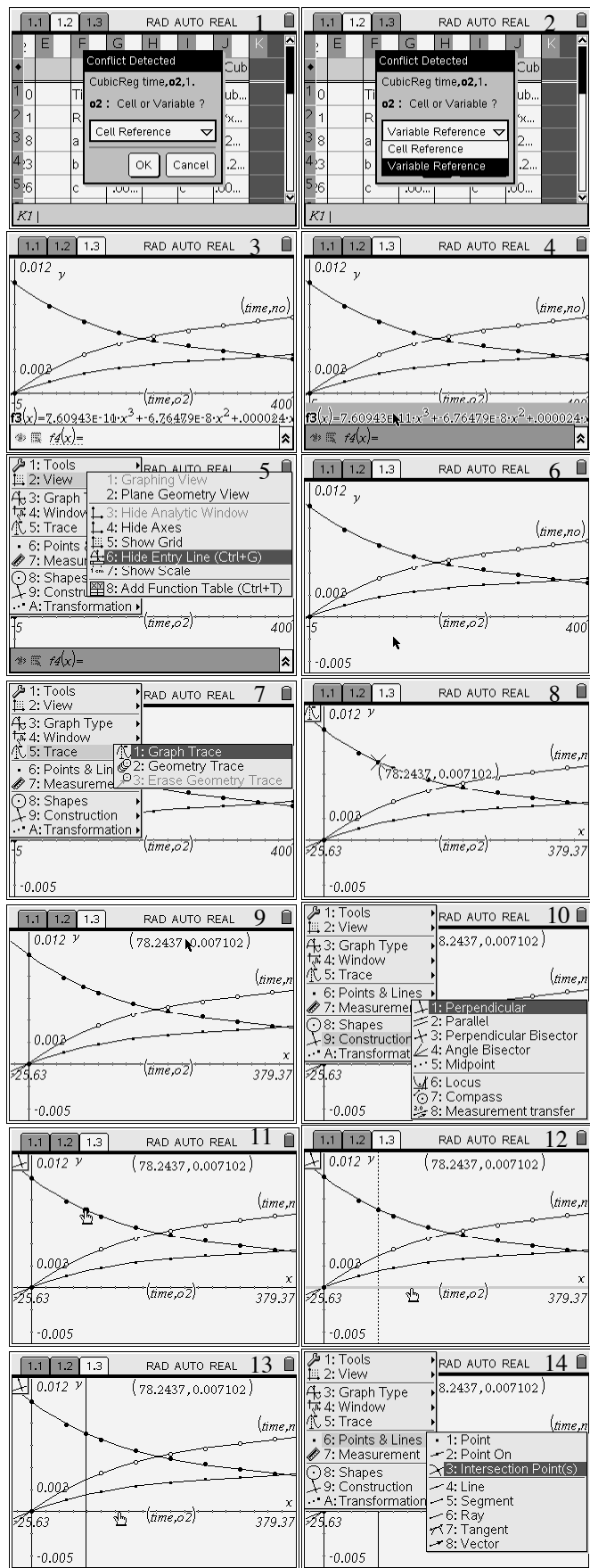
Next we want to trace the graph of f1(x) so we are going to **(menu)** and then #5 Trace, #1 Graph Trace (figure 7). You may need to move around until you are on the graph of NO₂ (figure 8). When you get there press enter once to accept the order pair for a point on the graph. Move up to the center of the screen (figure 9) and press enter. We will need this ordered pair later to be able to keep track of the Time as we move along the graph.

Next we want to construct a perpendicular to the x axis and through the point we created when we pressed enter earlier. Press **(menu)** #9 construction, #1 Perpendicular (figure 10).

Move the pointer to the point that we made on NO₂ (figure 11) press enter. Then move the pointer down to the x axis (figure 12). A line will appear press enter and the line will become solid (figure 13).

We want to have point at the intersection of this line and the other two graphs. Press **(menu)** and then #6 Points & Line, #3 Intersection Point(s) (figure 14).

Move the pointer to the line that is perpendicular press enter then to the NO graph and press enter. You will get a point at the intersection. Do the same for the graph of the equation of O₂.



Now we are going to draw a tangent to the graphs at the points we just created. Start by pressing (menu) #6 Points & Lines, #7 Tangent (figure 1). Move the pointer to the intersection on the NO₂ graph. Press enter and a tangent line will be created. Do this for the other two points and create the other two tangent lines (figure 3 & 4).

We would like to make the page less cluttered. Press (menu) #1 Tools, #2 Hide/Show (figure 5). Move the pointer around until it is on top of the two graphs of NO and O₂ (figure 6). I would like to make the NO₂ graph hide but problems occur when you do this.

We need to know the slope of these lines so press (menu) again then #7 Measurement, #3 Slope. Move the pointer to all three tangent lines press enter once then move the number to a place by its graph. Then press enter again and the number will stay here (figure 8 & 9).

We will now press escape and to get out of the slope function, and then move the pointer to the dot on the NO₂ graph. When the hand appears press the (hand) button and hold it for a second until it hand closes. When the hand closes you can move the hand back and forth and watch the slopes of the lines that are tangent change (figure 10 & 11). I will suggest that you move the point back to the left and leave it there or you will have problems holding on to the point if you leave it on the right side of the page.

I hope you learned how to work with the Nspire making this and I hope you know more about Chemistry than I do so this will make sense.

