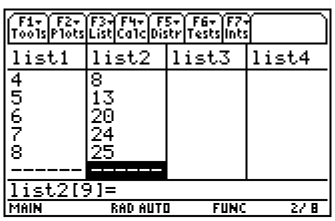
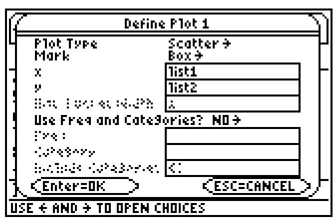
Logistic Growth, Differential Equations, Slope Fields

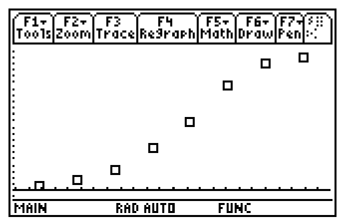
During the first day of the institute we simulate the spread of a disease through a class with a random number generator. This generates logistic data similar to the following table.

Day	Number Infected
1	1
2	2
3	4
4	8
5	13
6	20
7	24
8	25

We use the data analysis features of the calculator to create a scatter plot and find a logistic regression curve to fit the data.







Later in the week we revisit the data and use analytic methods to find the solution to the differential equation for logistic growth

$$y' = ky(26 - y).$$

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C:deSolve(y'=k*y*(26-y) and y(1)=1,x,y)
C:solve(y=26*e^(26*k*x)/(e^(26*k*x)+25*e^(26*k)),k)|x=5 and y=13
C:ln(5)/52→k
C:Define y1(x)=26*e^(26*k*x)/(e^(26*k*x)+25*e^(26*k))
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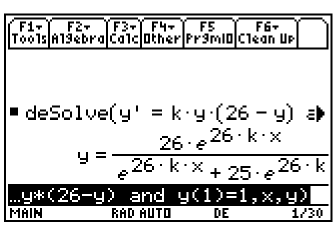
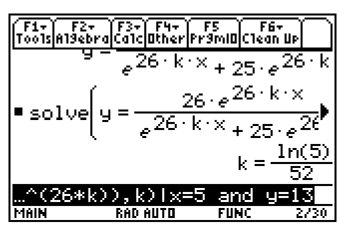
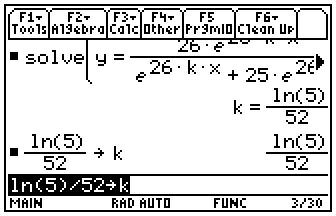
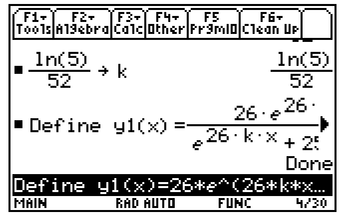
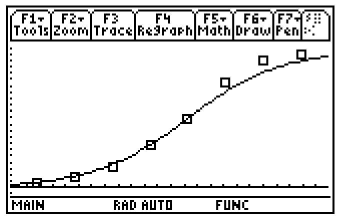




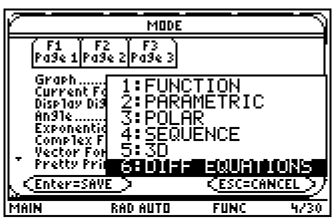


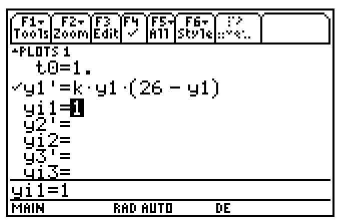


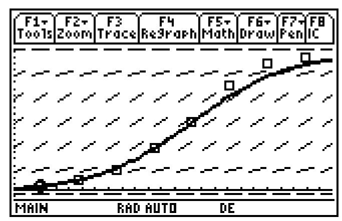
We then graph the solution along with the original scatter plot.



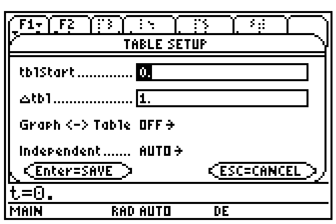
We can use Differential Equation graphing mode to see numerical and visual solutions to the differential equation without finding an analytic solution. The visual solution will include a slope field.

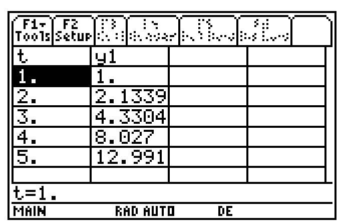






The numerical solution utilizes tables.





The TI-89 helps students investigate differential equations analytically, graphically and numerically and see relationships between the three approaches.