Math 1311
Section 2.4
Solving Nonlinear Equations

Equations that involve powers (other than one), radicals (such as square roots), exponential terms, etc. are called nonlinear equations.

Some such equations have algebraic ways in which they can be solved. For most nonlinear equations, we will focus on graphical techniques (using the TI calculator).

Crossing Graphs Method

1. Press 

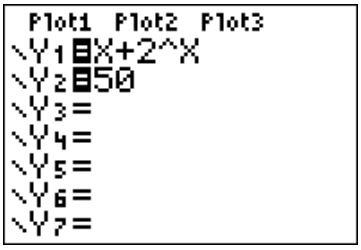
, enter the one side of the equation in Y_1 and the other side in Y_2
2. Use the table to get a get an approximation of where the solution(s) is/are
3. Press 

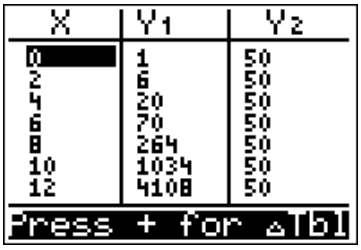
, set Xmin and Xmax so that the solution(s) are between them
4. Press 

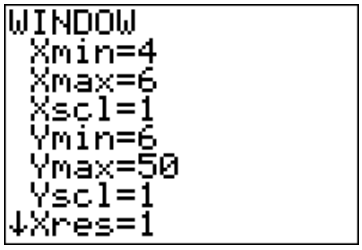
to see the graph
5. Press 

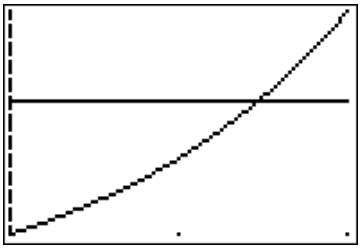
and choose "5: intersect" and follow the on screen directions

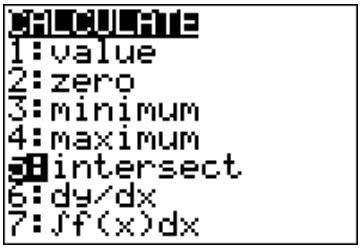
Example 1: The screen shots below show solving the equation $x + 2^x = 50$.

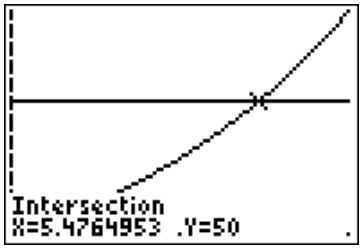












Example 2: Solve each of the following using the crossing graphs.

a. $x^2 - x^3 + 3 = \frac{x^5}{20}$

$x =$ _____ Xmin = _____ Xmax = _____

b. $x + 3^x = 20$

$x =$ _____ Xmin = _____ Xmax = _____

c. $\frac{1+2^x}{1+3^x} = x^2$ This equation has 2 solutions, one positive and one negative.

$x =$ _____ Xmin = _____ Xmax = _____

$x =$ _____ Xmin = _____ Xmax = _____

d. $e^{4-x} = x - 4$

$x =$ _____ Xmin = _____ Xmax = _____

e. $20(1 + 2^x) = x$

$x =$ _____ Xmin = _____ Xmax = _____

Example 3: The temperature C of a fresh cup of coffee t minutes after it is poured is given by $C(t) = 125e^{-0.03t} + 75C$. The coffee is cool enough to drink when its temperature is 150 degrees. When will the coffee be cool enough to drink?

Example 4: If you borrow \$5000 at an APR of r (as a decimal) from a bank that compounds interest continuously, and you plan to make monthly payments for 3 years to pay back the loan, then the monthly payment is $M(r) = \frac{5000(e^{r/12}-1)}{1-e^{-3r}}$. If your budget will allow for a \$150 a month payment, what APR must you receive?