Newton-Raphson Method - Part 1

Select RUN mode from the main menu by using the arrow keys to highlight the RUN icon or pressing 1.

Finding the solution to an equation such as f(x) = 0, using the derivative and tangent to achieve better and better approximations to the solution of f(x) = 0.

Formula used is: $x_{n+1} = x_n - f(x_n)/f'(x_n)$

N.B. The Newton-Raphson method fails when $f'(x_n) = 0$, or when a vertical asymptote value is calculates from the iteration method and then $f(x_n)$ cannot be calculated.

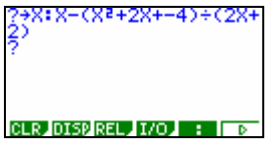
Tools needed are ? and : , these can be accessed via the PRGM menu by pressing **SHIFT** **VARS** the **F4** for the **?** and F6 then F5 for the **:**

Example: Find the solution to $x^2 + 2x - 4 = 0$, with the initial value of x = 1

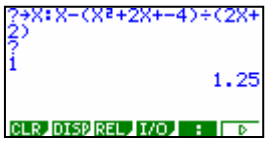
Note here that $f(x) = x^2 + 2x - 4$ and that $f'(x) = 2x + 2$

Solution: Enter the following into the calculator:

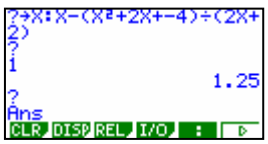
? → x : x – $(x^2 + 2x - 4)/(2x+2)$
then press **EXE**



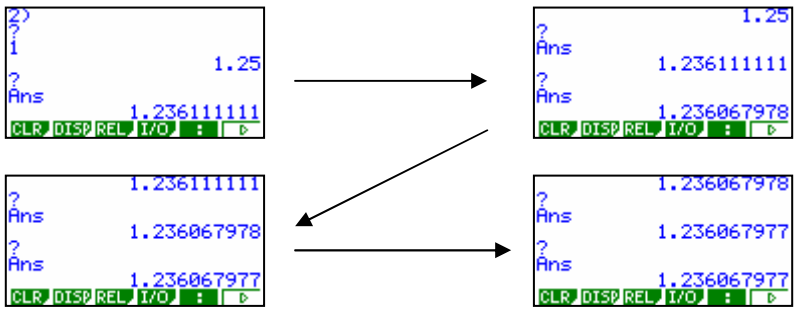
This sets up an algorithm for the calculator to have a value for x inputted. Then the N-R calculation is initiated with the first iteration value (the next best estimate) made. Enter the number: 1 then press **EXE** the answer 1.25 appears, this is the next best answer from the N-R algorithm.



Press **EXE** again and the ? reappears. This is where the calculator is to do another iteration of N-R. This time we want to use the revised answer from the first iteration. **Ans** needs to be entered. Press **SHIFT** then **(-)**, to get ANS on the screen.



Repeat the process EXE , then Ans until the entries that are appearing on the calculator are the same.



Don't forget to record your results as you progress through each iteration: An example of a way to set out your answer is shown below.

Number of iterations: n	**x_n**	**$x_n - f(x_n)/f'(x_n)$**	**Decision / Comment**
0	**1**	**1.25**	
1	**1.25**	**1.23611111111**	
2	**1.23611111111**	**1.236067978**	
3	**1.236067978**	**1.236067977**	
4	**1.236067977**	**1.236067977**	**Stop, answer found**

The recording of the iteration process is an important aspect of approximation and iterative methods used in mathematics.

Newton-Raphson Part 2 looks at using the derivative function f (x) instead of you having to differentiate the function manually.