

Newton-Raphson Method - Part 2

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

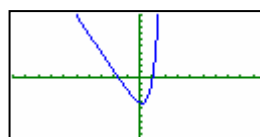
N.B. The Newton-Raphson method fails when $f'(x_n) = 0$, or when a vertical asymptote value is calculated from the iteration method and then $f(x_n)$ cannot be calculated, or when there is NO solution at all.

Tools needed are $\frac{d}{dx}$ and \int , these can be accessed via the **PRGM** menu by pressing **SHIFT** **VAR** then **F4** for the $\frac{d}{dx}$ and **F6** then **F5** for the \int :

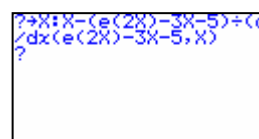
Example 1: Find both solutions to $e^{2x} - 3x - 5 = 0$, with the initial value of $x = 0$ and $x = 6$

Note here that $f(x) = e^{2x} - 3x - 5$ and that $f'(x) = 2e^{2x} - 3$

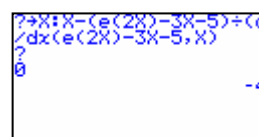
Solution: A graph illustrates that there are TWO solutions to this equation and N-R will show an oscillation in predictions and will not 'settle' on an answer.



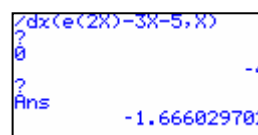
Enter the following into the calculator:
 $\frac{d}{dx} \rightarrow x : x - (e^{2x} - 3x - 5) / (d/dx(e^{2x} - 3x - 5, x))$
 then press **EXE**



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: 0 then press **EXE** the answer -4 appears, this is the next best answer from the N-R algorithm.



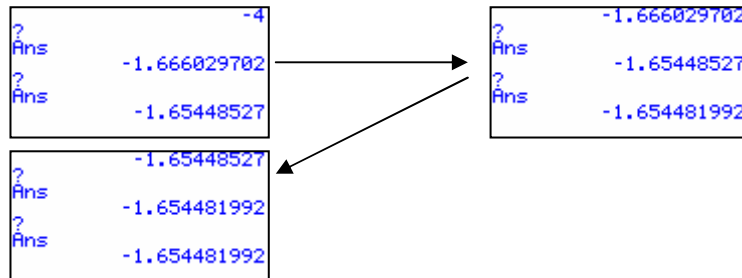
Press **EXE** again and the $\frac{d}{dx}$ reappears. This is where the calculator is to do another iteration of N-R. This time we want to use



the revised answer from the first iteration.

Ans needs to be entered. Press **SHIFT** then **(-)**, to get ANS on the screen.

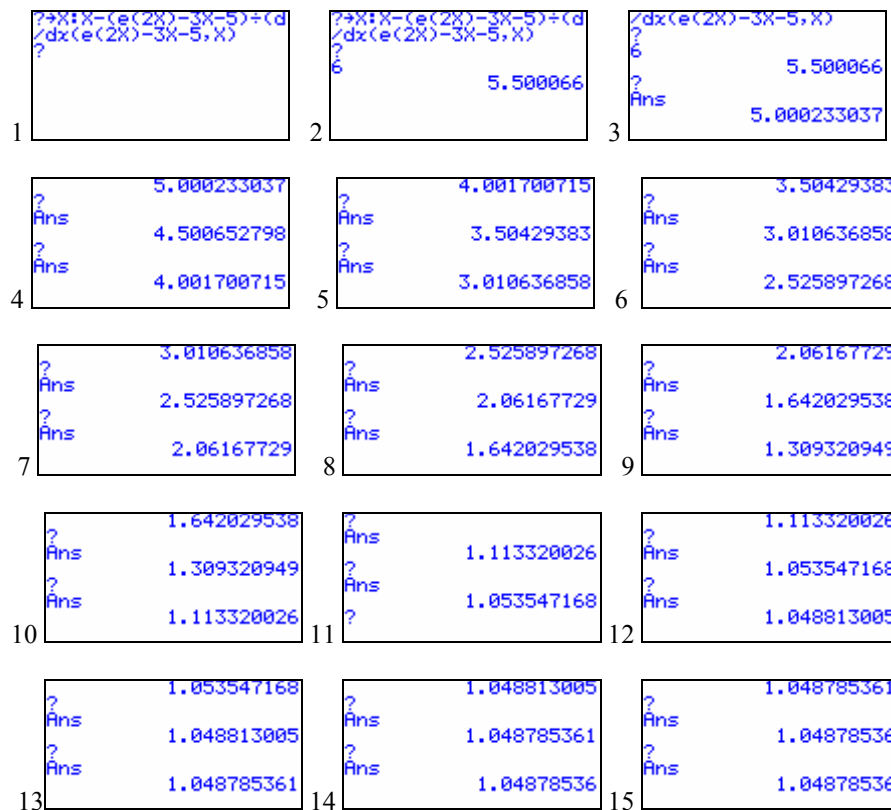
Repeat the process **EXE**, then **Ans** until the entries that are appearing on the calculator are the same.



Don't forget to record your results as you progress through each iteration: An example of 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	0	-4	
1	-4	-1.666029702	
2	-1.666029702	-1.65448527	
3	-1.65448527	-1.654481992	
4	-1.654481992	-1.654481992	Stop, solution found

Repeat the process for find the other solution using the initial value of $x = 6$



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