

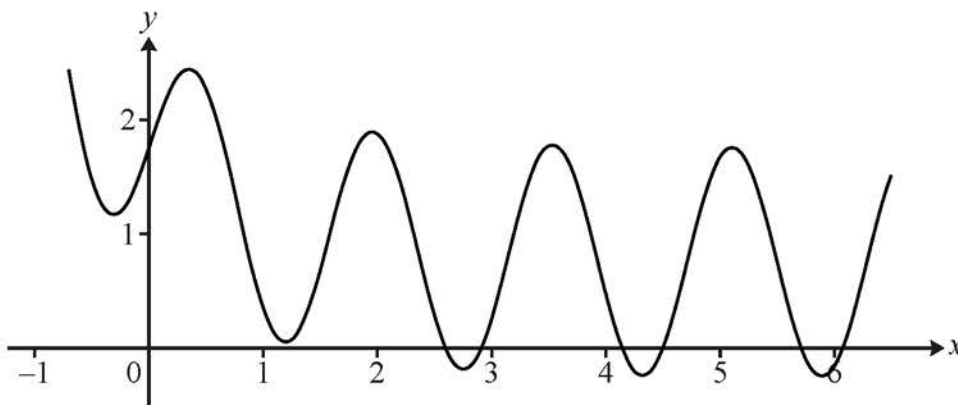
- 8 Kareem wants to solve the equation $\sin 4x + e^{-x} + 0.75 = 0$. He uses his calculator to create the following table of values for $f(x) = \sin 4x + e^{-x} + 0.75$.

x	0	1	2	3	4	5	6
$f(x)$	1.750	0.361	1.875	0.263	0.480	1.670	-0.153

He argues that because $f(6)$ is the first negative value in the table, there is a root of the equation between 5 and 6.

- (a) Comment on the validity of his argument. [1]

The diagram shows the graph of $y = \sin 4x + e^{-x} + 0.75$.



- (b) Explain why Kareem failed to find other roots between 0 and 6. [1]

Kareem decides to use the Newton-Raphson method to find the root close to 3.

- (c) (i) Determine the iterative formula he should use for this equation. [2]
(ii) Use the Newton-Raphson method with $x_0 = 3$ to find a root of the equation $f(x) = 0$. Show **three** iterations and give your answer to a suitable degree of accuracy. [3]

Kareem uses the Newton-Raphson method with $x_0 = 5$ and also with $x_0 = 6$ to try to find the root which lies between 5 and 6. He produces the following tables.

x_0	5
x_1	3.97288
x_2	4.12125

x_0	6
x_1	6.09036
x_2	6.07110

- (d) (i) For the iteration beginning with $x_0 = 5$, represent the process on the graph in the Printed Answer Booklet. [2]
(ii) Explain why the method has failed to find the root which lies between 5 and 6. [2]
(iii) Explain how Kareem can adapt his method to find the root between 5 and 6. [1]