

Lesson 4

Numerical Methods : Pure Year 2

4.1 Past Paper Questions

Question 1

C3 Examination question from January 2013, Q2.

$$g(x) = e^{x-1} + x - 6$$

(a) Show that the equation $g(x) = 0$ can be written as

$$x = \ln(6 - x) + 1, \quad x < 6$$

[2 marks]

The root of $g(x) = 0$ is a

The iterative formula

$$x_{n+1} = \ln(6 - x_n) + 1, \quad x_0 = 2$$

is used to find an approximate value for a

(b) Calculate the values of x_1 , x_2 and x_3 to 4 decimal places.

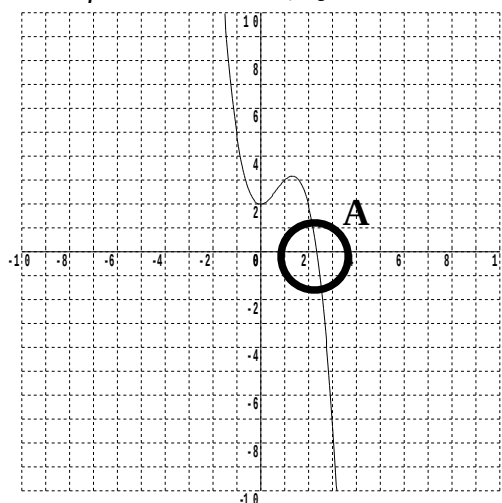
[3 marks]

(c) By choosing a suitable interval, show that $a = 2.307$ correct to 3 decimal places.

[3 marks]

Question 2

C3 Examination question from June 2009, Q1.



The graph shows part of the curve with equation

$$y = -x^3 + 2x^2 + 2$$

which intersects the x -axis at the point A where $x = \alpha$

To find an approximation to α the following iterative formula is used;

$$x_{n+1} = \frac{2}{(x_n)^2} + 2$$

- (a) Taking $x_0 = 2.5$, find the values of x_1 , x_2 , x_3 and x_4
Give your answers to 3 decimal places where appropriate.

[3 marks]

- (b) Show that $\alpha = 2.359$ correct to 3 decimal places.

[3 marks]

Question 3

C3 Examination question from January 2010, Q2.

$$f(x) = x^3 + 2x^2 - 3x - 11$$

(a) Show that $f(x) = 0$ can be rearranged as

$$x = \sqrt{\left(\frac{3x + 11}{x + 2} \right)} \quad x \neq -2$$

[2 marks]

The equation $f(x) = 0$ has one positive root α .

The following iterative formula is used to find an approximation to α .

$$x_{n+1} = \sqrt{\left(\frac{3x_n + 11}{x_n + 2} \right)}$$

(b) Taking $x_1 = 0$, find, to 3 decimal places, the values of x_2 , x_3 and x_4

[3 marks]

(c) Show that $\alpha = 2.057$ correct to 3 decimal places

[3 marks]

Question 4

C3 Examination question from June 2010, Q3.

$$f(x) = 4 \operatorname{cosec} x - 4x + 1, \quad \text{where } x \text{ is in radians}$$

- (a) Show that there is a root α of $f(x) = 0$ in the interval $[1.2, 1.3]$

[2 marks]

- (b) Show that the equation $f(x) = 0$ can be written in the form

$$x = \frac{1}{\sin x} + \frac{1}{4}$$

[2 marks]

- (c) Use the iterative formula

$$x_{n+1} = \frac{1}{\sin x_n} + \frac{1}{4}, \quad x_0 = 1.25$$

to calculate the values of x_1 , x_2 and x_3 giving answers to 4 decimal places .

[3 marks]

- (d) By considering the change of sign of $f(x)$ in a suitable interval, verify that $\alpha = 1.291$ correct to 3 decimal places.

[2 marks]

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