1MA1 Higher themed papers: Iteration

Write your name here

Surname

Other names

**Pearson Edexcel
Level 1/Level 2 GCSE (9–1)**

Centre Number

Candidate Number

Mathematics

Iteration

Paper Reference

1MA1

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The total mark for this paper is **39**. There are **6** questions.
- Questions have been arranged in an ascending order of mean difficulty, as found by all students in the June 2017–November 2019 examinations.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

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1 (*a*) Show that the equation $\quad x^3 + x = 7\quad$ has a solution between 1 and 2.

(**2**)

(*b*) Show that the equation $\quad x^3 + x = 7\quad$ can be rearranged to give $\quad x = \sqrt[3]{7 - x}$

(**1**)

(*c*) Starting with $x_0 = 2$,

use the iteration formula $x_{n+1} = \sqrt[3]{7 - x_n}$ three times to find an estimate for a solution of $\quad x^3 + x = 7$

....

(**3**)

(**Total for Question 1 is 6 marks**)

2 Using $x_{n+1} = -2 - \dfrac{4}{x_n^2}$

with $x_0 = -2.5$

(*a*) find the values of x_1, x_2 and x_3

$x_1 = $ ....

$x_2 = $ ....

$x_3 = $ ....

(3)

(*b*) Explain the relationship between the values of x_1, x_2 and x_3 and the equation $x^3 + 2x^2 + 4 = 0$

....

....

....

....

(2)

(Total for Question 2 is 5 marks)

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3   (*a*) Show that the equation $x^3 + 7x - 5 = 0$ has a solution between $x = 0$ and $x = 1$

(2)

(*b*) Show that the equation $x^3 + 7x - 5 = 0$ can be arranged to give $x = \dfrac{5}{x^2 + 7}$

(2)

(*c*) Starting with $x_0 = 1$, use the iteration formula $x_{n+1} = \dfrac{5}{x_n^2 + 7}$ three times to find
an estimate for the solution of $x^3 + 7x - 5 = 0$

....
(3)

(*d*) By substituting your answer to part (*c*) into $x^3 + 7x - 5$,
comment on the accuracy of your estimate for the solution to $x^3 + 7x - 5 = 0$

....

....

(2)

(Total for Question 3 is 9 marks)

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4   (a) Show that the equation $x^3 + 5x - 4 = 0$ has a solution between $x = 0$ and $x = 1$

(2)

   (b) Show that the equation $x^3 + 5x - 4 = 0$ can be arranged to give $x = \dfrac{4}{x^2 + 5}$

(2)

   (c) Starting with $x_0 = 0$,   use the iteration formula $x_{n+1} = \dfrac{4}{x_n^2 + 5}$ twice,

        to find an estimate for the solution of $x^3 + 5x - 4 = 0$

        ....

(3)

(Total for Question 4 is 7 marks)

5   (*a*) Show that the equation $x^3 - 3x^2 + 3 = 0$ has a solution between $x = 2$ and $x = 3$

(2)

(*b*) Show that the equation $x^3 - 3x^2 + 3 = 0$ can be rearranged to give $x = \sqrt[3]{3x^2 - 3}$

(1)

(*c*) Starting with $x_0 = 2$, use the iteration formula $x_{n+1} = \sqrt[3]{3x^2 - 3}$ to find the value of x_2.
Give your answer correct to 3 decimal places.

....

(3)

(Total for Question 5 is 6 marks)

6   (*a*) Show that the equation $3x^2 - x^3 + 3 = 0$ can be rearranged to give

$$x = 3 + \frac{3}{x^2}$$

           (2)

   (*b*) Using

$$x_{n+1} = 3 + \frac{3}{x_n^2} \quad \text{with } x_0 = 3.2,$$

find the values of x_1, x_2 and x_3

          ....

           (3)

   (*c*) Explain what the values of x_1, x_2 and x_3 represent.

....

....

           (1)

          (Total for Question 6 is 6 marks)

TOTAL MARKS FOR PAPER: 39