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| Centre Number | | | | | | Candidate Number | | | | |
| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |



General Certificate of Education
Advanced Level Examination
June 2015

Mathematics

MPC4

Unit Pure Core 4

Tuesday 9 June 2015 9.00 am to 10.30 am

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed

- 1 hour 30 minutes

- Instructions**
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
 - Fill in the boxes at the top of this page.
 - Answer **all** questions.
 - Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
 - You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
 - Do not write outside the box around each page.
 - Show all necessary working; otherwise marks for method may be lost.
 - Do all rough work in this book. Cross through any work that you do not want to be marked.

- Information**
- The marks for questions are shown in brackets.
 - The maximum mark for this paper is 75.

- Advice**
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
 - You do not necessarily need to use all the space provided.

| For Examiner's Use | |
|---------------------|------|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| TOTAL | |



J U N 1 5 M P C 4 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

1 It is given that $f(x) = \frac{19x - 2}{(5 - x)(1 + 6x)}$ can be expressed as $\frac{A}{5 - x} + \frac{B}{1 + 6x}$, where A and B are integers.

(a) Find the values of A and B .

[3 marks]

(b) Hence show that $\int_0^4 f(x) dx = k \ln 5$, where k is a rational number.

[6 marks]

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QUESTION
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4 (a) Find the binomial expansion of $(1 + 5x)^{\frac{1}{5}}$ up to and including the term in x^2 . **[2 marks]**

(b) (i) Find the binomial expansion of $(8 + 3x)^{-\frac{2}{3}}$ up to and including the term in x^2 . **[3 marks]**

(ii) Use your expansion from part **(b)(i)** to find an estimate for $\sqrt[3]{\frac{1}{81}}$, giving your answer to four decimal places. **[2 marks]**

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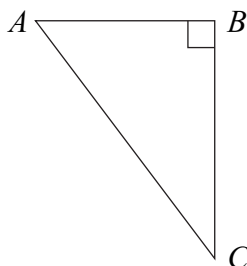
6 The points A and B have coordinates $(3, 2, 10)$ and $(5, -2, 4)$ respectively.

The line l passes through A and has equation $\mathbf{r} = \begin{bmatrix} 3 \\ 2 \\ 10 \end{bmatrix} + \lambda \begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$.

(a) Find the acute angle between l and the line AB .

[4 marks]

(b) The point C lies on l such that angle ABC is 90° .



Find the coordinates of C .

[4 marks]

(c) The point D is such that BD is parallel to AC and angle BCD is 90° . The point E lies on the line through B and D and is such that the length of DE is half that of AC .

Find the coordinates of the two possible positions of E .

[4 marks]

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QUESTION
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Answer space for question 7

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- 8 (a)** A pond is initially empty and is then filled gradually with water. After t minutes, the depth of the water, x metres, satisfies the differential equation

$$\frac{dx}{dt} = \frac{\sqrt{4 + 5x}}{5(1 + t)^2}$$

Solve this differential equation to find x in terms of t .

[7 marks]

- (b)** Another pond is gradually filling with water. After t minutes, the surface of the water forms a circle of radius r metres. The rate of change of the radius is inversely proportional to the area of the surface of the water.

- (i)** Write down a differential equation, in the variables r and t and a constant of proportionality, which represents how the radius of the surface of the water is changing with time.

(You are not required to solve your differential equation.)

[3 marks]

- (ii)** When the radius of the pond is 1 metre, the radius is increasing at a rate of 4.5 metres per second. Find the radius of the pond when the radius is increasing at a rate of 0.5 metres per second.

[2 marks]

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END OF QUESTIONS

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