

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel  
Level 3 GCE**

Centre Number

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Candidate Number

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**Thursday 13 June 2019**

Afternoon (Time: 1 hour 30 minutes)

Paper Reference **9FM0/3A**

**Further Mathematics**

**Advanced**

**Paper 3A: Further Pure Mathematics 1**

**You must have:**

Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

**Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

### Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 75.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions. Write your answers in the spaces provided.

1. Use Simpson's rule with 4 intervals to estimate

$$\int_{0.4}^2 e^{x^2} dx$$

(5)

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4. The parabola  $C$  has equation

$$y^2 = 16x$$

The distinct points  $P(p^2, 4p)$  and  $Q(q^2, 4q)$  lie on  $C$ , where  $p \neq 0, q \neq 0$

The tangent to  $C$  at  $P$  and the tangent to  $C$  at  $Q$  meet at the point  $R(-28, 6)$ .

Show that the area of triangle  $PQR$  is 1331

(8)

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5.

$$I = \int \frac{1}{4 \cos x - 3 \sin x} dx \quad 0 < x < \frac{\pi}{4}$$

Use the substitution  $t = \tan\left(\frac{x}{2}\right)$  to show that

$$I = \frac{1}{5} \ln \left( \frac{2 + \tan\left(\frac{x}{2}\right)}{1 - 2 \tan\left(\frac{x}{2}\right)} \right) + k$$

where  $k$  is an arbitrary constant.

(8)

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8. The hyperbola  $H$  has equation

$$\frac{x^2}{16} - \frac{y^2}{9} = 1$$

The line  $l_1$  is the tangent to  $H$  at the point  $P(4\cosh \theta, 3\sinh \theta)$ .

The line  $l_1$  meets the  $x$ -axis at the point  $A$ .

The line  $l_2$  is the tangent to  $H$  at the point  $(4, 0)$ .

The lines  $l_1$  and  $l_2$  meet at the point  $B$  and the midpoint of  $AB$  is the point  $M$ .

(a) Show that, as  $\theta$  varies, a Cartesian equation for the locus of  $M$  is

$$y^2 = \frac{9(4-x)}{4x} \quad p < x < q$$

where  $p$  and  $q$  are values to be determined.

(11)

Let  $S$  be the focus of  $H$  that lies on the positive  $x$ -axis.

(b) Show that the distance from  $M$  to  $S$  is greater than 1

(3)









