

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 16 May 2019**

Afternoon

Paper Reference **8FM0-21**

**Further Mathematics**

**Advanced Subsidiary**

**Further Mathematics options**

**21: Further Pure Mathematics 1**

**(Part of options A, B, C and D)**

**You must have:**

Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

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**Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra 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.
- The total mark for this part of the examination is 40. There are 5 questions.
- 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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2. A student was set the following problem.

Use algebra to find the set of values of  $x$  for which

$$\frac{x}{x-24} > \frac{1}{x+11}$$

The student's attempt at a solution is written below.

$$x(x-24)(x+11)^2 > (x+11)(x-24)^2$$

$$x(x-24)(x+11)^2 - (x+11)(x-24)^2 > 0$$

$$(x-24)(x+11)[x(x+11) - x - 24] > 0$$

Line 3

$$(x-24)(x+11)[x^2 + 10x - 24] > 0$$

$$(x-24)(x+11)(x+12)(x-2) > 0$$

$$x = 24, x = -11, x = -12, x = 2$$

$$\{x \in \mathbb{R} : -12 < x < -11\} \cup \{x \in \mathbb{R} : 2 < x < 24\}$$

Line 7

There are errors in the student's solution.

(a) Identify the error made

(i) in line 3

(ii) in line 7

(2)

(b) Find a correct solution to this problem.

(4)

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4.

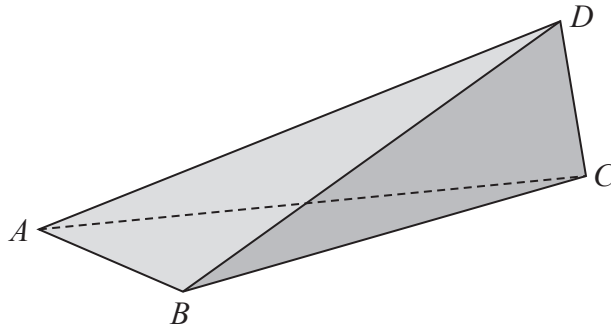
**Figure 1**

Figure 1 shows a sketch of a solid doorstop made of wood. The doorstop is modelled as a tetrahedron.

Relative to a fixed origin  $O$ , the vertices of the tetrahedron are  $A(2, 1, 4)$ ,  $B(6, 1, 2)$ ,  $C(4, 10, 3)$  and  $D(5, 8, d)$ , where  $d$  is a positive constant and the units are in centimetres.

(a) Find the area of the triangle  $ABC$ .

(4)

Given that the volume of the doorstop is  $21 \text{ cm}^3$

(b) find the value of the constant  $d$ .

(4)











5.

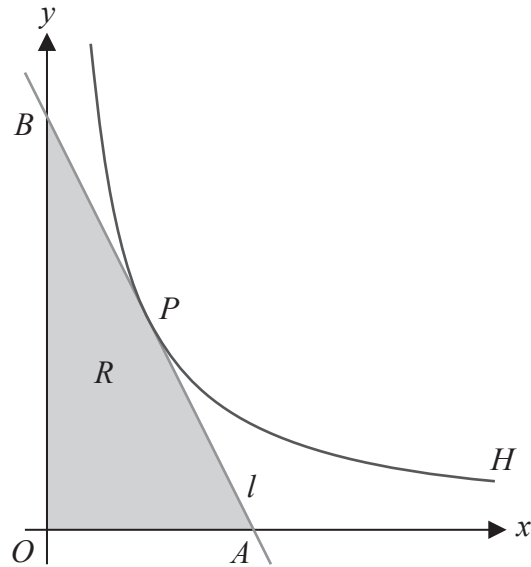


Figure 2

Figure 2 shows a sketch of part of the rectangular hyperbola  $H$  with equation

$$xy = c^2 \quad x > 0$$

where  $c$  is a positive constant.

The point  $P\left(ct, \frac{c}{t}\right)$  lies on  $H$ .

The line  $l$  is the tangent to  $H$  at the point  $P$ .

The line  $l$  crosses the  $x$ -axis at the point  $A$  and crosses the  $y$ -axis at the point  $B$ .

The region  $R$ , shown shaded in Figure 2, is bounded by the  $x$ -axis, the  $y$ -axis and the line  $l$ .

Given that the length  $OB$  is twice the length of  $OA$ , where  $O$  is the origin, and that the area of  $R$  is 32, find the exact coordinates of the point  $P$ .

(10)









