

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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MATHEMATICS

9709/13

Paper 1 Pure Mathematics 1 (P1)

October/November 2018

1 hour 45 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

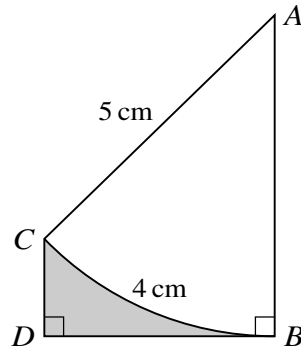
This document consists of **20** printed pages.

- [3]

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- 2** The function f is defined by $f(x) = x^3 + 2x^2 - 4x + 7$ for $x \geq -2$. Determine, showing all necessary working, whether f is an increasing function, a decreasing function or neither. [4]

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The diagram shows an arc BC of a circle with centre A and radius 5 cm. The length of the arc BC is 4 cm. The point D is such that the line BD is perpendicular to BA and DC is parallel to BA .

- (i) Find angle BAC in radians.

[1]

- (ii) Find the area of the shaded region BDC .

[5]

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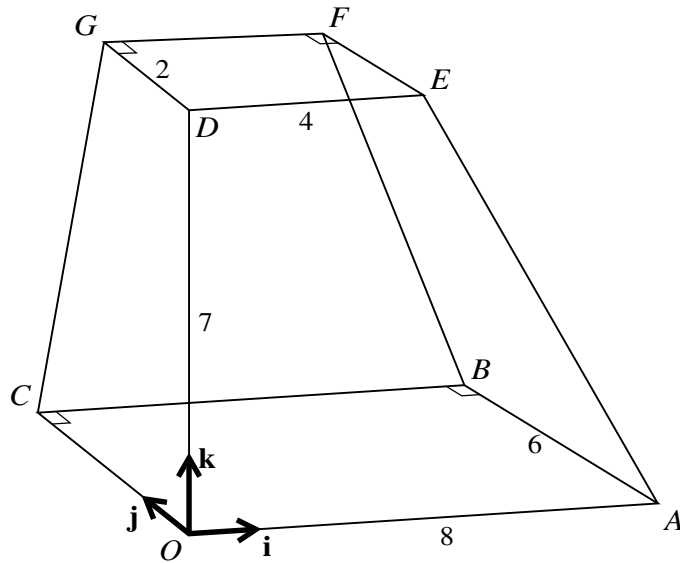
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- [illegible]

- 5** In an arithmetic progression the first term is a and the common difference is 3. The n th term is 94 and the sum of the first n terms is 1420. Find n and a . [6]

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[6]

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7 (i) Show that $\frac{\tan \theta + 1}{1 + \cos \theta} + \frac{\tan \theta - 1}{1 - \cos \theta} \equiv \frac{2(\tan \theta - \cos \theta)}{\sin^2 \theta}$. [3]

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$$\frac{\tan \theta + 1}{1 + \cos \theta} + \frac{\tan \theta - 1}{1 - \cos \theta} = 0$$

for $0^\circ < \theta < 90^\circ$.

[4]

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- 8** A curve passes through $(0, 11)$ and has an equation for which $\frac{dy}{dx} = ax^2 + bx - 4$, where a and b are constants.

(i) Find the equation of the curve in terms of a and b .

[3]

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- (ii)** It is now given that the curve has a stationary point at $(2, 3)$. Find the values of a and b . [5]

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- 9** A curve has equation $y = 2x^2 - 3x + 1$ and a line has equation $y = kx + k^2$, where k is a constant.

(i) Show that, for all values of k , the curve and the line meet.

[4]

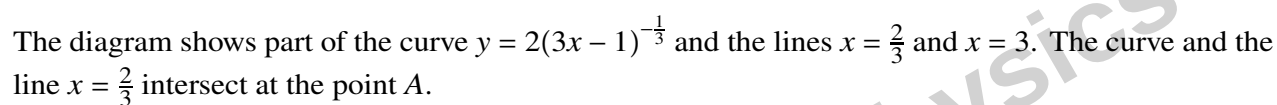
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- (ii)** State the value of k for which the line is a tangent to the curve and find the coordinates of the point where the line touches the curve. [4]

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- (i) Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the x -axis. [5]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. A faint, diagonal watermark is visible across the upper portion of the page, reading "Cambridge Math" and "kambridgemp.com". The watermark is light gray and semi-transparent. The overall appearance is that of a clean, unused piece of stationery or a worksheet.

- (ii)** Find the equation of the normal to the curve at A, giving your answer in the form $y = mx + c$.

[5]

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- 11 (i)** Express $2x^2 - 12x + 11$ in the form $a(x + b)^2 + c$, where a , b and c are constants. [3]

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The function f is defined by $f(x) = 2x^2 - 12x + 11$ for $x \leq k$.

- (ii)** State the largest value of the constant k for which f is a one-one function. [1]

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- (iii)** For this value of k find an expression for $f^{-1}(x)$ and state the domain of f^{-1} . [4]

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The function g is defined by $g(x) = x + 3$ for $x \leq p$.

- (iv) With k now taking the value 1, find the largest value of the constant p which allows the composite function fg to be formed, and find an expression for $fg(x)$ whenever this composite function exists. [3]

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