

## MEI STRUCTURED MATHEMATICS

### INTRODUCTION TO ADVANCED MATHEMATICS, C1

## Practice Paper C1-C

Additional materials: Answer booklet/paper  
Graph paper  
MEI Examination formulae and tables (MF12)

**TIME** 1 hour 30 minutes

#### INSTRUCTIONS

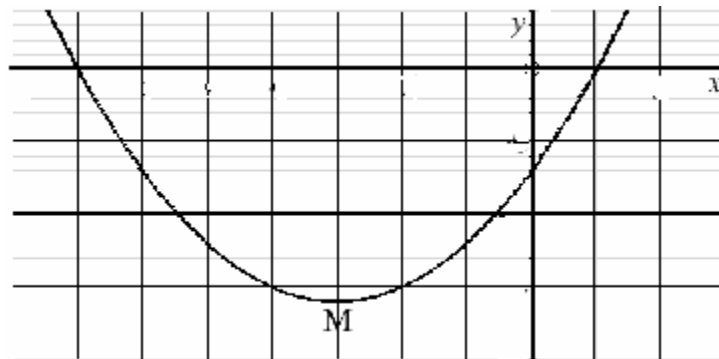
- Write your Name on each sheet of paper used or the front of the booklet used.
- Answer **all** the questions.
- You are **not** permitted to use a graphical calculator in this paper.

#### INFORMATION

- The number of marks is given in brackets [] at the end of each question or part-question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is **72**.

## Section A (36 marks)

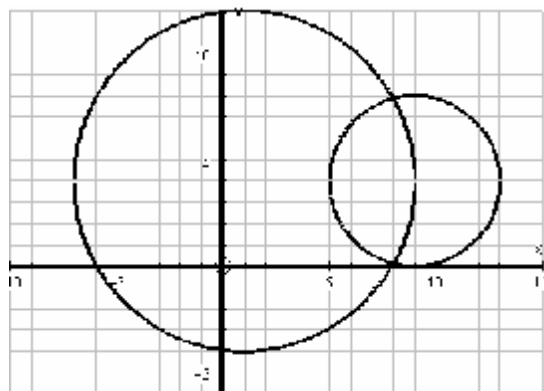
- 1 Simplify  $(3x - 1)(2x^2 - 5x + 3)$ . [2]
- 2 Make  $l$  the subject of the formula  $T = 2\pi\sqrt{\frac{l}{g}}$ . [3]
- 3 Solve the inequality  $2x^2 - 7x \geq 4$ . [4]
- 4 Simplify the following.
- (i)  $x^{\frac{5}{2}} \times \sqrt{x}$  [2]
- (ii)  $12x^{-5} \div 3x^{-2}$  [2]
- 5 The vertices of a triangle have coordinates  $(1, 5)$ ,  $(-3, 7)$  and  $(-2, -1)$ . Show that the triangle is right-angled. [4]
- 6 Find the coefficient of  $x^2$  in the expansion of  $(3 - 2x)^5$ . [4]
- 7 Find the coordinates of the points where the line  $y = 3x - 2$  cuts the curve  $y = x^2 + 4x - 8$ . [5]
- 8 The lines  $y = 5x - a$  and  $y = 2x + 18$  meet at the point  $(7, b)$ . Find the values of  $a$  and  $b$ . [5]
- 9 The graph shows the function  $y = x^2 + bx + c$  where  $b$  and  $c$  are constants. The point  $M(-3, -16)$  on the graph is the minimum point of the graph.



- (i) Write down the function  $y = f(x)$  in completed square form. [2]
- (ii) Hence find the coordinates of the points where the curve cuts the axes. [3]

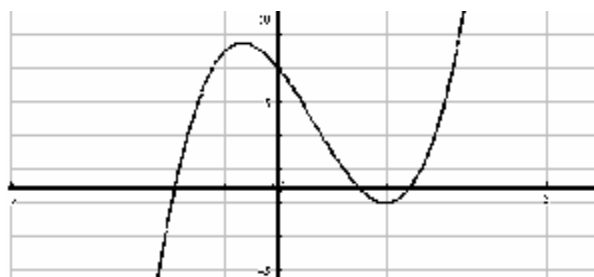
## Section B (36 marks)

- 10** A and B are circles with centres (1, 4) and (9, 4) respectively. The radius of circle A is 8. The circle B touches the  $x$  axis.



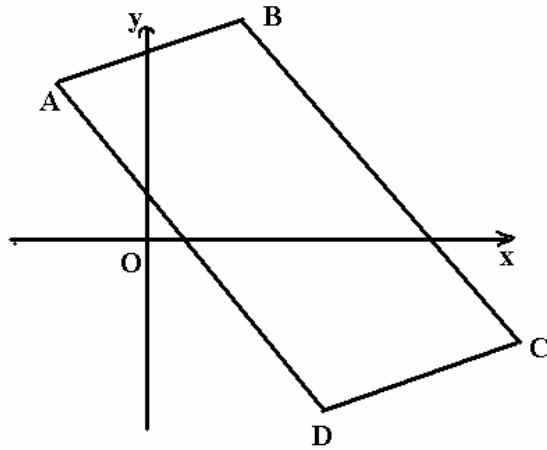
- (i) Write down the equations of the circles A and B. [4]
- (ii) Find the  $x$  coordinates of the points where the two curves intersect. [3]
- (iii) Find the  $y$  coordinates of these points, giving your answers in surd form. [5]
- 11** In this question  $f(x) = x^3 - 2x^2 - 4x + k$ .

- (i) You are asked to find the values of  $k$  which satisfy the following conditions.
- (A) The graph of  $y = f(x)$  goes through the origin. [1]
- (B) The graph of  $y = f(x)$  intersects with the  $y$  axis at (0, -2). [1]
- (C)  $(x - 2)$  is a factor of  $f(x)$ . [2]
- (D) The remainder when  $f(x)$  is divided by  $(x + 1)$  is 5. [2]
- (E) The graph of  $y = f(x)$  is as shown in the diagram below. [1]



- (ii) Find the solution of the equation  $f(x) = 0$  when  $k = 8$ .  
Sketch a graph of  $y = f(x)$  in this case. [5]

- 12 ABCD is a parallelogram. The coordinates of A, B, C and D are  $(-2, 3)$ ,  $(2, 4)$ ,  $(8, -3)$  and  $(4, -4)$  respectively.



- (i) Prove that AB and BD are perpendicular. [2]
- (ii) Find the lengths of AB and BD and hence find the area of the parallelogram ABCD. [3]
- (iii) Find the equation of the line CD and show that it meets the y-axis at X  $(0, -5)$ . [2]
- (iv) Show that the lines BX and AD bisect each other. [2]
- (v) Explain why the area of the parallelogram ABCD is equal to the area of the triangle BXC.  
Find the length of BX and hence calculate exactly the perpendicular distance of C from BX. [3]