

(O 25, B,I)

UNIVERSITIES OF MANCHESTER LIVERPOOL  
LEEDS SHEFFIELD AND BIRMINGHAM

JOINT MATRICULATION BOARD

GENERAL CERTIFICATE OF EDUCATION

**MATHEMATICS (O 25)**  
**SYLLABUS B, PAPER I**

ORDINARY

Monday 17 June 1963 9-30—12

**Negligently presented or slovenly work will be penalized.**

*Mathematical tables and one sheet of graph paper will be provided.*  
Answer **all** questions in Section A and any **three** questions from Section B.

*In each question necessary details of working, including rough work, must be shown with the answer*

**Section A**

**A 1.** (a) To build a motorway costs half a million pounds per mile.  
Find the cost per yard, in pounds, correct to the nearest pound.

(b) Solve the equation

$$\frac{8}{x} - \frac{6}{x+2} = 1$$

(c) In a triangle  $ABC$ ,  $AB = AC = 20$  cm.  
 $BC = 32$  cm. Calculate  $\angle C$ .

**[Turn over**

**A 2.** (a) Find the angle whose sine is

$$\frac{1}{2} \sin 62^{\circ} 12'$$

(b) Calculate the side of a regular polygon of 40 sides which is inscribed in a circle of radius 8 cm.

(c) Find  $x$ , where  $8 = 2\sqrt{9+x}$

**A 3.** (a) The angle  $A$  is obtuse and

$$\sin A = \frac{35}{37}$$

Without using tables, find  $\tan A$ .

(b) Simplify

$$\frac{x+1}{x-1} - \frac{x^2+1}{x^2-1}$$

(c) A tangent from a point  $P$  to a circle with centre  $O$  touches the circle at  $T$ . The line joining  $O$  to  $P$  cuts the circle at  $S$  and  $\angle TPS = 20^{\circ}$ . Calculate the obtuse angle of triangle  $TPS$ .

**A 4.** (a) Through how many degrees does the hour hand of a clock rotate in  $x$  minutes?

(b) Four angles of a pentagon are  $30^{\circ}$ ,  $88^{\circ}$ ,  $112^{\circ}$  and  $145^{\circ}$ . Find the fifth angle.

(c) If  $\frac{dy}{dx} = 6x^2$ , and  $y = 0$  when  $x = -1$ , find  $y$  in terms of  $x$ .

**A 5.** (a) An isosceles right-angled triangle is equal in area to a circle whose radius is  $10.5$  in. Calculate the length, of one of the equal sides of the triangle, taking  $\pi$  as  $\frac{22}{7}$ .

(b) A man is allowed two-ninths of a sum of money tax-free and pays tax at  $7s. 9d.$  in the £ on the remainder. Find the sum if the tax payable is £217.

**A 6.** (a) Calculate the largest angle of a triangle with sides  $4$ ,  $5$  and  $6$  cm.

(b) A quantity  $h$  is equal to  $\frac{ab}{c}$ . Find the percentage increase in  $h$  when  $a$  is increased by  $25$  per cent,  $b$  by  $8$  per cent and  $c$  by  $20$  per cent.

### Section B

Answer **three** questions from this section.

**B 7.** In a triangle  $ABC$ ,  $AB = 8$  cm.,  $\angle A = 130^\circ$  and  $\angle B = 40^\circ$ . Calculate  $BC$  and the radius of the circumcircle.

The inscribed circle touches  $AB$  at  $D$ . Write, down the value of each of  $AD$  and  $DB$  in terms of the radius of this circle and hence calculate the radius.

**B 8.**  $ABCD$  is a parallelogram and  $X$ ,  $Y$  are the mid-points of  $AD$ ,  $BC$  respectively.  $AC$  meets  $BX$  at  $P$  and  $XY$  at  $Q$ .

(i) Prove that  $P$  is a point of trisection of  $AC$ .

(ii) Find the areas of  $QYC$ ,  $ABP$  and  $PBYQ$  as fractions of the area of  $ABC$ .

[Turn over

**B 9.** Draw the graph of  $y = x^2 - 5x + \frac{6}{x}$  from  $x = 1$  to

$x = 5$ , taking 1 in. as the unit of both  $x$  and  $y$ .

From your graph estimate two roots of the equation  $x^3 + 6 = 5x^2$ .

Calculate the gradient of the curve at the point where  $x = 2$ , and hence draw the tangent to the curve at this point.

**B 10.** A factory makes cylindrical pencils 9 in. long and of radius  $\frac{3}{20}$  in. The graphite core is cylindrical, of radius  $\frac{1}{20}$  in., and it is surrounded by wood. During manufacture there is a wastage of 12 per. cent of graphite and 20 per cent of wood. Taking  $\pi$  as  $\frac{22}{7}$ , find how many pencils may be made from 50 cu. ft. of graphite and calculate the volume of wood required.

**B 11.** A 100 h.p. racing car travels at a steady speed of 40 metres per sec. in a race of 300 miles. Taking 8 km. as 5 miles, calculate the time in hours and minutes to complete the course.

Calculate the time taken for a 200 h.p. car to complete the course, assuming that the speed is proportional to the square root of the horsepower. Give your answer to the nearest minute.