UNIVERSITIES OF MANCHESTER LIVERPOOL LEEDS SHEFFIELD AND BIRMINGHAM

Joint Matriculation Board

General Certificate of Education

MATHEMATICS. SYLLABUS I. ALGEBRA ORDINARY

WEDNESDAY 17 NOVEMBER 1954, 9.30-11.30

Answer **all** *questions in* SECTION (A) *and any* **three** *questions from* SECTION (B).

In **Questions 1, 2** *and* **3** *a candidate need not write down more of his working than he finds necessary; in all other questions full explanations and all necessary details of working are required.*

Mathematical tables and graph paper provided.

SECTION (A)

A1. (*a*) If $t^2=\frac{2s}{g}$, find the positive value of t when $s=324$, $g=32$.

(*b*) Multiply x^2-2x+3 by x^2-1.

(*c*) Find the lowest common multiple of $2a^2b^2$, $4a^4b$, $6a^3b^3$.

(*d*) A car travels x miles in a hours, and then y miles at a speed of n m.p.h. Find (i) the average speed during the first part of the journey, (ii) the time taken on the second part of the journey, (iii) the average speed for the whole journey. *Do not simplify your answer.*

A2. (*a*) Find the positive value of k which will make $9x^2+kx+25$ a perfect square.

(*b*) Add together $2a+b-c$, $a-2b+2c$ and $-a+b-3c$.

(*c*) Factorize $(3y+1)^2-y^2$.

(*d*) Solve the equation $2x^2-3x-2=0$.

A3. (*a*) Simplify each of the following:

$$8^{\frac{2}{3}},\ 81^{-\frac{1}{4}},\ \frac{10^3\times 10^{-2}}{10^{-1}}.$$

(*b*) If $\frac{x-2y}{3x+y}=\frac{1}{10}$, find the value of $\frac{x}{y}$.

(*c*) Write down the square of $2+\sqrt{3}$, leaving your answer in surd form.

(*d*) If $y=\frac{2x^2+5}{x^2-3}$, express x in terms of y.

A4. (*a*) Factorize $ac+4bd+2ad+2bc$.

(*b*) Solve the equations

$$\frac{x+1}{2}+\frac{y+1}{3}=6,$$

$$3x-4y=1.$$

A5. Find the number which must be added to both the numerator and the denominator of the fraction $\frac{45}{52}$ to make the result equal to $\frac{8}{9}$.

A6. Simplify

$$\frac{3}{x^2-3x}+\frac{2}{x^2+2x}+\frac{1}{x^2-x-6}.$$

A7. Show that $x-2$ is a factor of the expression x^3-4x^2+x+6, and find the other factors.

SECTION (B)

Answer **three** *questions from* SECTION (B).

B8. Solve the equation

$$1+2x+\frac{3x}{1+2x}=0,$$

giving your answers correct to two decimal places.

Without further working write down the two values of y for which

$$1-2y-\frac{3y}{1-2y}=0.$$

B.9 If $y=\frac{1}{3}\left(\frac{a^2}{cx}+b\right)$,

(i) use logarithms to find the value of y when $a=3{\cdot}145$, $c=0{\cdot}2378$, $x=1{\cdot}472$, $b=29{\cdot}21$,

(ii) express x in terms of the other symbols.

B10. The floor of a room is in the shape of a rectangle on two adjacent sides of which are described squares. The perimeter of the floor is 32 yd., and the area is 49 sq. yd. Find the lengths of the sides of the two squares.

B11. On the same diagram draw the graphs of $y=\frac{1}{2}(x^2-3x+1)$ and $y=\frac{1}{2}x$ from $x=-1$ to $x=5$. Take 1 in. to represent 1 unit for both x and y.

Use your graphs to find the range of values of x for which $x^2-3x+1<x$.

B12. A variable y is equal to the sum of two terms, one of which is constant and the other proportional to the square of x. If $y=18$ when $x=\frac{1}{3}$ and $y=123$ when $x=2$, find the values of y when $x=0$ and $x=1$.