UNIVERSITY OF LONDON

GENERAL CERTIFICATE OF EDUCATION EXAMINATION

SUMMER 1964

Ordinary Level

PURE MATHEMATICS I

Syllabus B

Two and a half hours

Answer all questions in Section A and any FOUR questions in Section B.

All necessary working must be shown.

Credit will be given for the orderly presentation of material; candidates who neglect this essential will be penalized.

TE&S 62/1603 9/2/2125/35300

Section A

1. (i) A car averages 32 miles per gallon using petrol which costs 4*s*. 7*d*. per gallon. Calculate the cost of the petrol for a journey of 864 miles.

(ii) Factorize $2x^2 - 11xy - 6y^2$.

(iii) If $a = 4$ and $b = -1$, calculate the value of $3a^2 - 2ab - 5b^2$.

2. Solve the equations

(*a*) $3x - 2y = 8$
$y = 3x - 7$,

(*b*) $\dfrac{3x-5}{3} = \dfrac{x^2-2}{x}$.

3. Use tables to evaluate

(*a*) $0{\cdot}3216 \times 41{\cdot}03 \div 0{\cdot}741$,

(*b*) $\sqrt{1-\cos 84°23'}$

4. The tangent at *P* to the circumcircle of a triangle *PQR* cuts *RQ* produced at *A*. If *PQ* = *QA* and the angle $A = 37°$, calculate the angle *RPQ*. If, also, *QR* = 3 in., calculate the length of *PR*.

5. (i) On January 1st 1960 the total amount of money invested in a Building Society was 20 per cent more than the corresponding amount on January 1st 1959. On January 1st 1961 the amount was 15 per cent less than that on January 1st 1960. Express the total amount invested at January 1st 1961 as a percentage of the amount invested at January 1st 1959.

(ii) Solve the equation $4x^2 + 7x + 1 = 0$, giving the roots correct to two places of decimals.

6. (i) If $a = \dfrac{3}{4t+5}$, express *t* in terms of *a*.

(ii) Without using tables, write down the value of $625^{\frac{3}{4}}$.

(iii) Calculate the area of a triangle *ABC* in which *AB* = 1·6 in., *BC* = 2 in. and the angle $B = 64°$.

Section B

Answer any FOUR questions in this section.

7. (i) In a parallelogram *ABCD*, the sides *AB* and *AD* are of length 5 in. and 8 in. respectively, and the angle *DAB* = 32°. Calculate the length of the longer diagonal.

(ii) An aeroplane at the position *P* (42° N, 58° W) flies due South to *Q* (24° S, 58° W) and then due East along the parallel of latitude to *R* (24° S, 22° E). Ignoring the altitude at which the aeroplane flies, calculate the total distance flown.

(Take π as 3·142 and the earth as a sphere of radius 3,960 miles.)

8. The diagonal *AB* of a cyclic quadrilateral *XAYB* bisects the angle *XAY* and is a diameter of the circle through *X*, *A*, *Y* and *B*. The perpendicular *BN* to the tangent at *Y* to the circle meets this tangent at *N*. Prove that

(*a*) $BN.AB=BX^2$,

(*b*) *BY* bisects the angle *XYN*.

9. Measurements *u*, *f* and *p* taken in a certain experiment are related by the formula $p = \frac{1}{f} - \frac{1}{u}$. If *p* is kept constant while *u* and *f* are varied, it is found that the value of *f* when *u* = 24 is 6 more than the value obtained when *u* = 8. Calculate the value of *f* when *u* = 8, given that *f* is positive for every value of *u*.

10. (i) The volume of a cone is given by the formula $V = \frac{1}{3}\pi r^2 h$, where *h* is the height of the cone and *r* is the radius of the base. If *h* = 6 – *r*, calculate the value of *r* for which the volume is a maximum.

(ii) Calculate the area between the curve $y = 5x - x^3$, the ordinates *x* = 1 and *x* = 2 and the *x*-axis.

11. A point *A* is 12 miles due West of a point *B*. A bird takes 45 minutes to fly in a straight line from *B* to *A* in a wind the velocity of which is 15 m.p.h. from 320° (N 40° W). Calculate

(*a*) the speed, taken to be constant, at which the bird is moving relative to the ground,

(*b*) the bird's airspeed.

12. If a Channel tunnel could be constructed at a cost of £438,000,000 such that every day of the year (365 days) 120 trains could run through it each way, each train carrying on an average 250 tons of freight, calculate the cost per ton which should be charged to give a return of 5 per cent per annum on the cost of construction.

If the rate charged were £5 per ton, calculate how many years would elapse before the freight charges had cleared the construction costs.