AN ROINN OIDEACHAIS
(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS
(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1926.

HONOURS

MATHEMATICS (II).

MONDAY, 21st JUNE.—AFTERNOON, 3.30 TO 6 P.M

Six questions may be answered. All questions carry equal marks.

Tables of Measures, Constants and Formulae and Logarithmic Tables may be obtained from the Superintendent.

1. Find from first principles the derivative of $\cos x$. If $y = a \cos x + b \sin x + c$ and y', y'' are the first and second derivatives of y with respect to x, show that $y + y'' = c$ and $y'^2 + y''^2 = a^2 + b^2$.

2. If $y = f(x)$, what conclusions can you draw with regard to $f(x)$ when $\frac{dy}{dx}$ is (i) positive (ii) negative (iii) zero ?

An open rectangular box is to be made from a rectangular piece of cardboard of sides 10 ins. and 6 ins. by cutting four equal squares from the corners and folding up at the sides. Find the maximum volume of the box.

3. Show that the tangent to the curve $y = x^2 - x + \frac{1}{2}$ at the point where $x = 1$ and the tangent to the curve $y = x^2 - 2x + 3$ at the point where $x = 2$ intersect on the x-axis. Calculate the angle between these tangents.

4. Make a rough diagram showing the graphs $y = 3x^2$ and $y + 2x = 1$. Find the area external to the parabola and bounded by the parabola, the straight line and the x-axis.

5. D is a point in BC of triangle ABC, AD the bisector of angle A and I the in-centre of the triangle. If $AI = 1 \cdot 684 \cdot ID$ and $A = 47°40'$, find angles B and C.

6. If $\sin 5x = \sin 3x$ show that $x = n\pi$ or $\frac{2n+1}{8}\pi$, where n is an integer.

Hence find the values of $\sin\frac{\pi}{8}$, $\sin\frac{3\pi}{8}$.

7. The sides BA, CD of a quadrilateral circumscribed about a circle of centre O meet at E. POQ is perpendicular to OE and meets AB in P and CD in Q. Show that $PB \cdot QC = OP^2$ and that P,Q divide AB and CD in equal inverse ratios.

8. Define "radical axis" of two circles and state how it divides the line of centres of the two circles.

A variable circle touches two fixed circles: show that its radius bears a constant ratio to the distance of its centre from their radical axis.