OLLSCOIL NA hÉIREANN.

THE NATIONAL UNIVERSITY OF IRELAND.

M 12 S

MATRICULATION EXAMINATION.

MATHEMATICS.

FIRST PAPER.

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(*This Paper must be answered wholly in Irish or wholly in English*).

Not more than *eight* questions should be attempted.

1. (*a*) One cubic centimetre of water weighs one gram and mercury is 13·6 times as heavy as water. A spherical container of internal radius 10 cms. is filled with mercury. Find the weight of the mercury to the nearest kilogramme.

   (*b*) If the above amount of mercury be filled into a right circular cylinder of base radius 15 cms. find the height to which the mercury will rise in the cylinder.

2. Money is borrowed at 12% per annum compound interest. Show it will take $£r = £1·12$ to repay a loan of £1 at the end of one year.

   How much will be required to repay £12,500 at the end of two years.

   A loan of $£A$ is to be repaid in two equal instalments at the end of each of the first two years. Prove that

   $$Ar^2 - Pr - P = 0$$

   where $£P$ is the amount of each instalment.
   Find P if $A = 12,500$.

a.[

8. State when a set of four real or complex numbers, $\{a, b, c, d\}$, form a group under the operation of multiplication.

Find x if $\{1, -1, x, {}^1\!/x\}$ form a group under multiplication.

OR

An experimental measurement yields the results

2·26

1·95, 2·15, 2·15, 2·17, 2·45, 2·45, 2·5

when repeated. Find the mean and standard deviation.

9. If $f(x) = x^3 + 3x^2 - 9x + 5$, $-4 \leqslant x \leqslant +4$
find $f'(x)$ from first principles.

Find the equations of the tangents to the curve $y = f(x)$ at the points where $x = -3$, $x = 0$ and $x = 1$.

10. Differentiate by rule

$$2x/(x^2 + 1), \quad (3x + 2)/\{(x - 1)(x + 2)\}.$$