EXAMINATION FOR QUALIFYING CERTIFICATES

ADVANCED ALGEBRA

Monday, September 15, 1913—9.15 a. m. to 12.15 p. m., only

Answer eight questions. Credit will not be granted unless all operations (except mental ones) necessary to find results are given; simply indicating the operations is not sufficient. Each answer should be reduced to its simplest form. Each complete answer will receive 12½ credits. Papers entitled to less than 75 credits will not be accepted.

1 The difference between two numbers is 32 and the arithmetic mean exceeds the geometric mean by 4; find the numbers.

2 Two points move at constant rates along the circumference of a circle whose length is 15 feet; when they move in the same direction they are together every 25 seconds; when they move in opposite directions they meet every 5 seconds. What are their rates?

3 Solve $\begin{cases} (x-3y)^2 - 8x + 24y = -12 \\ 2(2x+y)^2 - 22x - 11y = -5 \end{cases}$

4 From the letters in the word *problem* how many distinct arrangements of *five* letters can be formed? How many will contain *p*? How many will not contain *m*?

5 For what values of n are the roots of the equation
$$8n^2 x(x+3) = n - 5$$
(*a*) equal, (*b*) real, (*c*) complex?

6 Evaluate the determinant $\begin{vmatrix} 2 & 3 & 1 & -1 \\ 2 & 0 & 0 & 3 \\ 4 & 1 & 0 & 1 \\ -1 & 2 & -2 & 1 \end{vmatrix}$

7 Solve the equation $12x^4 + 4x^3 - 35x^2 - 9x + 18 = 0$

8 Find, to *two* places of decimals, the root which lies between 3 and 4, of the equation $x^4 - 10x^2 - 4x + 8 = 0$

9 Find the equation of lowest degree, with rational coefficients, two of whose roots are $-5 + 2i$ and $-1 + \sqrt{5}$.

10 Transform the equation $36x^3 + 18x^2 + 2x + 9 = 0$ into another whose leading coefficient is 1 and whose remaining coefficients are integers.