

## ADVANCED ALGEBRA

Monday, January 19, 1925 — 9.15 a. m. to 12.15 p. m., only

Write at top of first page of answer paper (a) name of school where you have studied, (b) number of weeks and recitations a week in (1) elementary algebra, (2) intermediate algebra, (3) advanced algebra.

The minimum time requirement is five recitations a week in algebra for two school years.

Answer eight questions. Each answer should be reduced to its simplest form.

In the examination in advanced algebra the use of the slide rule will be allowed for checking, provided all computations with tables are shown on the answer paper.

1 a Express  $(1+i)^5$  and  $\frac{2+2i}{1-i}$  in the form  $a+bi$  [8]

b Represent graphically  $2i-2$  and  $1+3i$  and find their sum graphically. [2, 2½]

2 If one of the roots of  $6x^4 - 11x^3 + x^2 + 33x - 45 = 0$  is  $1 - \sqrt{-2}$ , find the other roots. [12½]

3 Find the values of  $q$  which will make two roots of the equation  $x^3 - 3x + q = 0$  equal. [12½]

4 By the use of Horner's method find to the nearest hundredth the positive root of  $x^3 + x - 4 = 0$ . [12½]

5 a If no two books are alike, in how many ways can 2 red books, 3 green books and 4 brown books be arranged on a shelf so that the books of the same color are together? [6]

b Six baseball nines wish to arrange a schedule of games in which each nine shall meet every other nine three times. How many games must be scheduled? [6½]

6 a Express as a common fraction the repeating decimal  $0.42727 \dots$  [6]

b Solve the following equation for  $n$ :  
 $876 = 329(1.06)^{4n}$  [6½]

7 Solve the following set of equations and group your answers:

$$\frac{1}{x^2} + \frac{1}{y^2} = 35$$

$$\frac{1}{x^2} - \frac{1}{xy} + \frac{1}{y^2} = 7 \quad [10, 2½]$$

8 a Obtain all the information possible concerning the roots of the following equation by the use of Descartes' rules and by inspection of the constant term:

$$x^4 + x^3 - x^2 + x - 1 = 0 \quad [6½]$$

b Transform  $x^2 - 2x^2 + 5x + 7 = 0$  into an equation whose roots are  $-2$  times the roots of the given equation. [6]

9  $A$  and  $B$  can run around a circular track 880 yards in length in 3 minutes and 7 minutes respectively. If they start together in how many minutes will  $A$  overtake  $B$ ? [12½]

10 a Plot between the values  $x = -2$  and  $x = +3$  the curve represented by the equation

$$y = 4x^3 - 6x^2 - 6x + 10 \quad [8½]$$

b From the curve estimate to the nearest tenth the negative root of the equation  $4x^3 - 6x^2 - 6x + 10 = 0$  and the positive value of  $x$  that will produce the least value of  $4x^3 - 6x^2 - 6x + 10$  [2, 2]