The University of the State of New York

224TH HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Monday, January 17, 1921—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.

1 Solve for x and y:

$$x^2-xy=12$$
$$xy-y^2=3$$

[12½]

2 *a* Rationalize the denominator and express the result in the form $a+bi$:

$$\frac{\sqrt{3}-i\sqrt{2}}{2\sqrt{3}-i\sqrt{2}}$$

b Simplify: $\left(a^{-\frac{1}{2}}x^{\frac{1}{2}}\sqrt{ax^{-\frac{1}{2}}}\sqrt[4]{x^{\frac{1}{2}}}\right)^{\frac{1}{2}}$

a [8]; *b* [4½]

3 *a* What must be the value of k if the roots of

$$x^2+2(1+k)x+k^2=0$$

are to be equal?

b Show that $3mx^2-(2m+3n)x+2n=0$ has rational roots.

a [6½]; *b* [6]

4 Solve and check *one* root:

$$\left(x+\frac{1}{x}\right)^2-\frac{7}{2}\left(x+\frac{1}{x}\right)=2$$

Solution [9], check [3½]

5 In the expansion $\left(\frac{3}{\sqrt[3]{x^2}}-\frac{x\sqrt{x}}{3}\right)^6$ find the fourth term and write it in its simplest form. [12½]

6 A ball is dropped to the pavement and rebounds 4 feet. It continues to rebound one half as far each time as it did the preceding time. Find the total distance the ball has passed over since first striking the pavement, when it finally comes to rest. [12½]

144

7 Given the equation $8x^3-20x^2+14x-3=0$

a Transform this equation into another having integral coefficients, the coefficient of the highest degree term being unity.

b Solve the resulting equation by any method. From the roots thus obtained determine the roots of the original equation.

a [4]; *b* [6], [2½]

8 By the use of formulas, find (*a*) how many different selections of 5 digits each can be made from the digits 1 to 9 inclusive, (*b*) how many different numbers of 5 digits each can be made from these same digits, repetition of a digit not being allowed. *a* [6]; *b* [6½]

9 Two trains go from A to B by different routes, one of which is 15 miles longer than the other. A train on the shorter route takes 6 hours to make the journey and a train on the longer route, traveling 10 miles less per hour, takes 8½ hours. Find the length of the shorter route. [12½]

10 The amount to which P dollars will accumulate in n years, when interest is compounded annually, is given by the formula $A=P\left(1+\frac{r}{100}\right)^n$. By means of this formula find the length of time it will take a sum of money to double itself if placed at interest at 5%. [12½]

11 Find to the nearest *tenth* the negative root of

$$x^3-3x^2-3x+18=0$$

[12½]; if not written to the nearest tenth [10]

12 A freely falling body will, at the end of the first second, have passed over approximately 16 feet; at the end of the second, 64 feet; at the end of the third, 144 feet; at the end of the fourth, 256 feet, etc. Represent graphically the path of a ball falling for 4 seconds and having a uniform horizontal velocity of 40 feet per second. [12½]