

ADVANCED ALGEBRA

Monday, January 20, 1919—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 If d is the distance in yards at which a certain train can be stopped on the level when going at a speed of V miles an hour, it is known that the following relation exists:

$V=$	30	40	55	60
$d=$	100	180	340	400

Plot a curve expressing this relation and from it find d when $V=35$; 45; 50

2 Given the quadratic equation

$$S=111.7D+1.35D^2-110.97$$

Find to two significant figures the value of D when $S=59.62$.

3 A bomb dropped from a point H feet above the earth by an airplane moving s feet per second, will fall D feet ahead of the perpendicular on which it was dropped, D being found by the formula

$$D=\left(\frac{\sqrt{H}}{4}+\frac{H}{8000}\right)s-\frac{H}{40}$$

If it is known that $s=100$ and $D=2000$ feet, find the height of the airplane to the nearest 100 feet.

4 Find all the roots of the equation $x^6-1=0$. Check each root.

5 a Plot the graph of $x^3-15x-4$

b From this graph find to two significant figures the value of x in the equation $x^3-15x-4=0$ that lies between -3 and -4 .

6 Solve the equation $x^4+2x^3+2x^2-2x-3=0$

7 Find to two decimal places the positive root of the equation $x^3-2x-5=0$

8 Given the equation

$$x^n+c_1x^{n-1}+c_2x^{n-2}+\dots+c_n=0$$

a What is the sum of the roots?

b What is the product of the roots?

c Express c_2 in terms of the roots.

9 One of the roots of the equation

$$x^4-2x^2+8x-3=0 \text{ is } 1-\sqrt{-2}$$

Find the other roots.

10 In how many ways can a detail of 2 officers and 5 men be chosen from a group of 10 officers and 100 men?

11 a If the equation $x^2+2(1+k)x+k^2=0$ has equal roots, find the value of k .

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

12 Given the equation $4x^5+3x^3-40x^2-x+10=0$

Without solving the equation, fill out the following statements by placing the proper number in each parenthesis; justify each statement by quoting the appropriate theorem or principle:

a The equation has () roots.

b It has no more than () positive roots and no more than () negative roots.

c It has at least () fractional roots.

d It has at least () imaginary roots.

e All the integral roots, if any, must be factors of ().

f The product of the roots is ().

g The equation has at least () real roots.

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DIRECTIONS FOR RATING

The direction, "Less than 60% of the credit should be granted when an error in computation occurs," should be followed in rating all incorrect answers to questions which fall under the topics mentioned in "Suggestions on the Rating of Regents Examination Papers in Mathematics" under "General 3."

Except in schools where the "committee system" is used, teachers are urged to mark papers cumulatively, that is, to add the credits earned by each answer to the total credits earned by preceding answers so that the mark given to the last answer is the per cent to which the paper is entitled, e. g. consecutive answers earning 3, 7, 4 etc. respectively should be marked 5, 12, 16 etc. respectively.

- 1 $12\frac{1}{2}$ credits
Allow $6\frac{1}{2}$ credits for correct curve.
Allow 6 credits for correct values of d (2 each).
- 2 $12\frac{1}{2}$ credits
Allow $7\frac{1}{2}$ credits for the correct value of D expressed in radical form.
Allow 5 credits for finding D correct to two significant figures.
- 3 $12\frac{1}{2}$ credits
See General Suggestion 3.
- 4 $12\frac{1}{2}$ credits
Allow $3\frac{1}{2}$ credits for correct solution.
Allow 1 credit for checking the real roots ($\frac{1}{2}$ each).
Allow 8 credits for checking the imaginary roots (2 each).
- 5 $12\frac{1}{2}$ credits
a Allow 10 credits for plotting the graph.
b Allow $2\frac{1}{2}$ credits for finding the value of x correct to two significant figures.
- 6 $12\frac{1}{2}$ credits
Allow 8 credits for finding the real roots (4 each).
Allow $4\frac{1}{2}$ credits for finding the imaginary roots.

- 7 $12\frac{1}{2}$ credits
Allow $3\frac{1}{2}$ credits for first figure of root.
Allow 4 credits for second figure of root.
Allow 5 credits for third figure of root.
- 8 $12\frac{1}{2}$ credits
a Allow 3 credits.
b Allow 4 credits.
c Allow $5\frac{1}{2}$ credits.
- 9 $12\frac{1}{2}$ credits
Allow $2\frac{1}{2}$ credits for finding the conjugate root.
Allow 10 credits for finding the other two roots (5 each).
- 10 $12\frac{1}{2}$ credits
Allow 5 credits for finding the number of combinations of officers.
Allow 5 credits for finding the number of combinations of men.
Allow $2\frac{1}{2}$ credits for finding the number of details.
- 11 $12\frac{1}{2}$ credits
a Allow 7 credits.
b Allow $5\frac{1}{2}$ credits.
- 12 $12\frac{1}{2}$ credits
a 1 credit *e* 2 credits
b 3 credits *f* 2 credits
c $1\frac{1}{2}$ credits *g* 2 credits
d 1 credit