INTERMEDIATE ALGEBRA

Tuesday, January 26, 1954—9.15 a. m. to 12.15 p. m., only

Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed.

1. **Express** as a single term the sum of $2\sqrt{-9}$ and $5i$. 1.....

2. **Find** the positive root of the equation $3x^2 - 7x - 6 = 0$ 2.....

3. Reduce the fraction $\frac{ax - ay}{by - bx}$ to lowest terms. 3.....

4. Write the fraction $\frac{2}{\sqrt{7} - 2}$ as an equivalent fraction with a rational denominator. 4.....

5. Find the value of x that satisfies the equation $3\sqrt{x - 1} - 4 = 0$. 5.....

6. Find the value of $4^{-\frac{3}{2}} + 8^0$ 6.....

7. Using the formula $S = \frac{\pi(D^2 - d^2)}{4}$, find the value of S if $D = 26$ and $d = 16$. [Use $\pi = \frac{22}{7}$] 7.....

8. Solve the following formula for P: $A = P + PRT$ 8.....

9. If x varies directly as y and $y = 27$ when $x = 6$, find y when $x = 8$. 9.....

10. The legs of a right triangle are in the ratio 2:5. Find to the *nearest degree*, the smaller acute angle of the triangle. 10.....

11. Find the logarithm of 23.56 11.....

12. Find n if $\log n = 9.6791 - 10$ 12.....

13. If $\log a = p$, express $\log 10a^2$ in terms of p. 13.....

14. If the number 0.00000128 is expressed in the form 1.28×10^n, what is the value of n? 14.....

15. Find the slope of the straight line that passes through the points (0, 0) and (6, 3). 15.....

16. Write an equation that expresses the relationship between x and y shown in the following table:

x	-2	-1	0	2
y	-6	-2	2	10

16.....

17. Simplify the complex fraction: $\frac{\frac{1}{a^2} + \frac{1}{b^2}}{\frac{2}{ab}}$ 17.....

18. The first term of an arithmetic progression is —4 and the fifth term is 20. Find the second term. 18.....

19. If the first term of an arithmetic progression is —3 and the 40th term is 54, find the sum of the first 40 terms of the progression. 19.....

20. Insert the positive geometric mean between a and $\frac{1}{a}$ 20.....

21. Find the sum of the infinite geometric progression 5, $\frac{3}{5}$, $\frac{5}{9}$, ... 21.....

22. Write in simplest form the first two terms in the expansion of $(a - 2b)^7$. 22.....

Directions (23-25): Indicate the correct completion for *each* of the following by writing on the line at the right the letter *a*, *b* or *c*.

23. In the quadratic equation $x^2 - 5x + 2 = 0$, the sum of the roots exceeds the product of the roots by (*a*) —3 (*b*) 3 (*c*) 7 23.....

24. If the discriminant of a quadratic equation is —25, the roots of the equation are (*a*) real and equal (*b*) real and unequal (*c*) imaginary 24.....

25. An equation of an ellipse may be (*a*) $3x^2 + y = 4$ (*b*) $3x^2 + y^2 = 4$ (*c*) $3x^2 - y^2 = 4$ 25.....

Part II

Answer three questions from part II.

26. If 16 is added to three times a given positive number, the sum is equal to the square of the number.
   a. Write the equation that can be used to find the number. [2]
   b. Find the number to the *nearest tenth*. [8]

27. Solve the following system of equations and check: [8, 2]
$$3x^2 - xy = 3$$
$$6x - y = 10$$

28. *a.* Draw the graph of $y = x^2 - 4x + 6$ from $x = -1$ to $x = 5$ inclusive. [6]
   b. On the graph made in answer to *a* indicate by letters A and B the points whose abscissas are the roots of the equation $x^2 - 4x + 6 = 8$. [2]
   c. From the graph determine the least value of k for which the roots of $x^2 - 4x + 6 = k$ are real. [2]

29. Given the formula $S = \sqrt{\frac{0.8V}{h \tan 54^\circ}}$. Using logarithms, find S to the *nearest hundredth* if $V = 327$ and $h = 28.7$. [10]

*30. Answer either *a* or b: [10]

a. Solve the equation: $2x^3 - 7x^2 - 7x + 30 = 0$

b. In how many years (n) will $350 amount to $498 if the money earns interest at the rate of 3% compounded annually? [Use $A = P(1 + r)^n$ and give the answer to the *nearest year.*]

*This question is based upon optional topics in the syllabus.

Part III

Answer two questions from part III.

31. Write the equations that would be used in solving the following problems. In each case state what the letter or letters represent. [Solution of the equations is not required.] [5, 5]

a. A man has $2,000 invested in bonds that pay 5% interest. How much should he invest in bonds that pay 2½% interest in order to get a return equal to 3½% on his total investment?

b. Mr. Jones bought a machine costing $240. He arranged to pay $60 down and the rest in monthly installments. If he paid $33 the first month and each payment thereafter was $3 less than the preceding one, in how many months did Mr. Jones complete payment for the machine?

32. The area of a rectangle is 30 square inches. If the length of the rectangle is increased by 4 inches and the width is decreased by one inch, the area of the rectangle becomes 33 square inches. Find the length and the width of the original rectangle. [5, 5]

33. A clerk is assigned a job that she can complete in 8 hours. After she has been working 2 hours, another clerk, who is able to do this job in 10 hours, is assigned to help her. In how many hours will the clerks working together complete the job? [6, 4]

34. Write the numbers 1-5 on your answer paper and next to each indicate the correct completion for the corresponding statement by writing *a*, *b* or *c*: [10]

(1) The number $\sqrt[3]{-\frac{1}{8}}$ is (*a*) real and rational (*b*) real and irrational (*c*) imaginary

(2) $\frac{9^x}{3^{2x}}$ equals (*a*) $\frac{3}{x}$ (*b*) 1 (*c*) 3^{-x}

(3) The graphs of the equations $3x - 4y = 5$ and $6x - 8y = 7$ are (*a*) intersecting lines (*b*) coincident lines (*c*) parallel lines

(4) 4 is a root of the equation (*a*) $\sqrt{2x + 1} + 3 = 0$ (*b*) $\sqrt{12x + 1} - x - 3 = 0$ (*c*) $x + \frac{1}{\sqrt{x}} - \frac{7}{2} = 0$

(5) The statement $(x + y)^2 = x^2 + y^2$, in which neither x nor y is zero, is true for (*a*) all other values of x and y (*b*) certain other values of x and y (*c*) no other value of x and y