36. The length of a rectangle is 3 more than its width. If the length is decreased by 1 and the width is increased by 1, the area of the new rectangle will be 20. Find the width of the original rectangle. [*Only an algebraic solution will be accepted.*] [5, 5]

37. On your answer paper write the letters *a* through *e*. After each letter write the answer to the correspondingly lettered question below. *The replacement set is the set of real numbers.* [10]

a What number is the multiplicative identity element?

b What number is the multiplicative inverse of $-\frac{3}{2}$?

c What number has no multiplicative inverse?

d What is the additive inverse of 2?

e Write a number which is equal to its multiplicative inverse.

January 25, 1971

Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided.

1. Find the value of $-5xy$ when $x = 2$ and $y = -1$. 1_____

2. Express in terms of x and y the total value, in dollars, of $3x$ books sold at y dollars each. 2_____

3. Solve for y: $\frac{y}{8} - \frac{y}{10} = 3$ 3_____

4. Find the solution set for p: $0.2p + 3 = 5$ 4_____

5. Solve for x: $\frac{2}{5}(x - 5) = 8$ 5_____

6. If the replacement set is {0, 1, 2, 3}, find the solution set of $3x + 1 \geq 10$. 6_____

7. Express $\sqrt{98}$ in *simplest radical form.* 7_____

8. What is the multiplicative inverse of $3x$? 8_____

9. A is the set of odd numbers between 0 and 6. B is the set of whole numbers greater than 1 and less than 6. List the members of the set which is the intersection of sets A and B. 9_____

10. On level ground, a man 6 feet tall casts a shadow which is 8 feet long at the same time that a tree casts a shadow that is 20 feet long. Find the number of feet in the height of the tree. 10_____

11. Express the fraction $\frac{x^2 + x - 2}{x + 2}$ in *lowest terms.* 11_____

12. Factor completely: $4x^2 + 2x$ 12_____

13. The area of a triangle is 10, and its base is 2. Find the height of the triangle. 13_____

14. If $\sin A = .3896$, find A to the *nearest degree.* 14_____

15. Find the value of $\sqrt{79}$ to the *nearest tenth.* 15_____

16. From $3b + c$ subtract $3b - c$. 16_____

17. Solve the following system of equations for x:

$$x - y = 5$$
$$2x + y = 1$$

17_____

18. The length of a rectangle is 7, and its width is 3. Express the length of a diagonal in radical form. 18_____

19. Solve for t in terms of A, p, and r: $A = p + prt$ 19_____

Directions (20-30): Write in the space provided the *number* preceding the expression that best completes *each* statement or answers *each* question.

20. If $2x + 7$ represents an odd number, what is the next larger odd number? (1) $3x + 7$ (2) $2x + 8$ (3) $2x + 9$ (4) $3x + 9$ 20____

21. The product of $+6x^3$ and $12x^4$ is (1) $72x^{12}$ (2) $72x^7$ (3) $18x^7$ (4) $18x^{12}$ 21____

22. What is the sum of $\frac{x + 2}{3}$ and $\frac{x - 3}{7}$? (1) $\frac{10x + 5}{21}$ (2) $\frac{2x - 1}{10}$ (3) $\frac{-1}{21}$ (4) $\frac{4x + 5}{21}$ 22____

23. The quotient $\frac{2}{x} \div \frac{x}{2}$ is (1) 1 (2) 0 (3) $\frac{4}{x^2}$ (4) $\frac{4 - x^2}{2x}$ 23____

24. Which is a rational number? (1) $\sqrt{2}$ (2) $\sqrt{3}$ (3) $\sqrt{9}$ (4) $\sqrt{5}$ 24____

25. What are all the values of x for which $|x| + 3 = 8$ is true? (1) 5, 11 (2) 5, −11 (3) 5, −5 (4) 11, −11 25____

26. If $C = 2\pi r$ and $d = 2r$, the ratio $\frac{C}{d}$ is (1) 1 (2) 2 (3) $\sqrt{2}$ (4) π 26____

27. If $x \neq 0$, which expression is undefined? (1) $\frac{x}{0}$ (2) $\frac{0}{x}$ (3) $x(x)$ (4) $\frac{x}{1}$ 27____

28. If $(2a + 5)$ is squared, the result is (1) $2a^2 + 25$ (2) $4a^2 + 25$ (3) $4a^2 + 10a + 25$ (4) $4a^2 + 20a + 25$ 28____

29. The y-intercept of the graph of the equation $y = 3x$ is (1) 1 (2) 0 (3) 3 (4) $\frac{1}{3}$ 29____

30. Which set is shown on the graph below?

(1) $\{x \mid -2 < x \leq 4\}$ (2) $\{x \mid -2 \leq x < 4\}$
(3) $\{x \mid -2 < x \leq 4\}$ (4) $\{x \mid -2 \leq x \leq 4\}$ 30____

Part II

Answer four questions from this part. Show all work unless otherwise directed.

31. On the same set of coordinate axes, graph the following system of inequalities and label the solution set A: [8, 2]

$$y > -2x + 10$$
$$y \geq x + 1$$

32. Answer *both* a and b:

a Express as a single fraction in *lowest terms*: [6]

$$\left(\frac{x^2 + x - 6}{x^2 - 1}\right)\left(\frac{x - 1}{x - 2}\right)$$

b From the sum of $2x^2 - 3x + 5$ and $x^2 + 3x + 7$ subtract $3x^2 - 10$. [4]

33. A school club held a bake sale at which a total of 40 cakes and pies were sold. The cakes sold for 90¢ each and the pies sold for 75¢ each. The club received $32.25 from the sale. How many cakes were sold? [*Only an algebraic solution will be accepted.*] [5, 5]

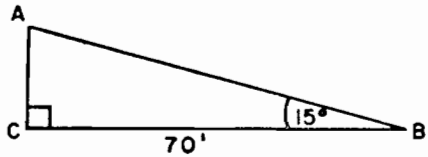
34. Write an equation or system of equations which can be used to solve *each* of the following problems. In each case state what the variable or variables represent. [*Solution of the equations is not required.*]

a A man is 35 years old, and his son is 7 years old. In how many years will the father be three times as old as his son will be then? [5]

b In a certain fraction, if 1 is subtracted from both the numerator and denominator, the resulting fraction is equivalent to $\frac{1}{2}$. If 5 is added to both the numerator and denominator of the original fraction, the resulting fraction is equivalent to $\frac{4}{5}$. Find the original fraction. [5]

35. Answer *both* *a* and *b*:

a As indicated in the accompanying diagram, a vertical pole, AC casts a shadow of 70 feet when the measure of the angle of elevation of the sun is 15°.



Find the number of feet in the height of the pole to the *nearest foot.* [5]

b A 20-foot ladder is leaning against the side of a house. If the foot of the ladder is 4 feet from the house on level ground, what angle does the ladder make with the ground to the *nearest degree*? [5]

36. Answer *either* *a* or *b*, but *not* both:

a Find the smallest of three consecutive positive odd integers such that the product of the second and third is 35. [*Only an algebraic solution will be accepted.*] [4, 6]

OR

b The length of a certain rectangle is 5 inches greater than a side of a square. The width of the rectangle is 2 inches less than a side of the square. The area of the rectangle is 8 square inches greater than the area of the square.

(1) Find the number of inches in the length of a side of the square. [4, 4]

(2) Find the number of square inches in the area of the rectangle. [2]

37. After *each* letter (*a* through *e*) write the number of the property, *chosen from the list below,* which justifies the corresponding statement. [10]

Properties

(1) additive inverse property
(2) transitive property of equality
(3) additive identity property
(4) commutative property for multiplication
(5) associative property for addition
(6) distributive property for multiplication with respect to addition
(7) closure property for addition

(*a*) $ab = ba$ (*a*)____

(*b*) If $a = b$ and $b = c$, then $a = c$. (*b*)____

(*c*) $ab + ac = a(b + c)$ (*c*)____

(*d*) $(a + b) + c = a + (b + c)$ (*d*)____

(*e*) $a + (-a) = 0$ (*e*)____