NINTH YEAR MATHEMATICS
June 15, 1984
Part 1

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 on the answer sheet.

1. If three times a certain number is increased by 4, the result is 19. What is the number? 1._____

2. Solve for x: $2x + 7 = 5x - 14$ 2._____

3. Factor: $x^2 - 5x - 24$ 3._____

4. If $\cos A = .8576$, find the measure of angle A to the *nearest degree.* 4._____

5. Solve for x: $\dfrac{x}{2} - \dfrac{x}{3} = \dfrac{1}{6}$ 5._____

6. Find the numerical value of $|-3| + |7| - |-7|$. 6._____

7. If $S = 4t - 2y$, find S when $t = 2$ and $y = -1$. 7._____

8. Factor: $49 - x^2$ 8._____

9. What is the y-intercept of the line whose equation is $y = 3x - 5$? 9._____

10. Solve for x: $0.3x - 6 = 0.9$ 10._____

11. A vertical pole casts a shadow 10 feet long. At the same time, a man 6 feet tall casts a shadow 4 feet long. What is the height, in feet, of the pole? 11._____

12. The solution set of the equation
$$(y - 3)(y - b) = 0 \text{ is } \{3,5\}.$$
What is the value of b? 12._____

13. Divide $12x^3 - 24x^2 + 3x$ by $3x$. 13._____

14. Find $\sqrt{53}$ to the *nearest tenth.* 14._____

15. Solve the following system of equations for y:
$$3y + x = 13$$
$$y + x = 1$$
  15._____

16. Solve for x in terms of a, b, and c: $\dfrac{cx}{a} = b$ 16._____

17. The sum of the measures of two angles is $90°$. If the measures of the two angles are in the ratio $1:5$, find the measure, in degrees, of the *smaller* angle. 17._____
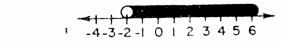
18. Subtract $x^2 - 6x + 5$ from $2x^2 - 3x + 2$. 18._____

Directions (19-30): Write in the spaces provided on the answer sheet the *numeral* preceding the expression that best completes *each* statement or answers *each* question.

19. Which is a rational number?   (1) $\sqrt{8}$ (2) $\sqrt{12}$
(3) $\sqrt{16}$ (4) $\sqrt{20}$ 19____

20. The product of $3x^5$ and $2x^7$ is   (1) $5x^{12}$ (2) $6x^{12}$
(3) $5x^{35}$ (4) $6x^{35}$ 20____

21. If p and q represent natural numbers, which expression must

represent another natural number?   (1) $p + q$ (2) $\dfrac{p}{q}$

(3) $p - q$ (4) $\dfrac{q}{p}$ 21____

22. The product of $(2 + a)$ and $(3 - b)$ is equal to
(1) $6 + ab - b^2$ (2) $5 + ab + 3a - 2b$ (3) $6 - 2b + 3a - ab$
(4) $6 - ab$ 22____

23. The multiplicative inverse of $-\frac{1}{8}$ is (1) 1 (2) $\frac{1}{8}$ (3) -8 (4) 8 23____

24. The base of an isosceles triangle is 4 more than one of its legs. If x represents the length of one of its legs, then the perimeter of the triangle is represented by   (1) $4 - x$ (2) $3x + 4$ (3) $3x - 4$
(4) $3x + 8$ 24____

25. For which value of x is the fraction $\dfrac{x + 3}{x - 5}$ undefined?

(1) -3 (2) -5 (3) 3   (4) 5   25____

26. Which equation illustrates the associative property of addition?
(1) $3 + 5 = 5 + 3$ (2) $2 + (-2) = 0$
(3) $2(3 + 4) = 2(3) + 2(4)$ (4) $(3 + 4) + 7 = 3 + (4 + 7)$ 26____

27. The sum of $3\sqrt{3}$ and $\sqrt{12}$ is   (1) $5\sqrt{3}$ (2) $7\sqrt{3}$
(3) $3\sqrt{15}$ (4) $\sqrt{21}$ 27____

28. The expression $(-3x^2y^3)^3$ is equivalent to   (1) $-3x^5y^6$
(2) $-9x^6y^9$ (3) $-27x^5y^6$ (4) $-27x^6y^9$ 28____

29. Which coordinates represent a point on the graph of $y = 4x - 14$?   (1) $(-2,6)$ (2) $2,-6)$ (3) $(-6,2)$ (4) $(6,-2)$ 29____

30. Which inequality is represented by the graph below?

(1) $-2 \leq x \leq 6$ (2) $-2 \leq x < 6$ (3) $-2 < x < 6$
(4) $-2 \leq x \leq 6$ 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 S.

$$2x + y \leq 6$$
$$y \geq 2 \qquad [8, 2]$$

32. Answer *both* a and b.

a Solve for x and check:

$$\frac{2}{x} - \frac{x - 1}{3x} = 2 \qquad [5, 1]$$

b Perform the indicated operation and express the result in simplest terms:

$$\frac{x + 3}{2x + 4} \cdot \frac{x^2 - x - 6}{2x + 6} \qquad [4]$$

33. Write an equation or a system of equations that 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 Beth paid \$3.30 for stamps. Some of the stamps cost 20 cents each and the rest cost 13 cents each. If the number of 20-cent stamps was 10 less than twice the number of 13-cent stamps, how many of each kind did she buy? [5]

b A cargo plane leaves an airport and travels east at 180 miles per hour. Two hours later a jet plane leaves the same airport and travels in the same direction at 900 miles per hour. How long will it take the jet plane to catch up to the cargo plane? [5]

34. The sum of the squares of two positive consecutive odd integers is 130. Find the integers. [*Only an algebraic solution will be accepted.*] [5, 5]

35. The denominator of a fraction is 3 times the numerator. If 8 is added to the numerator and 6 is subtracted from the denominator, the value of the resulting fraction is $\frac{8}{9}$. Find the original fraction [*Only an algebraic solution will be accepted.*] [6, 4]

36. Answer *both* a and b.

a Find to the *nearest foot* the height of a building that casts a shadow of 80 feet when the angle of elevation of the Sun is 42°. [5]

b In right triangle ABC, angle C is a right angle. The ratio of leg AC to hypotenuse AB is 4 to 5. Find the measure of angle B to the *nearest degree*. [5]

37. The replacement set for x for each of the open sentences below is $\{-2,-1,0,1,2\}$. On your answer paper, write the letters a through e, and next to *each* letter write the solution set of the open sentence. [*Each answer must be a subset of the replacement set.*]   [10]

a $(x - 1)(x + 2) = 0$ a_____

b $\dfrac{4}{|x|} = 2$ b_____

c $3x - 3 > x + 1$ c_____

d $x^2 = 1$ d_____

e $-2x \geq 4$ e_____