Part I

Answer 30 questions from this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Write your answers in the spaces provided on the separate answer sheet. Where applicable, answers may be left in terms of π or in radical form.   [60]

1 Solve for x: $3x + 8 = 4 + 5x$

2 Danielle's test grades are 83, 92, 99, 86, and 90. What is the median of her grades?

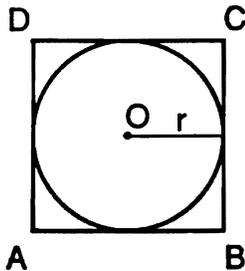3 Solve for x: $0.03x + 1.2 = 3.3$

4 Factor: $a^2 - 9$

5 Solve the following system of equations for x:
$$3x - 2y = 6$$
$$-x + 2y = 12$$

6 If the perimeter of an equilateral triangle is represented by $9x - 15$, express the length of a side of the triangle as a binomial in terms of x.

7 Let p represent "It is cold" and let q represent "I wear a sweater." Using p and q, write in symbolic form: "If I wear a sweater, it is cold."
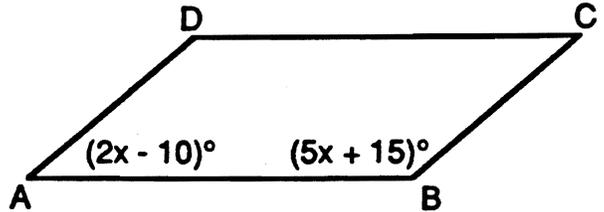
8 In the accompanying diagram, the length of the diameter of circle O equals the length of a side of square $ABCD$. If the area of the square is 100, find the length of r, the radius of circle O.

9 Solve for x: $\frac{2}{5}x - 7 = 3$

10 The measure of the vertex angle of an isosceles triangle is 76°. Find the measure of a base angle.

11 In the accompanying diagram of parallelogram $ABCD$, $m\angle A = 2x - 10$ and $m\angle B = 5x + 15$. Find x.

12 The sides of a triangle have measures of 4, 5, and 6. Find the measure of the *shortest* side of a similar triangle whose longest side has a measure of 9.

13 Express the sum $\frac{1}{3x} + \frac{2}{5x}$, $x \neq 0$, as a single fraction in lowest terms.

14 The measures of two complementary angles are in the ratio 2:7. Find the measure of the larger angle.

15 Express the product $(2x - 3)(x - 2)$ as a trinomial.

16 If $(-2,k)$ is a point on the line whose equation is $3x + y = 2$, what is the value of k?

17 Write an equation of the line whose slope is 2 and whose y-intercept is -3.

Directions (18–35): For *each* question chosen, write on the separate answer sheet the *numeral* preceding the word or expression that best completes the statement or answers the question.

18 The product of $-3x^3$ and $6x^5$ is equal to
(1) $3x^8$ (3) $-18x^8$
(2) $-18x^2$ (4) $-18x^{15}$

19 An urn contains three red marbles and four blue marbles. One marble is selected at random, its color is noted, and it is returned to the urn. Another marble is then selected. What is the probability the second marble drawn is red?

(1) $\frac{1}{7}$ (3) $\frac{3}{7}$

(2) $\frac{2}{7}$ (4) $\frac{3}{6}$

20 Which letter has both point and line symmetry?

(1) A   (3) T

(2) M   (4) X

21 The graph of the equation $y = 3$ is a line
(1) parallel to the x-axis
(2) parallel to the y-axis
(3) passing through the origin
(4) passing through the point (3,0)

22 Which number is *not* a member of the solution set of $5x \le 23$?
(1) 0   (3) 4.6
(2) −4.7   (4) 4.7

23 Which is equivalent to $\sqrt{40}$?
(1) $2\sqrt{10}$ (3) $4\sqrt{10}$
(2) $2\sqrt{20}$ (4) $10\sqrt{2}$

24 The additive inverse of $a - b$ is

(1) $a + b$ (3) $-a - b$

(2) $-a + b$ (4) $\frac{1}{a - b}$

25 If the probability that an event will occur is $\frac{x}{4}$, what is the probability that the event will *not* occur?

(1) $\frac{1 - x}{4}$ (3) $\frac{4}{x}, x \ne 0$

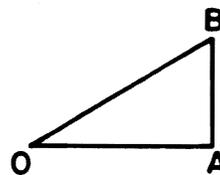(2) $\frac{4 - x}{4}$ (4) $\frac{4 - x}{x}, x \ne 0$

26 On a quiz taken by 24 students, the 75th percentile was 84. How many students scored *higher* than 84?
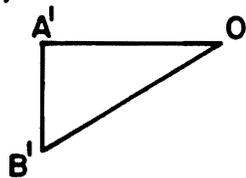(1) 6   (3) 18
(2) 12   (4) 21

27 Let p represent the statement "x is an odd number" and let q represent the statement "x is a perfect square number." If $x = 16$, which is *not* true?
(1) $p \vee q$ (3) $\sim p$
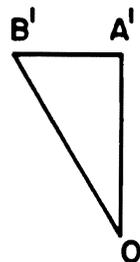(2) $p \to q$ (4) q

28 In the accompanying diagram, if $\triangle OAB$ is rotated counterclockwise 90° about point O, which figure represents the image of this rotation?
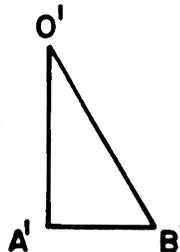

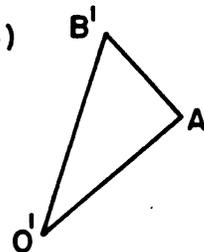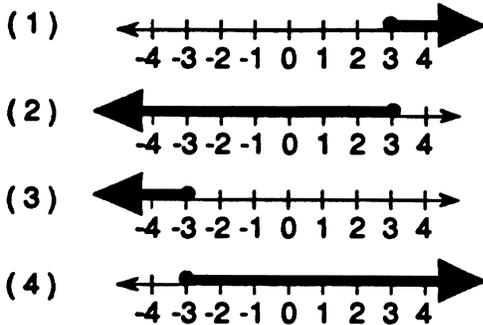29 Given the true statement: "If a quadrilateral is a square, then it is a parallelogram." Which statement *must* also be true?
(1) If a quadrilateral is a parallelogram, then it is a square.
(2) If a quadrilateral is not a parallelogram, then it is not a square.
(3) If a quadrilateral is not a square, then it is a parallelogram.
(4) If a quadrilateral is not a square, then it is not a parallelogram.

30 Which graph represents the solution of the inequality $-3x + 1 \leq 10$?

(1)

-4 -3 -2 -1 0 1 2 3 4

(2)

-4 -3 -2 -1 0 1 2 3 4

(3)

-4 -3 -2 -1 0 1 2 3 4

(4)

-4 -3 -2 -1 0 1 2 3 4

31 Which statement is *always* true if the domain of the variables is the set of positive integers?

(1) $\sqrt{a^2 + b^2} = a + b$

(2) $ab = b$

(3) $\dfrac{a + b}{c} = \dfrac{a}{c} + \dfrac{b}{c}$

(4) $(a + b)^2 = a^2 + b^2$

32 The three vertices of $\triangle ABC$ are in Quadrant I. If $\triangle ABC$ is reflected in the x-axis, its image will lie in Quadrant

(1) I   (3) III

(2) II   (4) IV

33 If $14x^3 - 35x^2 + 7x$ is divided by $7x$, the quotient is

(1) $2x^2 - 5x$ (3) $2x^3 - 5x^2 + x$

(2) $2x^2 - 5x + 1$ (4) $2x^2 - 5x + x$

34 A family consumes q quarts of milk in d days. The amount of milk consumed in x days is represented by

(1) qdx (3) $\dfrac{qx}{d}$

(2) $\dfrac{dx}{q}$ (4) $\dfrac{d}{qx}$

35 The width of a rectangle is 3 less than its length. If ℓ represents the length, which expression represents the area of the rectangle?

(1) $\ell^2 - 3\ell$ (3) $3\ell^2$

(2) $\ell^2 - 3$ (4) $4\ell - 6$

Answers to the following questions are to be written on paper provided by the school.
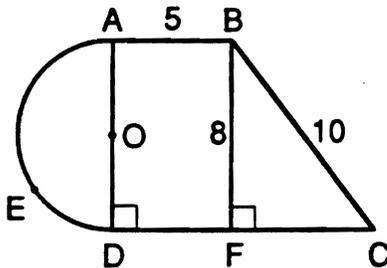
Part II

Answer four questions from this part. All work, including calculations, must be shown on your answer paper. [40]

36 Solve the following system of equations graphically and check:

$$y - 2x = 7$$
$$x + y = -2$$ [8,2]

37 In the accompanying diagram, AODE is a semicircle with diameter $\overline{AOD}$, ABCD is a trapezoid, $\overline{BF}$ and $\overline{AD}$ are perpendicular to $\overline{DC}$, $\overline{AB} \parallel \overline{CD}$, AB = 5, BF = 8, and BC = 10.

a Find FC. [2]
b Find the area of trapezoid ABCD. [4]
c Express, in terms of π, the area of the entire figure. [4]

38 The domain (replacement set) for each open sentence below is {-3,-2,-1,0,1,2,3}. On your answer paper, write the letters a through e and next to each letter, write the solution set for each open sentence.

a $0.4x + 3.6 = 2.2x$ [2]

b $\frac{x - 3}{2} = \frac{4}{5}$ [2]

c $-4x - 3 > 5$ [2]

d $2x^2 - x - 1 = 0$ [2]

e $x^2 - 3x = 0$ [2]

39 One positive integer is 3 less than a second positive integer. The sum of the squares of the two integers is 65. Find both positive integers. [*Only an algebraic solution will be accepted.*] [5,5]

40 The table below represents the distribution of grades in a college mathematics class. A, B, C, and D are passing grades, and x represents a positive integer.

Grade	Frequency
A	x
B	$2x - 3$
C	$x + 1$
D	5
F	$x - 4$

a If 29 students are in this class, find x. [3]
b What is the median grade? [3]
c If a student is selected at random from the class, find the probability that the student's grade is
  (1) *not* a passing grade [1]
  (2) equal to the mode [1]
  (3) at least a C [2]

41 The length of a rectangle is three times the width. If the width of the rectangle is increased by 3 inches and the length of the rectangle is decreased by 1 inch, the ratio of the width of the new rectangle to the length of the new rectangle is 4:7. Find the dimensions of the original rectangle. [*Only an algebraic solution will be accepted.*] [5,5]

42 *a On your answer paper*, copy the table and then complete the truth values for each statement in the table. [7]

p	q	~p	~q	p ∧ q	~(p ∧ q)	p ∨ q	~(p ∨ q)	~p ∨ ~q
T	T							
T	F							
F	T							
F	F							

b Using the table completed in part *a*, list the statements, if any, that are equivalent. [2]

c If one of the truth values of the statement p ∧ q is selected from the table, what is the probability that it is a T? [1]