## Part I

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

1. A set of geometric figures consists of a square, a trapezoid, an obtuse triangle, an equilateral triangle, and a right triangle. If one of the figures is selected at random, what is the probability that all of its sides are congruent?

2. Solve for x: $5(x + 2) - 3x = 12$

3. In the accompanying diagram, $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$ intersects $\overleftrightarrow{AB}$ at G and $\overleftrightarrow{CD}$ at H. If $m \angle AGH = 80$ and $m \angle DHG = 5x$, find the value of x.
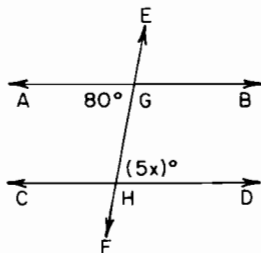
4. If x varies directly as y and $x = 3$ when $y = 15$, find the value of x when $y = 25$.

5. Solve for x: $0.5x - 4 = 0.5$

6. In the accompanying diagram, $\angle ACD$ is an exterior angle of $\triangle ABC$. If $m \angle A = 35$ and $m \angle B = 65$, find $m \angle ACD$.
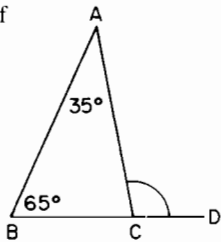

7. In the accompanying diagram, $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at E, and $m \angle AED = 3x + 15$. If $m \angle CEB = 2x + 45$, find the value of x.
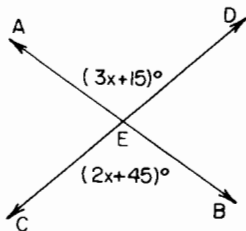

8. The measure of the vertex angle of an isosceles triangle is $50°$. Find the measure of a base angle of the triangle.

9. Solve for x: $\dfrac{x}{5} - 3 = 7$

10. Express $x^2 + 2x - 15$ as the product of two binomials.

11. What is the value of $-2x^2y$ if $x = -1$ and $y = -3$?

12. If the point $(3, k)$ is on the graph of the equation $x + 2y = 15$, what is the value of k?

13. For which value of x is the expression $\dfrac{1}{x - 2}$ undefined?

14. If $3x$ represents the width of a rectangle and $5x$ represents the length of the rectangle, express the perimeter of the rectangle as a monomial in terms of x.

15. In the accompanying diagram, right triangle ABC is similar to right triangle RST with $\angle A \cong \angle R$. If $AB = 6$, $AC = 9$, and $RS = 4$, find RT.
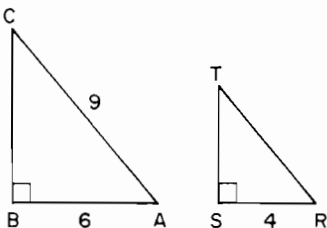
16. The probability that the XYZ Light Bulb Factory will produce a defective bulb is 5%. How many defective light bulbs might be expected out of each 1,000 bulbs produced?

17. If $198{,}000{,}000$ is written in the form 1.98×10^n, what is the value of n?

18. In the accompanying diagram, $MINT$ is a rectangle and $MPKT$ is a square. If $MT = 6$ and $TN = 14$, find PN.
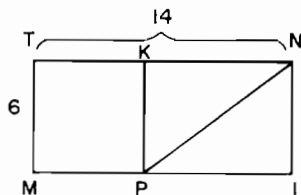

19. If the sum of $\sqrt{50}$ and $x\sqrt{2}$ is $8\sqrt{2}$, find the value of x.

Directions (20–35): 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.

20. The reciprocal of $\dfrac{1}{x}$, $x \neq 0$, is

    (1) $-\dfrac{1}{x}$ (2) x (3) $-x$ (4) $1 - \dfrac{1}{x}$

21. The product of $\frac{1}{2}x^3$ and $\frac{1}{4}x^5$ is

    (1) $\frac{1}{8}x^{15}$ (2) $\frac{1}{8}x^8$ (3) $\frac{1}{6}x^8$ (4) $\frac{3}{4}x^8$

22. For a set of scores, 80 is the score for the 75th percentile. Which statement is true?
    (1) Eighty scores are at or below 75.
    (2) Seventy-five scores are at or below 80.
    (3) Seventy-five percent of the scores are at or below 80.
    (4) Eighty percent of the scores are at or below 75.

23. Which type of symmetry, if any, does regular hexagon *ABCDEF* have?
    (1) point symmetry, only   (2) line symmetry, only
    (3) point and line symmetry   (4) no symmetry
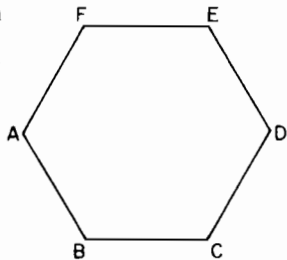
24. Which graph represents the solution set of the inequality $2x - 5 > 7$?
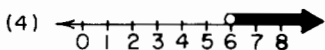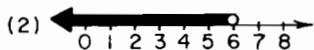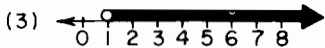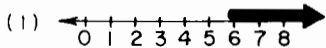
25. The vertices of rectangle *ABCD* are $A(3, 1)$, $B(-5, 1)$, $C(-5, -3)$, and *D*. What are the coordinates of *D*?
    (1) $(3, -3)$ (2) $(-3, 3)$ (3) $(3, 3)$ (4) $(-3, -3)$

26. If *p* represents the statement "*x* is an integer" and *q* represents the statement "*x* is a prime number," which statement is *not* true when $x = 7$?
    (1) $p \rightarrow q$ (2) $p \leftrightarrow q$ (3) $p \wedge \sim q$ (4) $p \vee q$

27. If the measure of angle *A* is $60°$, which statement must also be true?
    (1) Both angle *A* and its supplement are obtuse angles.
    (2) Both angle *A* and its supplement are acute angles.
    (3) Both angle *A* and its complement are obtuse angles.
    (4) Both angle *A* and its complement are acute angles.

28. In the accompanying diagram, which is an equation of line *l*?
    (1) $y = 3$ (2) $x = 3$ (3) $x + y = 3$
    (4) $x - y = 3$
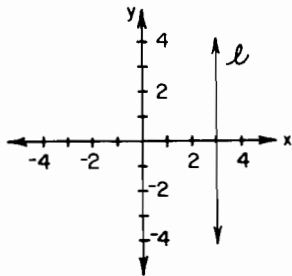
29. Written in factored form, the binomial $a^2b - ab^2$ is equivalent to
    (1) $ab(a - b)$ (2) $(a - b)(a + b)$ (3) $a^2(b - b^2)$ (4) $a^2b^2(b - a)$

30. The solution set of the equation $x^2 - x - 6 = 0$ is
    (1) $\{6, -1\}$ (2) $\{3, -2\}$ (3) $\{2, -3\}$ (4) $\{-6, 1\}$

31. The statement "If p, then q" is false if and only if
    (1) p is true and q is false   (3) p is false and q is false
    (2) p is true and q is true   (4) p is false and q is true

32. What is the converse of the statement "If an animal is a black cat, then it has four legs"?
    (1) If an animal has four legs, then it is a black cat.
    (2) If an animal does not have four legs, then it is not a black cat.
    (3) If an animal has four legs, then it is not a black cat.
    (4) If an animal is not a black cat, then it does not have four legs.

33. Based on the data in the table (*right*), which interval contains the median?
    (1) 0–5   (2) 6–10   (3) 11–15   (4) 16–20

Interval	Frequency
0–5	1
6–10	2
11–15	2
16–20	4

34. Which does *not* represent a rational number?
    (1) $\frac{3}{2}$ (2) $\sqrt{7}$ (3) $\sqrt{16}$ (4) $0.\overline{29}$

35. If the edge of a cube is doubled, the volume is multiplied by
    (1) 6   (2) 2   (3) 3   (4) 8

Part II

Answer four questions from this part. Show all work unless otherwise directed.   [40]

36. *a.* On the same set of coordinate axes, graph the following system of inequalities:

$$y > 2x + 5$$
$$x + y \leq 4 \quad [8]$$

   b. Based on the graphs drawn in part *a*, write the coordinates of a point in the solution set of the system of inequalities.   [2]

37. *a.* Solve algebraically and check:

$$2x + 3y = -5$$
$$3x - 2y = 12 \quad [7, 2]$$

   b. If the system of equations in part *a* were graphed, in which quadrant would the solution lie?   [1]

38. In the accompanying diagram, $ABCD$ is a rectangle with $\overline{AB}$ as a diameter of semicircle O. Diagonal $\overline{BD}$ is drawn in rectangle $ABCD$. The length of $\overline{BD}$ exceeds the length of $\overline{AB}$ by 1, and $AD = 5$.
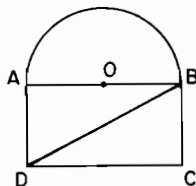
    a. Find AB. [6]
    b. Find, to the *nearest integer*, the area of the semicircle. [Use $\pi = 3.14$.] [4]

39. The larger of two positive integers is three more than the smaller. If twice the square of the smaller integer is increased by three times the larger integer, the result is 74. Find the integers. [*Only an algebraic solution will be accepted.*] [5, 5]

40. Each part below consists of three statements. The truth value for two of the statements is given. *On your answer paper*, write the letters *a* through *e*, and next to each letter, write the missing truth value (TRUE or FALSE). If the truth value cannot be determined from the information given, write "CANNOT BE DETERMINED."

a.

p	q	$p \leftrightarrow q$
	T	F

[2]

d.

p	q	$\sim (p \wedge q)$
	T	F

[2]

b.

p	q	$q \rightarrow p$
	T	F

[2]

e.

p	q	$p \vee \sim q$
	T	F

[2]

c.

p	q	$p \vee q$
T		T

[2]

41. a. In $\triangle ABC$, the measures of angles A and B are in the ratio $1:3$, and the measure of angle C is twice the measure of angle B. Write an equation or a system of equations that could be used to find the measure of each angle. State what the variable or variables represent. [*Solution of the equation(s) is not required.*] [5]
    b. Write an equation that could be used to find three consecutive integers such that the sum of the first two integers is nine more than the third integer. State what the variable represents. [*Solution of the equation is not required.*] [5]

42. A jar contains five disks numbered 1, 2, 3, 4, and 5, respectively. A two-digit number is formed by drawing a disk, not replacing it, and then drawing a second disk.
    a. Draw a tree diagram or list the sample space showing all possible outcomes of two-digit numbers. [4]
    b. Find the probability that the two-digit number
       (1) is greater than 40   [2]
       (2) is divisible by 5   [2]
       (3) has the same digit in both places [2]