The following information is for your reference in solving some of the problems.
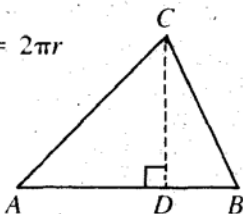
Circle of radius r: Area $= \pi r^2$ Circumference $= 2\pi r$
  The number of degrees of arc in a circle is 360.
The measure in degrees of a straight angle is 180.

Triangle: The sum of the measures in degrees of the angles of a triangle is 180.

Definitions of symbols:
  $=$ is equal to $\leqq$ is less than or equal to
  $\neq$ is unequal to $\geqq$ is greater than or equal to
  $<$ is less than $\|$ is parallel to
  $>$ is greater than $\perp$ is perpendicular to

If $\angle CDA$ is a right angle, then

(1) area of $\triangle ABC = \dfrac{AB \times CD}{2}$

(2) $AC^2 = AD^2 + DC^2$

Note: Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated. All numbers used are real numbers.
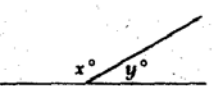
1. How much more is $\frac{1}{3}$ of $\frac{1}{4}$ than $\frac{1}{4}$ of $\frac{1}{12}$?
   (A) $\frac{1}{4}$ (B) $\frac{1}{16}$ (C) $1\frac{2}{3}$ (D) 3 (E) 4

2. $100 - \frac{100}{0.2}$ equals
   (A) -400 (B) -50 (C) 50 (D) 99.8
   (E) 400

3. $\dfrac{5 + \frac{3}{4}}{1 - \frac{13}{36}}$ equals the square of what number?
   (A) $\sqrt{3}$ (B) $2\frac{1}{4}$ (C) 3 (D) 9 (E) 81

4. What is the largest integer that is a factor of all three of the following numbers: 2160, 1344, 1440?
   (A) 6 (B) 8 (C) 12 (D) 16 (E) 48

5. $\frac{1}{4}\%$ of 2 $=$
   (A) $\frac{1}{200}$ (B) $\frac{1}{100}$ (C) $\frac{1}{80}$ (D) $\frac{1}{8}$ (E) $\frac{4}{5}$

6. $2^x = \dfrac{\sqrt[4]{81}}{\sqrt{18}} : x =$
   (A) -1 (B) $-\frac{1}{2}$ (C) 0 (D) $\frac{1}{2}$ (E) 1

7. A man earns d dollars each week and spends s dollars a week. In how many weeks will he have Q dollars?
   (A) $\dfrac{ds}{Q}$ (B) $\dfrac{Q}{ds}$ (C) $\dfrac{Q}{s-d}$ (D) $\dfrac{Q}{d-s}$
   (E) $\dfrac{d-s}{Q}$

8. What part of $3.00 is a dime?
   (A) $\frac{1}{300}$ (B) $\frac{1}{30}$ (C) $\frac{1}{3}$ (D) $33\frac{1}{3}$ (E) $3\frac{1}{3}$

9. What percent of k is 10?
   (A) $10k$ (B) $\frac{k}{10}$ (C) $\frac{10}{k}$ (D) $\frac{1000}{k}$ (E) $\frac{k}{1000}$

10. A school now has a registration of $50, which represents a $6\frac{1}{4}\%$ increase over the previous year. The registration in the previous year was
    (A) 644 (B) 722 (C) 797 (D) 800
    (E) 903

11. If 2 erasers cost 6¢, how many erasers can be bought for 36¢?
    (A) 6 (B) 12 (C) 18 (D) 36 (E) 72

12. During the drama society's performance in a school auditorium, with 750 seats in the orchestra and 400 seats in the balcony, $\frac{2}{3}$ of the seats in the orchestra and $\frac{3}{8}$ of the seats in the balcony are sold. What part of all the seats are left unsold?
    (A) $\frac{10}{23}$ (B) $\frac{13}{23}$ (C) $\frac{23}{24}$ (D) $\frac{24}{25}$ (E) $\frac{13}{25}$

13. Three boys have marbles in the ratio of $19:5:3$. If the boy with the least number has 9 marbles, how many marbles does the boy with the greatest number have?
    (A) 27 (B) 33 (C) 57 (D) 81 (E) 171

14. A bowler has an average of 150 points a game for 12 games. If he bowls 6 more games, how high an average must he make in these games to raise his average for the 18 games to 160?
    (A) 170 (B) 175 (C) 180 (D) 210
    (E) 225

15. On a certain map the scale is given as 1 inch $=$ 1 mile. A boy copies the map, making each dimension three times as large as the given dimensions. On his map how many miles will 6 inches represent?
    (A) 2 (B) 3 (C) 6 (D) 18 (E) 20

Questions 16-32 each consist of two quantities, one in Column A and one in Column B. You are to compare the two quantities and on the answer sheet fill in circle

A if the quantity in Column A is greater;
B if the quantity in Column B is greater;
C if the two quantities are equal;
D if the relationship cannot be determined from the information given.

Notes:
1. In certain questions, information concerning one or both of the quantities to be compared is centered above the two columns.
2. In a given question, a symbol that appears in both columns represents the same thing in Column A as it does in Column B.
3. Letters such as x, n, and k stand for real numbers.

EXAMPLES		
Column A	Column B	Answers
E1. 2×6	$2 + 6$	● Ⓑ Ⓒ Ⓓ
E2. $180 - x$	y	Ⓐ Ⓑ ● Ⓓ
E3. $p - q$	$q - p$	Ⓐ Ⓑ Ⓒ ●

Column A   Column B

$$\frac{(7)(7)(21)}{x} = (7)(3)$$

16.   21 x

17. $\sqrt{\frac{1}{4}}$ $(0.25)^2$

$$2^{n+1} = 32$$

18. n 5

$$xy = 0$$

19. y x

$$x^2 - y^2 = 0$$

20. $x + y$ 0

21. $\dfrac{a+b}{b}$ $\dfrac{a}{b} + 1$

$$a + 3 = 5$$
$$b + 3 = 7$$

22. $b - a$ a
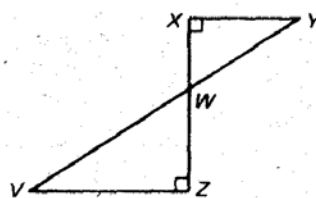
Column A   Column B

City A is 10 miles from City B and City C is 5 miles from City B.

23.   Distance from   15 miles
           City A to City C
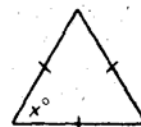
24.   The average of a, b, and c x

$$XY = 8,\ WY = 10,\ VZ = 16$$
$$ZX \perp XY \text{ and } XZ \perp VZ$$

25.   Length of XWZ $XY + WY$

$$abc = 0 \text{ and } a = 1$$

26.   1 bc
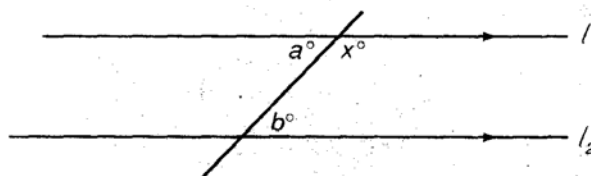
$$a + b = 110°$$

27. x 110

$$4x > 3y$$

28. x y

29. $(1)^{27}$ $(3)^9$

x is an integer.

30.   The maximum value of   11
           $10 - x^2$

$$x = \frac{y}{7}$$

31. $7x$ y

$$a^2 - 11a + 30 = 0$$

32. a 7

33. History of First-Class Letter Rates

1885–1917	2 cents	March 2, 1974	10 cents
1917–1919 (war years)	3 cents	December 31, 1975	13 cents
1919	2 cents	May 29, 1978	15 cents
July 6, 1932	3 cents	March 22, 1981	18 cents
August 1, 1958	4 cents	November 1, 1981	20 cents
January 7, 1963	5 cents	February 17, 1985	22 cents
January 7, 1968	6 cents	April 3, 1988	25 cents
May 16, 1971	8 cents		

The percentage increase of letter rates by 1978 as compared with the rate in 1932 was
(A) 8% (B) 12% (C) 40% (D) 80%
(E) 400%

34. Flight #602 left Kennedy Airport at 1:00 P.M. and traveled south at an average rate of 200 miles per hour. Flight #302 left from the same point one-half hour later and traveled west at 320 miles per hour. How far apart are these planes at 4:00 P.M.?
(A) 1000 miles (B) 1200 miles (C) 1400 miles
(D) 1600 miles (E) 2800 miles

35. Three men own a business establishment in the ratio of 19:5:3. What part of the total business does the man with the smallest interest control?
(A) 3% (B) 9% (C) 11.1% (D) 16.6%
(E) 88.8%

36. A store has chewing gum selling for 3¢ a stick and another brand selling for 4¢. How many combinations of these 2 brands can I buy and receive no change for a quarter?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

37. If $x + y = 16$, what does $x - z$ equal?
(A) $z + 16$ (B) 8 (C) $16 - y$ (D) $z(16 - y)$
(E) $16 - y - z$

38. If a and b are positive integers and $\dfrac{a - b}{3.5} = \dfrac{4}{7}$, then which of the following is (are) correct?
  I. $b < a$
  II. $b \geq a$
  III. $b \leq a$
(A) I only (B) II only (C) III only
(D) I and II only (E) I, II, and III

39. 10^x means that 10 is to be used as a factor x times, and 10^{-x} means $\dfrac{1}{10^x}$. Very large and very small numbers, therefore, are frequently written as decimals multiplied by 10^x, where x is a positive or a negative integer. All of the following are correct EXCEPT
(A) $470,000 = 4.7 \times 10^5$
(B) 450 billion $= 4.5 \times 10^{11}$
(C) $0.00000000075 = 7.5 \times 10^{-10}$
(D) 86 hundred-thousandths $= 8.6 \times 10^{-2}$
(E) 26 million $= 2.6 \times 10^7$

40. The graduating class of a certain school desires to leave as a memorial two prizes of $50 each to be awarded annually for the two best essays. What is the minimum amount of money that must be invested in 10% bonds to insure the necessary income?
(A) $1000 (B) $10,000 (C) $4000
(D) $5000 (E) more than $10,000

41. A farmer has enough feed to take care of 60 chickens for 8 days. How long will this feed last if he purchases 20 additional chickens?
(A) 2 days (B) 5 days (C) 6 days
(D) $10\frac{2}{3}$ days (E) 24 days

42. A rectangular fish tank 25″ by 9″ has water in it to a level of 2″. This water is carefully poured into a cylindrical container with a diameter of 10″. How high (in terms of π) will the water reach in the cylindrical container?
(A) 18π (B) $\dfrac{\pi}{18}$ (C) $\dfrac{18}{\pi}$ (D) $\dfrac{9}{2\pi}$ (E) $\dfrac{9\pi}{2}$

43. AB and CD are chords of a circle intersecting at E. If $\overset{\frown}{AD} = 60°$ and $\angle AED \overset{\circ}{=} 45$, what is the measure of $\angle EDB$?
(A) 15° (B) 20°
(C) 30° (D) 45°
(E) 60°
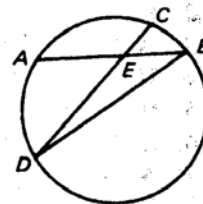
44. AOC is a diameter of circle O. $\angle BAC \overset{\circ}{=} 30$. $\overset{\frown}{BC} = \overset{\frown}{CD}$. How many degrees are there in the measure of $\overset{\frown}{AD}$?
(A) 60 (B) 120
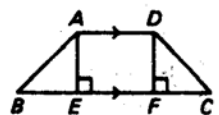(C) 150 (D) 165
(E) 180
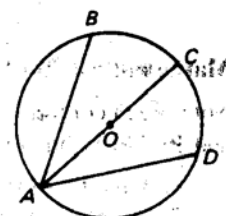
45. If $\boxtimes$ is defined by the equation $x \boxtimes y = x + xy + y$ for all numbers x and y, what is the value of a if $8 \boxtimes a = 3$?
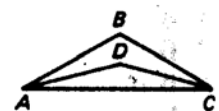(A) -5 (B) $-\dfrac{5}{9}$ (C) $\dfrac{3}{8}$ (D) $\dfrac{5}{9}$ (E) 5

46. $AD = 10$, $AE = 8$, $\angle B = \angle C \overset{\circ}{=} 45$; $BC =$
(A) 16 (B) 18 (C) 26
(D) 36 (E) none of these

47. $\angle BAD = \angle CAD$, $BA = BC$, $DA = DC$, and $\angle B \overset{\circ}{=} 120$. $\angle ADC$ has a measure of
(A) 60° (B) 120°
(C) 150° (D) 160°
(E) 165°

48. The base of a 39-foot ladder is placed 15 feet from a building which is 200 feet tall. How many feet up the building will the ladder extend?

(A) 36 (B) 54 (C) 146 (D) 161 (E) 185

49. A box was made in the form of a cube. If a second cubical box has inside dimensions three times those of the first box, how many times as much does it contain?

(A) 3 (B) 6 (C) 9 (D) 12 (E) 27

50. *ABCD* is a square of side 10. *AFC* is an arc of a circle with the center at *D*. *AGC* is an arc of a circle with the center at *B*. Which of the following correctly express(es) the area of the shaded portion?
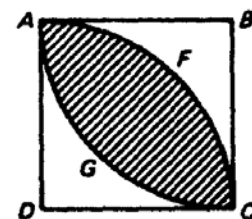
I. $50\pi - 100$
II. $100 - 50\pi$
III. $100\pi - 100$

(A) I only (B) II only (C) III only
(D) I and II only (E) I, II, and III

Mathematical Aptitude Section

Note: Each correct answer to the mathematics questions is keyed by number to the corresponding topic in Chapters 9 and 10. These numerals refer to the topics listed below, with specific page references in parentheses.

1. Basic Fundamental Operations (155–157)
2. Algebraic Operations (157–160)
3. Using Algebra (160–164)
4. Exponents, Roots and Radicals (159–160)
5. Inequalities (164–165)
6. Fractions (176–178)
7. Decimals (176)
8. Percent (178–180)
9. Averages (180–181)
10. Motion (182–183)
11. Ratio and Proportion (183–185)
12. Mixtures and Solutions (177–178)
13. Work (185–186)
14. Coordinate Geometry (172–173)
15. Geometry (165–172, 173–176)
16. Quantitative Comparisons (189–192)

ANSWER KEY

1. **B** (1,6)	*11.* **B** (11)	*21.* **C** (2,16)	*31.* **C** (16,2)	*41.* **C** (11)
2. **A** (6,7)	*12.* **A** (6)	*22.* **C** (2,16)	*32.* **B** (16,2)	*42.* **C** (15)
3. **C** (1,6)	*13.* **C** (11)	*23.* **D** (15,16)	*33.* **E** (8)	*43.* **A** (15)
4. **E** (1)	*14.* **C** (9)	*24.* **C** (15,16)	*34.* **A** (10)	*44.* **B** (15)
5. **A** (8)	*15.* **A** (11)	*25.* **C** (15,16)	*35.* **C** (11)	*45.* **B** (2)
6. **B** (4)	*16.* **B** (6,16)	*26.* **A** (2,16)	*36.* **C** (1)	*46.* **C** (15)
7. **D** (2)	*17.* **A** (4,6,7,16)	*27.* **A** (15,16)	*37.* **E** (2)	*47.* **C** (15)
8. **B** (6)	*18.* **B** (4,16)	*28.* **D** (16,5)	*38.* **A** (5)	*48.* **A** (15)
9. **D** (8)	*19.* **D** (2,16)	*29.* **B** (16,4)	*39.* **D** (4,7)	*49.* **E** (15)
10. **D** (8)	*20.* **D** (2,16)	*30.* **B** (16,4)	*40.* **A** (2)	*50.* **A** (2,15)