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T.B.C. : FDGT-T-EMT

Test Booklet Series



TEST BOOKLET
ELEMENTARY MATHEMATICS

Time Allowed : Two Hours

Maximum Marks : 100

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES **NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside.
DO NOT write *anything else* on the Test Booklet.
4. This Test Booklet contains **100** items (questions). Each item is printed both in **Hindi** and **English**. Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. You have to mark all your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. **All** items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator **only the Answer Sheet**. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.
 - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
 - (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
 - (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

ध्यान दें : अनुदेशों का हिन्दी रूपान्तर इस पुस्तिका के मुख पृष्ठ पर छपा है ।

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1. If

$$x^2 - 20 = \sqrt{20 + \sqrt{20 + \sqrt{20 + \sqrt{20 + \dots \text{infinite terms}}}}}$$

then what is x equal to ?

- (a) 4
- (b) 5
- (c) $\sqrt{5}$
- (d) $2\sqrt{5}$

2. If $\frac{a+b}{b+c} = \frac{c+d}{d+a}$ where $a \neq c$, then which one of the following is correct ?

- (a) $a + b = c + d$
- (b) $a + c = b + d$
- (c) $a - b - c + d = 0$
- (d) $a + b + c + d = 0$

3. If $(a^3 + b^3)$ is proportional to $(a^2 - b^2)$, then $(a^2 - ab + b^2)$ is proportional to

- (a) $(a - b)$
- (b) $(a + b)$
- (c) $(a + ab + b)$
- (d) $(a^3 - b^3)$

4. If $\frac{\sqrt{x+20} + \sqrt{x-1}}{\sqrt{x+20} - \sqrt{x-1}} = \frac{7}{3}$, then what is the value of $\sqrt{(x+20)(x-1)}$?

- (a) 8
- (b) 9
- (c) 10
- (d) 12

5. What is the HCF of $(x^8 - y^8)$ and $(x^7 - y^7 + x^5y^2 - x^2y^5)$?

- (a) $(x^2 + y^2)$
- (b) $(x^2 - y^2)$
- (c) $(x^3 - y^3 - x^2y + xy^2)$
- (d) $(x^3 - y^3 + x^2y - xy^2)$

6. If the sum of the squares of the roots of the equation $x^2 - 14x + k = 0$ is 100, then what is the value of k ?

- (a) 42
- (b) 48
- (c) 52
- (d) 56

7. If $(x + k)$ is the HCF of $x^2 + px + q$ and $x^2 + qx + p$, where $p \neq q$, then what is the value of k ?

- (a) -1
- (b) 0
- (c) $\frac{1}{2}$
- (d) 1

8. If three times the greater of two numbers is divided by the smaller number, the quotient will be 6 and the remainder will be 6. If five times the smaller number is divided by the greater number, the quotient will be 2 and the remainder will be 3. What is the difference between the numbers ?

(a) 8
(b) 9
(c) 10
(d) 12

9. Consider the following statements :

1. $(ab + bc + ca)$ is a factor of $a^2(b - c)^3 + b^2(c - a)^3 + c^2(a - b)^3$.
2. $(a + b + c)$ is a factor of $a^2(b - c)^3 + b^2(c - a)^3 + c^2(a - b)^3$.

Which of the statements given above is/are correct ?

(a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) Neither 1 nor 2

10. What is

$$\frac{1}{x(x-y)(x-z)} + \frac{1}{y(y-z)(y-x)} + \frac{1}{z(z-x)(z-y)}$$

equal to ?

(a) 0
(b) 1
(c) $\frac{1}{xyz}$
(d) $-\frac{1}{xyz}$

11. Consider the following statements :

1. $x^4(y - z) + y^4(z - x) + z^4(x - y)$ is positive if $x > y > z$.
2. $x^4(y - z) + y^4(z - x) + z^4(x - y)$ is negative if $x < y < z$.

Which of the above statements is/are correct ?

(a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) Neither 1 nor 2

12. What is $\frac{x^6 - 24x^4 + 144x^2}{(x^2 + 4\sqrt{3}x + 12)(x - 2\sqrt{3})^2}$ equal to ?

(a) x^2
(b) $x^2 - 2$
(c) $x^2 + 2\sqrt{3}$
(d) $x^2 - 2\sqrt{3}$

13. X and Y can do a piece of work in 45 days and 40 days respectively. They begin to work together, but X leaves after n days and then Y completes the remaining work in 23 days. What is n equal to ?
- (a) 8
(b) 9
(c) 10
(d) 12
14. 480 persons working 10 hours per day complete one-fourth of a work in 10 days. How many additional persons are to be employed in order to complete the remaining work in 20 days, working 8 hours per day ?
- (a) 400
(b) 420
(c) 480
(d) 500
15. 12 women and 16 men can do a piece of work in 5 days. 13 women and 24 men can do it in 4 days. How long will 25 women and 50 men take to do it ?
- (a) 1 day
(b) 2 days
(c) 3 days
(d) 4 days
16. There are two stations X and Y, 1320 km apart. A train starts from station X at 6 a.m. and moves at an average speed of 60 km/hr. At 2 p.m. another train starts from Y towards X and moves at an average speed of 80 km/hr. When do they meet ?
- (a) 6 p.m.
(b) 7 p.m.
(c) 8 p.m.
(d) 9 p.m.
17. Two glasses of equal volume are filled with a mixture of alcohol and water in the ratio 3 : 2 and 4 : 1, respectively. These glasses are emptied into a third glass. What is the ratio of alcohol and water in the third glass ?
- (a) 5 : 4
(b) 7 : 2
(c) 7 : 3
(d) 7 : 4

18. If x is the HCF and y is the LCM of $\frac{3}{5}, \frac{6}{25}, \frac{9}{20}, \frac{27}{50}$, then which one of the following is correct ?
- (a) $y = 90x$
(b) $y = 180x$
(c) $y = 270x$
(d) $y = 360x$
19. There are two natural numbers x and y , where $x > y$. When x is divided by 6, it leaves the remainder 2 and; when y is divided by 6, it leaves the remainder 3. What is the remainder when $(x - y)$ is divided by 6 ?
- (a) 1
(b) 3
(c) 5
(d) Remainder cannot be determined
20. The value of a 2-digit number is 5 times the sum of the digits. What is the product of the digits ?
- (a) 15
(b) 18
(c) 20
(d) 27
21. Consider the number $N = 12^6 \times 3^8 \times 5^3$. Which of the following statements is/are correct ?
1. The number of odd factors of N is 60.
2. The number of even factors of N is 720.
- Select the correct answer using the code given below :
- (a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) Neither 1 nor 2
22. If $\frac{\log_{10} a}{b - c} = \frac{\log_{10} b}{c - a} = \frac{\log_{10} c}{a - b}$, ($a \neq b \neq c$), then what is the value of abc ?
- (a) -1
(b) 0
(c) 1
(d) 3
23. What is the angle between the hour hand and the minute hand of a clock when the clock shows 4 hours 40 minutes ?
- (a) 80°
(b) 100°
(c) 120°
(d) 220°

24. If $\log_{10} \left[995 + \sqrt{x^2 - 12x + 60} \right] = 3$, then what is the sum of the roots of the equation ?

- (a) 12
- (b) 11
- (c) 10
- (d) 9

25. How many of the following values of x would satisfy the equation $qx^2 - 2px + q = 0$?

1. $x = \frac{\sqrt{p+q} + \sqrt{p-q}}{\sqrt{p+q} - \sqrt{p-q}}$, where $p > q$

2. $x = \frac{p + \sqrt{p^2 - q^2}}{q}$, where $p > q$

3. $x = \frac{\sqrt{p+q}}{\sqrt{p-q}}$, where $p > q$

Select the correct answer using the code given below :

- (a) Only one value
- (b) Only two values
- (c) All three values
- (d) None

26. Let $p(x) = x^4 + x^2 + 1$, $q(x) = x^4 - 2x^3 + 3x^2 - 2x + 1$. If GCD of $p(x)$ and $q(x)$ is $x^2 - x + 1$, then what is their LCM ?

- (a) $(x^2 + x + 1)(x^2 - x + 1)^2$
- (b) $(x^4 + x^2 + 1)^2 (x^2 - x + 1)$
- (c) $(x^4 + x^2 + 1)(x^2 + x + 1)^2$
- (d) $(x^4 + x^2 + 1)(x^2 - x + 1)^2$

27. Consider the question and two statements given below :

A 2-digit number is added to the number formed by reversing the digits of the 2-digit number.

Question : What is the 2-digit number ?

Statement-1 : The sum is divisible by 9.

Statement-2 : The sum is divisible by 2.

Which one of the following is correct in respect of the question and the statements ?

- (a) Statement-1 alone is sufficient to answer the question
- (b) Statement-2 alone is sufficient to answer the question
- (c) Both Statement-1 and Statement-2 are sufficient to answer the question
- (d) Both Statement-1 and Statement-2 are not sufficient to answer the question

28. Consider the question and two statements given below :

LCM of two numbers x and y is 481 where $x > y$.

Question : What is the value of $(3x - 2y)$?

Statement-1 : $y > 1$.

Statement-2 : HCF of x and y is 1.

Which one of the following is correct in respect of the question and the statements ?

- (a) Statement-1 alone is sufficient to answer the question
- (b) Statement-2 alone is sufficient to answer the question
- (c) Both Statement-1 and Statement-2 are sufficient to answer the question
- (d) Both Statement-1 and Statement-2 are not sufficient to answer the question

29. Consider the question and two statements given below :

Question : Is $(x^n + y^n)$ divisible by $(x + y)$?

Statement-1 : n is a natural number.

Statement-2 : n is an even natural number.

Which one of the following is correct in respect of the question and the statements ?

- (a) Statement-1 alone is sufficient to answer the question
- (b) Statement-2 alone is sufficient to answer the question
- (c) Both Statement-1 and Statement-2 are sufficient to answer the question
- (d) Both Statement-1 and Statement-2 are not sufficient to answer the question

30. Consider the question and two statements given below :

Let x and y be two real numbers.

Question : Is $xy > 0$?

Statement-1 : $x^8y^9 < 0$.

Statement-2 : $x^9y^{10} < 0$.

Which one of the following is correct in respect of the question and the statements ?

- (a) Statement-1 alone is sufficient to answer the question
- (b) Statement-2 alone is sufficient to answer the question
- (c) Both Statement-1 and Statement-2 are sufficient to answer the question
- (d) Both Statement-1 and Statement-2 are not sufficient to answer the question

31. If $a = 3b$, $4b = 5c$, $6c = 7d$, then what is $\frac{d+a}{d-a}$ equal to ?

- (a) $\frac{27}{43}$
- (b) $\frac{43}{27}$
- (c) $-\frac{27}{43}$
- (d) $-\frac{43}{27}$

32. What are the values of k for which the polynomial $(k - 3)x^2 - kx - 1$ has **no** real linear factors ?

- (a) $k < -6$
- (b) $-6 < k < 2$
- (c) $2 < k < 6$
- (d) $k > 6$

33. If $bc + cd = 2bd$ and $a + c = 2b$, then which one of the following is correct ?

- (a) $ab - cd = 0$
- (b) $ac - bd = 0$
- (c) $ad - bc = 0$
- (d) $ad + bc = 0$

34. In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 100 km/hr and time of flight increased by 30 minutes. What was the original average speed of the aircraft ?
- (a) 700 km/hr
(b) 750 km/hr
(c) 800 km/hr
(d) 900 km/hr
35. If $x = b + c$, $y = c + a$, $z = a + b$, then what is $(x + y + z)^3 - 24xyz$ equal to ?
- (a) $a^3 + b^3 + c^3$
(b) $2(a^3 + b^3 + c^3)$
(c) $8(a^3 + b^3 + c^3)$
(d) None of the above
36. A person X starts from a place A and another person Y starts simultaneously from another place B which is d km away from A. They walk in the same direction. X walks at an average speed of u km/hr and Y walks at an average speed of v km/hr. How far will X have walked before he overtakes Y ?
- (a) $\frac{ud}{(u - v)}$
(b) $\frac{vd}{(u - v)}$
(c) $\frac{(ud - vd)}{(u - v)}$
(d) $\frac{(ud + vd)}{(u + v)}$
37. If p is the difference between a number and its reciprocal and q is the difference between the square of the same number and the square of its reciprocal, then what is $p^4 + 4p^2$ equal to ?
- (a) $4q$
(b) $8q$
(c) $4q^2$
(d) q^2
38. If $x = 2 + 2^{1/2}$, then what is the value of $x^4 + 16x^{-4}$?
- (a) 152
(b) 144
(c) 136
(d) 132
39. X takes 3 hours longer than Y to walk 30 km. If X doubles his speed, he takes 2 hours less than Y. What is the speed of Y ?
- (a) 3 km/hr
(b) 4 km/hr
(c) $4\frac{2}{7}$ km/hr
(d) $4\frac{3}{7}$ km/hr
40. If C is the compound interest on ₹ 10,000 for one year at 4% per annum when compounded quarterly, then which one of the following is correct ?
- (a) $C < ₹ 100$
(b) $₹ 100 < C < ₹ 200$
(c) $₹ 200 < C < ₹ 400$
(d) $C > ₹ 400$

Consider the following for the next **two (02)** items that follow :

Consider the equation

$$6x^2 - 25x + \frac{6}{x^2} + \frac{25}{x} + 12 = 0.$$

41. What is one of the possible values of $x - \frac{1}{x}$?

- (a) $\frac{1}{2}$
- (b) $\frac{3}{2}$
- (c) 2
- (d) $\frac{5}{2}$

42. What is one of the possible values of $x^2 + \frac{1}{x^2}$?

- (a) 6
- (b) $\frac{62}{9}$
- (c) 8
- (d) $\frac{82}{9}$

Consider the following for the next **three (03)** items that follow :

A triangle ABC with sides $AB = 15$ cm, $BC = 9$ cm, $CA = 12$ cm is inscribed in a circle.

43. What is $\cos^2 A + \cos^2 B + \cos^2 C$ equal to ?

- (a) $\frac{3}{4}$
- (b) 1
- (c) $\frac{5}{4}$
- (d) 2

44. What is $\sin^2 A + \sin^2 B + \sin^2 C$ equal to ?

- (a) 2
- (b) $\frac{5}{4}$
- (c) 1
- (d) $\frac{3}{4}$

45. What is the radius of the circle ?

- (a) 4.5 cm
- (b) 6 cm
- (c) 7.5 cm
- (d) 15 cm

Consider the following for the next **two (02)** items that follow :

The angle of elevation of a cloud at C from a point (P), H metres above the surface of a lake is 30° . The height of the cloud from the surface of the lake is $2H$ metres. Let θ be the angle of depression of the reflection of the cloud in the lake from the point P.

46. What is the value of θ ?

- (a) 30°
- (b) 45°
- (c) 60°
- (d) Cannot be determined due to insufficient data

47. What is PC equal to ?

- (a) H metres
- (b) $\sqrt{2}H$ metres
- (c) $\sqrt{3}H$ metres
- (d) $2H$ metres

Consider the following for the next **three (03)** items that follow :

A frequency distribution table is given below :

x	0	1	2	3	4	5
f	46	p	q	25	10	5

Total frequency is 200 and mean of the distribution is 1.46.

48. What is the value of p ?

- (a) 70
- (b) 72
- (c) 76
- (d) 78

49. What is the value of q ?

- (a) 32
- (b) 34
- (c) 36
- (d) 38

50. What is the median of the distribution ?

- (a) 1
- (b) 2
- (c) 3
- (d) 4

51. If $\tan \theta = \frac{\sqrt{q^2 - p^2}}{p}$; $0 < \theta < 90^\circ$, then what is $\sec \theta + \cos \theta + 2$ equal to ?

- (a) $\frac{p^2 + q^2}{pq}$
- (b) $\frac{(p + q)^2}{pq}$
- (c) $\frac{(p + q)^2}{2pq}$
- (d) $\frac{(p - q)^2}{pq}$

52. If $11 \sin \theta + 60 \cos \theta = 61$; $0 < \theta < 90^\circ$, then what is the value of $\sqrt{660} (\tan \theta + \cot \theta)$?

- (a) 61
- (b) $61\sqrt{2}$
- (c) 122
- (d) $122\sqrt{2}$

53. What is the diameter of a circle inscribed in a regular polygon of 15 sides with side length unity ?

- (a) $0.5 \cot 12^\circ$
- (b) $\cot 12^\circ$
- (c) $0.5 \tan 12^\circ$
- (d) $\tan 12^\circ$

54. If $x = \frac{1 + \sin \theta}{\cos \theta}$, then what is $\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1}$ equal to ?

- (a) $-x$
- (b) x
- (c) $2x$
- (d) $\frac{x}{2}$

55. Consider the following :

1. $\frac{\tan \theta + \sin \theta}{\tan \theta - \sin \theta} = \frac{\sec \theta + 1}{\sec \theta - 1},$

where $0 < \theta < \frac{\pi}{2}.$

2. $\frac{\cos^2 \theta - \sin^2 \theta}{\cos^2 \theta + \sin^2 \theta} = \frac{2 \tan \theta}{\tan^2 \theta + 1},$

where $0 < \theta < \frac{\pi}{2}.$

Which of the above is/are identities ?

- (a) Only 1
- (b) Only 2
- (c) Both 1 and 2
- (d) Neither 1 nor 2

56. If $\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} = 5$, where $0 < \theta < \frac{\pi}{2}$, $\theta \neq \frac{\pi}{4}$,

then what is the value of $\frac{2 \sin \theta + 3 \cos \theta}{3 \sin \theta - 2 \cos \theta} ?$

- (a) $\frac{8}{5}$
- (b) 2
- (c) $\frac{12}{5}$
- (d) 3

57. If $\frac{1}{\operatorname{cosec} \theta - \cot \theta} - \frac{1}{\sin \theta} = x$, then what is $\frac{1}{\operatorname{cosec} \theta + \cot \theta} - \frac{1}{\sin \theta}$ equal to, where

$0 < \theta < \frac{\pi}{2} ?$

- (a) $-x$
- (b) x
- (c) $\frac{1}{x}$
- (d) $-\frac{1}{x}$

58. What is $2 \sin^6 \theta + 2 \cos^6 \theta - 3 \sin^4 \theta - 3 \cos^4 \theta$ equal to ?

- (a) -1
- (b) 0
- (c) 1
- (d) 2

59. What is the minimum value of $3600 \sec^2 \theta + 121 \operatorname{cosec}^2 \theta$, where $0 < \theta < \frac{\pi}{2} ?$

- (a) 1320
- (b) 2401
- (c) 3721
- (d) 5041

60. What is $\sqrt{\left(\frac{1 + \sin \theta}{\cos \theta}\right)^2 + \left(\frac{\cos \theta}{1 + \sin \theta}\right)^2} - 2$ equal to, where $0 < \theta < \frac{\pi}{2} ?$

- (a) $\tan \theta$
- (b) $\cot \theta$
- (c) $2 \tan \theta$
- (d) $2 \cot \theta$

61. If x is the harmonic mean between y and z , then which one of the following is correct ?
- $xy + xz - yz = 0$
 - $xy + xz - 2yz = 0$
 - $xy + xz + yz = 0$
 - $xy + xz - 4yz = 0$
62. What is the median of all possible factors of 120 ?
- 10
 - 11
 - 12
 - 13.5
63. The sum of deviations of a set of n values measured from 50 is -10 and the sum of deviations of the values measured from 46 is 70. What is the mean of the values ?
- 48.5
 - 49.0
 - 49.5
 - 50.0
64. Consider the following table in respect of students of 4 schools who appeared in a test :

School	Number of students	Average marks in the test
I	60	60
II	50	80
III	50	40
IV	x	50

If the average marks of the students of all four schools are 58, then how many students appeared from School-IV ?

- 38
- 40
- 42
- 44

65. The data of different natural numbers 4, 7, 10, 14, $2x + 3$, $2x + 5$, 22, 23, 30, 50 are in ascending order. How many possible values are there for the median of the data for various values of x ?
- Only one value
 - Only two values
 - Only three values
 - Five values
66. If M is the mean of the first 100 even natural numbers, then what is the mean of the first 100 odd natural numbers ?
- $M - 1$
 - M
 - $M + 1$
 - $M + 2$
67. Mean marks of 50 students were found to be 78.4. But later it was detected that 95 was misread as 59 and 25 was misread as 52. What is the difference between correct mean and incorrect mean ?
- 0.04
 - 0.08
 - 0.12
 - 0.18

68. In a triangle ABC, $\angle A = 2\theta$, $\angle B = \angle C = 4\theta$ and θ satisfies $4 \sin^2 \theta + 2 \sin \theta - 1 = 0$. What is the ratio of BC to AB ?

- (a) $\sqrt{5} - 1$
- (b) $\frac{(\sqrt{5} - 1)}{2}$
- (c) $\frac{(\sqrt{5} - 1)}{4}$
- (d) $2(\sqrt{5} - 1)$

69. A circle is inscribed in a triangle ABC. It touches the sides BC, CA, AB at D, E, F respectively. What is $\angle EDF$ equal to ?

- (a) $90^\circ - A$
- (b) $90^\circ - \frac{(B + C)}{2}$
- (c) $90^\circ - 2A$
- (d) $90^\circ - \left(\frac{A}{2}\right)$

70. The length of a room is $\frac{21}{16}$ times its breadth and breadth is $\frac{4}{3}$ times its height. If H is the height of the room and L is the longest rod that can be placed in the room, then which one of the following is correct ?

- (a) $12L = 29H$
- (b) $9L = 25H$
- (c) $7L = 23H$
- (d) $5L = 13H$

Consider the following for the next **three (03)** items that follow :

A conical vessel of radius 12 cm and height 16 cm is filled with water. A sphere is lowered into water and its size is such that it touches the sides of the vessel and it is just immersed.

71. What is the radius of the sphere ?

- (a) 5 cm
- (b) 6 cm
- (c) 6.5 cm
- (d) 7 cm

72. How much water will remain in the vessel after the overflow ?

- (a) 288π mL
- (b) 360π mL
- (c) 480π mL
- (d) 500π mL

73. What is the ratio of lateral surface area of the vessel to the surface area of the sphere ?

- (a) $\frac{4}{3}$
- (b) $\frac{3}{2}$
- (c) $\frac{5}{3}$
- (d) 2

Consider the following for the next **two (02)** items that follow :

A chord of length l of a circle makes an angle 90° at the centre of the circle.

74. What is the area of the minor segment ?

(a) $\frac{l^2}{2} \left(\pi - \frac{1}{2} \right)$

(b) $\frac{l^2}{4} \left(\pi - \frac{1}{2} \right)$

(c) $\frac{l^2}{4} \left(\frac{\pi}{2} - 1 \right)$

(d) $\frac{l^2}{2} \left(\frac{\pi}{2} - \frac{1}{2} \right)$

75. What is the area of the major segment ?

(a) $\frac{l^2}{4} \left(\frac{3\pi}{2} + 1 \right)$

(b) $\frac{l^2}{4} \left(\frac{3\pi}{2} - 1 \right)$

(c) $\frac{l^2}{2} \left(\frac{3\pi}{2} + 1 \right)$

(d) $\frac{l^2}{2} \left(\frac{3\pi}{2} - 1 \right)$

76. Triangle ABC is right-angled at A and AD is perpendicular to BC. If $BD = 7.5$ cm and $DC = 10$ cm, then what is AD equal to ?

(a) 5 cm

(b) $5\sqrt{2}$ cm

(c) $5\sqrt{3}$ cm

(d) 10 cm

77. The perpendicular AD on the base BC of a triangle ABC intersects BC at D so that $DB = 3 CD$. Which one of the following is correct ?

(a) $2 (AB + AC) (AB - AC) = BC^2$

(b) $3 (AB + AC) (AB - AC) = 2 BC^2$

(c) $4 (AB + AC) (AB - AC) = 3 BC^2$

(d) $5 (AB + AC) (AB - AC) = 4 BC^2$

78. Triangle ABC is right-angled at C and $AC = \sqrt{3} BC$. What is $\angle ABC$ equal to ?

(a) 30°

(b) 45°

(c) 60°

(d) 75°

79. In a triangle ABC, $\angle A = 60^\circ$. What is $AB^2 + AC^2 - BC^2$ equal to ?

(a) $AB \cdot AC$

(b) $AB \cdot BC$

(c) $AC \cdot BC$

(d) $2 AB \cdot AC$

80. The diameter of a sphere made of copper is 3 cm. The sphere is melted and recast into a wire. If the length of the wire is half metre, then what is the diameter of the wire ?

(a) 0.3 cm

(b) 0.45 cm

(c) 0.6 cm

(d) 0.75 cm

81. The height of a cone is 30 cm. A small cone is cut off at the top by a plane parallel to its base. If its volume is $\frac{1}{27}$ of the volume of the given cone, then what is the height of the frustum of the cone ?
- (a) 10 cm
(b) 12 cm
(c) 18 cm
(d) 20 cm
82. A rectangular metal sheet is of length 24 cm and breadth 18 cm. From each of its corners a square of side x cm is cut off and an open box is made of the remaining sheet. If the volume of the box is 640 cubic cm, then what is the value of x ?
- (a) 2
(b) 3
(c) 4
(d) 6
83. Let x, y, z be the length, breadth, height of a cuboid. If its volume is 400 cubic cm and total surface area is 340 square cm, then what is $x^{-1} + y^{-1} + z^{-1}$ equal to ?
- (a) $\frac{17}{20}$
(b) $\frac{17}{40}$
(c) $\frac{7}{10}$
(d) $\frac{9}{10}$
84. Two parallel sides of a trapezium are 29 cm and 21 cm. Non-parallel sides are equal and each is of length 8.5 cm. What is the area of the trapezium ?
- (a) 187.5 square cm
(b) 227.5 square cm
(c) 375 square cm
(d) 455 square cm
85. A square copper plate of side 16 cm weighs 128 gm. A circular disc of diameter 14 cm is cut off from the plate. What is the weight of the remaining part ? ($\pi = \frac{22}{7}$)
- (a) 48 gm
(b) 49 gm
(c) 50 gm
(d) 51 gm
86. The area of a rhombus is 96 square cm and one of its diagonals is of length 12 cm. What is the perimeter of the rhombus ?
- (a) 36 cm
(b) 40 cm
(c) 44 cm
(d) 48 cm
87. A right-angled triangle ABC is inscribed in a circle of radius 10 cm. The altitude drawn to the hypotenuse AC is of length 8 cm. If $AB = x$ cm and $BC = y$ cm, then what is the value of xy ?
- (a) 60
(b) 80
(c) 120
(d) 160

88. Two circles touch externally. The sum of their areas is 89π square cm and the distance between their centres is 13 cm. What is the difference in their radii ?
- (a) 2 cm
(b) 2.5 cm
(c) 3 cm
(d) 3.5 cm
89. A square and a rectangle have same perimeter. They differ in areas by 1 square cm. The length of the rectangle exceeds its breadth by
- (a) 1 cm
(b) 2 cm
(c) 3 cm
(d) 4 cm
90. Two rectangles are of same area equal to 480 square cm. They differ in lengths by 6 cm and breadths by 4 cm. What is the difference in their perimeters ?
- (a) 2 cm
(b) 4 cm
(c) 6 cm
(d) 10 cm
91. A closed box is built of wood of uniform thickness. Its external dimensions are 12 cm, 10 cm and 8 cm. If the inner surface area is 376 square cm, then what is the thickness of the wood ?
- (a) 0.5 cm
(b) 1 cm
(c) 1.5 cm
(d) 2 cm
92. X, Y and Z are three equilateral triangles. The sum of the areas of X and Y is equal to the area of Z. If the side lengths of X and Y are 6 cm and 8 cm respectively, then what is the side length of Z ?
- (a) 9 cm
(b) 9.5 cm
(c) 10 cm
(d) 10.5 cm
93. What is the time taken by a person to cover one round of a circular park of diameter 210 m if he walks at a speed of 6 km/hr ? ($\pi = \frac{22}{7}$)
- (a) 6.6 minutes
(b) 5.5 minutes
(c) 4.4 minutes
(d) 3.3 minutes

94. In an equilateral triangle of side $2\sqrt{3}$ cm, a circle is inscribed touching the sides. What is the area of the remaining portion of the triangle ?

- (a) $(2\sqrt{3} - \pi)$ square cm
- (b) $(3\sqrt{3} - \pi)$ square cm
- (c) $(4\sqrt{3} - 2\pi)$ square cm
- (d) $(4\sqrt{3} - \pi)$ square cm

95. A triangle has side lengths x cm, $x + 13$ cm and $x + 26$ cm. If its area is 126 square cm, then what is the value of x ?

- (a) 18
- (b) 17
- (c) 16
- (d) 15

96. ABCD is a parallelogram. A circle through A, B and C intersects CD (produced) at E. Which of the following is/are correct ?

- 1. $AE = AD$
- 2. $CD = DE$

Select the correct answer using the code given below :

- (a) Only 1
- (b) Only 2
- (c) Both 1 and 2
- (d) Neither 1 nor 2

97. Consider the following statements :

- 1. In an equilateral triangle, the centroid and centre of circumcircle coincide.
- 2. Angle bisectors of a cyclic quadrilateral form another cyclic quadrilateral.
- 3. Every cyclic parallelogram is a rectangle.

Which of the statements given above are correct ?

- (a) Only 1 and 2
- (b) Only 2 and 3
- (c) Only 1 and 3
- (d) 1, 2 and 3

98. ABCD is a trapezium in which AB is parallel to DC. The vertices A, B, C and D pass through a circle. Which of the following are correct ?

- 1. $AD = BC$
- 2. $\angle A + \angle C = 180^\circ$
- 3. $\angle A + \angle D = 180^\circ$

Select the correct answer using the code given below :

- (a) Only 1 and 2
- (b) Only 2 and 3
- (c) Only 1 and 3
- (d) 1, 2 and 3

99. ABCD is a cyclic quadrilateral. AB and DC when produced, meet in E. Which of the following statements is/are correct ?

1. $\triangle EBC$ is similar to $\triangle EAD$.
2. $\angle CBE + \angle DAE = 180^\circ$.

Select the correct answer using the code given below :

- (a) Only 1
- (b) Only 2
- (c) Both 1 and 2
- (d) Neither 1 nor 2

100. In a triangle ABC, DE is a line segment which intersects AB at D and AC at E such that DE is parallel to BC. The line segment divides the triangle in two parts of equal area. What is $\frac{BD}{AB}$ equal to ?

- (a) $\frac{\sqrt{2}-1}{2}$
- (b) $\frac{\sqrt{2}-1}{\sqrt{2}}$
- (c) $\frac{\sqrt{3}-1}{\sqrt{3}}$
- (d) $\sqrt{2}$