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COMMON DEFENCE SERVICE (CDS)

INTRODUCTION:

For those young and courageous individuals who nurture a patriotic sentiment, who are willing to take on any kind of challenges and dedicate their lives to defending the country and its people, the Common Defence Service Test is the path to join the nation's Defence forces.

Combined Defence Service exam is conducted by UPSC twice every year for recruitment to office cadre of the Army, Navy and Air force. CDS exam is conducted generally in the months of May and October.

Candidates qualifying the written test are interviewed by the Service Selection Board and if finally selected, depending upon the choice given by the candidates and their merit list ranking, are sent to one of the following institutes for orientation training: -
(a) Indian Military Academy (IMA), Dehradun
(b) Naval Academy, Goa
(c) Air Force Academy, Begumpet, Hyderabad
(d) Officers Training Academy (OTA), Chennai

Those joining the first three institutes get permanent commission, however cadets passing out of OTA get short service commission. Applicants are required to mention their preferences while filling up the application forms.

Educational Qualifications:

- **For IMA /OTA :** A degree from a recognized University or equivalent.
- **For Naval Academy:** B.Sc. with Physics and/or Mathematics or Bachelor of Engineering.
- **For Air Force Academy:** B.Sc. of a recognized University or equivalent with Physics and/or Mathematics as subjects or Bachelor of Engineering

Age critera:

- **For IMA:** Unmarried male candidates between 19-24 years on 1st January or 1st July of the year succeeding the year of examination.
- **For Naval Academy:** Unmarried male candidates between 19-22 years on 1st January or 1st July of the year succeeding; the year of examination.
- **For Air Force Academy:** Unmarried male candidates between 19-23 years on 1st January or 1st July of the year succeeding the year of examination.
- **For Officers Training Academy:** Male candidates (married or unmarried) between 19-25 years on 1st January or 1st July of the year succeeding the year of exams

Examination :

- Written Examination
- Interview for intelligence and personality test of such candidates as may be called for interview at one of the Services Selection Centers

Examination Subjects:

The following will be subjects for the written examination (each of 2 hours duration):

For admission to Indian Military Academy, Naval Academy and Air Force Academy:

- English - This paper tests the understanding of the English language.
- General Knowledge - This tests the general knowledge, current events, history of India, geography of nature and other matters of everyday observation.
- Elementary Mathematics - This paper covers arithmetic, algebra, geometry, trigonometry, and statistics.

For Admission to Officers Training Academy (OTA):

- English - This paper tests the understanding of the English language.
- General Knowledge - This tests the general knowledge, current events, history of India, geography of nature and other matters of everyday observation.

Those who qualify the written test, undergo interview and a series of intelligence and personality tests. The tests, both verbal and non-verbal, are designed not only to judge the mental caliber of the candidate but also to assess his social traits and interest in current affairs.

- **Situation Reaction Test (SRT)** - Sixty situations are given and the candidate is required to answer the reactions within 30 minutes.
- **Thematic Apperception Test (TAT)** - A set of 12 pictures are shown and the candidate is required to write a story in 3 minute for each picture.
- **Word Association Test (WAT)** - Sixty words are projected and the candidate is required to make a sentence, in 15 seconds for each word.
- **Group test** - Group Test is conducted in batches of 8-10 candidates. The test consists of group planning, group discussion, outdoor group tasks. The candidates are asked to take lectures on certain topics.

Candidates recommended by the Services Selection Board must undergo a medical examination by the Board of Service Medical Officers, and are allowed to go for the training programs only after being declared fit by the medical board.

You have identified your goal and are ready to prepare yourself for this highly Specialized CDS Exam. You want to score high, the course is large and the time is less.

Application:

Blank application forms and other particulars are published by UPSC in leading newspapers and Employment News in the month of May/June and November/December. A candidate seeking admission must apply to The Secretary, UPSC, New Delhi on prescribed application form. The application forms are available on payment of the requisite amount from any of the designated post office throughout the country. The examination is held in over 40 centres spread all of the country.

Agartala, Ahmedabad, Aizawl, Allahabad, Bangalore, Bareilly, Bhopal, Calcutta, Chandigarh, Chennai, Cochin, Cuttack, Delhi, Dharwar, Dispur (Guwahati), Gangtok, Hyderabad, Imphal, Itanagar, Jaipur, Jammu, Jorhat, Kohima, Lucknow, Madurai, Mumbai, Nagpur, Panaji (Goa), Patna, Port Blair, Raipur, Sambalpur, Shillong, Shimla, Srinagar, Tirupati, Trivandrum, Udaipur and Vishakhapatnam. The centres and the date of

holding the examination are liable to be changed at the discretion of the Commission

Syllabus of C D S Exam:

English

The question paper will be designed to test the candidates' understanding of English and workman-like use of words.

General Knowledge

General Knowledge, including knowledge of current events and such matters of everyday observation and experience in their scientific aspects as may be expected of an educated person who has not made a special study of any scientific subject. The paper will also include questions of History of India and Geography of a nature which candidates should be able to answer without special study.

Elementary Mathematics

Arithmetic:

Number system, Natural numbers, Integers, Rational and Real numbers. Fundamental Operations-addition, subtraction, multiplication, division, square roots, decimal fractions.

Unitary method:

Time and distance, time and work, percentages, applications to simple and compound interest, profit and loss, ratio and proportion, variation.

Elementary Number Theory:

Division algorithm, Prime and composite numbers, Tests of divisibility by 2, 3, 4, 5, 9 and 11, Multiples and factors, Factorization Theorem, H.C.F. and L.C.M.,

Algebra:

Basic operations, simple factors, Remainder Theorem, H.C.F., L.C.M., Theory of Polynomials, Solutions of quadratic equations, relation between its roots and coefficients (only real roots to be considered).

Simultaneous linear equations in two unknowns-analytical and graphical solutions. Simultaneous linear in-equations in two variables and their solutions. Practical problems leading to two simultaneous linear equations or in-equations in two variables or quadratic equations in one variable and their solutions.

Set language and set notation, Rational expressions and conditional identities, Laws of indices.

Trigonometry:

Sine x, Cosine x, Tangent x when $0° \leq x \leq 90°$. Values of sin x, cos x and tan x, for x = 0°, 30°, 45°, 60° and 90°.
Simple trigonometric identities. Use of trigonometric tables.
Simple cases of heights and distances.

Geometry:

Lines and angles, Plane and plane figures.
Theorems on:

1. Properties of angles at a point
2. Parallel lines
3. Sides and angles of a triangle
4. Congruency of triangles
5. Similar triangles
6. Concurrence of medians and altitudes
7. Properties of angles, sides and diagonals of a parallelogram, rectangle and square
8. Circle and its properties, including tangents and normals
9. Loci.

Mensuration

Areas of squares, rectangles, parallelograms, triangle and circle. Areas of

figures, which can be split up into the figures (Field Book). Surface area and volume of cuboids, lateral surface and volume of right circular cones and cylinders. Surface area and volume of spheres.

Statistics-Collection and tabulation of statistical data. Graphical representation-frequency polygons, histograms, bar charts, pie charts, etc. Measures of Central Tendency.

CDS QUESTION PAPERS

QUANTITATIVE APTITUDE

1. ABC is a right-angled triangle, right angled at A and AD is the altitude on BC. If AB : AC = 3 : 4, what is the ratio of BD to DC?

(*a*) 3 : 4 (*b*) 9 : 16 (*c*) 2 : 3 (*d*) 1 : 2

2. ABC and PQR are two triangles such that AB = AC = PQ = PR. . = BAC α and . = QPR ., and α . . . What is the relation between α and ., such that the area of .ABC = area of .PQR?

(*a*) α . + = π 180 (*b*) α . + = π 90
(*c*) α . + = π 240 (*d*) α . + = π 120

3. A solid sphere is cut into four equal parts. If the total surface area of each part now is x times that of the sphere, then what is the value of x?

(*a*)1,4
(*b*) 1,2
(*c*) 3,4
(*d*)3,8

4. Two spheres of radii 6 cm and 1 cm are inscribed in a right circular cone. The bigger sphere touches the smaller one and also the base of the cone. What is the height of the cone?

(*a*) 14 cm (*b*) 15 cm (*c*)856 cm (*d*)725 cm

5. ABCD is a cyclic quadrilateral whose side AB is a diameter of the circle through the points A, B, C and D. If $. = \pi$ ADC 130 , what is the value of .BAC?

(*a*) 30° (*b*) 40° (*c*) 50° (*d*) 60°

6.Triangles ABC and DEF are similar. If the length of the perpendicular AP from A on the opposite side BC is 2 cm and the length of the perpendicular DQ from D on the opposite side EF is 1 cm, then what is the area of the triangle ABC?

(*a*) One and half times the area of the triangle DEF
(*b*) Four times the area of the triangle DEF
(*c*) Twice the area of the triangle DEF
(*d*) Three times the area of the triangle DEF

7. A semi-circular thin sheet of metal of diameter 28 cm is bent and an open conical cup is made. What is the ratio of radius to slant height of the conical cup?

(*a*) 1 : 2 (*b*) 1 : 3 (*c*) 2 : 3 (*d*) 1 : 4

8. s and t are transversals cutting a set of parallel lines such that a segment of length 3 in s corresponds to a segment of length 5 in t. What is the length of segment in t corresponding to a segment of length 12 in s?

(*a*) 20 (*b*)365 (*c*) 14 (*d*)54

9. Squares ABDE and ACFH are drawn externally on the sides AB and AC respectively, of a scalene triangle ABC. Which one of the following is correct?

(*a*) BH = CE (*b*) AD = AF
(*c*) BF = CD (*d*) DF = EH

10. O and O' are the centres of the two circles with radii 7 cm and 9 cm respectively. The distance between the centres is 20 cm. If PQ be the transverse common tangent to the circles, which cuts OO' at R, what is the length of OR?

(*a*) 10 cm (*b*) 12 cm (*c*)354cm (*d*) 454 cm

11. In .PQR, QR = 10, RP = 11 and PQ = 12. D is the mid-point of PR. DE is drawn parallel to PQ meeting QR in E. EF is drawn parallel to RP meeting PQ in F. What is the length of DF?

(*a*)112 (*b*) 6 (*c*)334 (*d*) 5

12. In a locality there are 500 households out of which 260 households have no land and total land possessed by the rest 240 households is 500 acres. What is the mean landholding per household?

(*a*) 240 acres (*b*) 1 acre (*c*)2512 acres(*d*) Mean cannot be computed with the given data

13. The proportions of male students and female students in a class are equal. The average height of male students of the class is 128 cm and average height of all the students of the class is 127 cm. What is the average height of female students of the class?

(*a*) 126 cm (*b*) 125 cm (*c*) 134 cm
(*d*) Average cannot be computed with the given data

14. The length of a rectangle R is 10% more than the side of a square S. The width of the rectangle R is 10% less than the side of the square S. What is the ratio of the area of

A
B C P E
D
F Q

R to that of S?

(*a*) 1: 1 (*b*) 99 : 100
(*c*) 199 : 200 (*d*) 201 : 200

15. If an angle of a triangle remains unchanged but each of its two including sides is doubled, then by what factor does the area get multiplied?

(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 6

16. Shadow of a person X, when angle of elevation of

the sun is α , is equal in length to the shadow of a person Y, when angle of elevation of the sun is ( ) α
2
. Which one of the following is correct?

(*a*) Person X is shorter than person Y
(*b*) Person X is twice as tall as Y
(*c*) Person X is taller than person Y but is not twice as tall as Y
(*d*) Both X and Y are of equal height

17. What is the value of
1–sin cos
cos (sec – cos)
A A
A A ecA
. sin – cos
sin cos
2 2
3 3
A A
A A +
?

(*a*) cos A (*b*) sec A (*c*) sin A (*d*) cosec A

18. If cos sin α α + = 2 cosα, then what is the value of cos – sin α α?

(*a*) 2 cosα (*b*) 2 sinα (*c*) 2 (*d*) 1

19. What is the value of
sin sin sin ... sin
cos cos cos ...cos
2 4 6 88
88 86 84 2
π π π π
π π π π?

(*a*) 0 (*b*) 1 (*c*) 2 (*d*) 4

20. How many solutions does the equation sin. + cos. = 2 have?

(*a*) It has no solution
(*b*) It has only one solution
(*c*) It has two solutions
(*d*) It has infinite number of solutions

21. What is the value of
(tan A + cot A + sec A) (tan A + cot A – sec A)?

(*a*) sin2 A (*b*) cosec2 A (*c*) cos2 A (*d*) sec2 A

22. What is the value of the expression
3 tan2
π π π
6
4
3 6
1
2 4
2 3 + cos – cot –
2
3 sin2 π
3
+
1
8 sec4
π
3 ?

(*a*) 3 (*b*) 2 (*c*) 4 (*d*) 5

23. If x = a (1 + cos cos . ϕ)
y = b (1 + cos sin . ϕ)
and z = c (1 + sin .)
then which one of the following is correct?

(*a*) (–) x aa2 + (–) y bb2 + (–) z cc2= 1
(*b*)xaybzc222222 + + = 1
(*c*) x2 + y2 + z2 = a2 + b2 + c2
(*d*)( ) ( ) ( ) x aay bbz cc–+–+– 2 2 2= 1

24. If x = a cos2 . sin ., y = a sin2 . cos ., then which one of the following expressions is independent of .?

1.( )( )x yx y2 232 2+2.( ) x yxy2 23+
Select the correct answer using the codes given below:

Codes:
(*a*) 1 only (*b*) 2 only
(*c*) Both 1 and 2 (*d*) Neither 1 nor 2

25. If 2 sin. = sec., what is the value of sin4 .+ cos4 .?
Ifsincoscossin.... 11+++= 4 then what is the value of
., where 02= = . π?

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

27.
Let A, B, C be subsets of the universal set x represented by the circles. Let A', B' and C' denote their complements in X. Then which of below corresponds to the shaded portion in the figure given above?
(*a*) A B C 'ν ν (*b*) A B C ν ν'
(*c*) A B C ν ν' ' (*d*) A B C ' ' ν ν
28. Match List-I with List-II and select the correct answer using the codes given below the lists:
List-I List-II
A. (–) (– ') E A E A . 1. ϕ
B. E A A A A –((')–(')) . ν 2. A
C. (E A A A ν . (– ')) 3. A'
D. ((–) (–))– E E A ϕ ϕ . 4. E
Here A' is the complement set of A, E is the universal set and ϕ is an empty set.
Codes:
A B C D
(*a*) 4 1 2 3
(*b*) 4 3 2 1
(*c*) 2 3 4 1
(*d*) 2 1 4 3
A
B
C
O B J E C T I V E -T Y P E Q U E S T I O N S

29. 1 man or 2 women or 3 boys can do a piece of work in 55 days. In how many days can 1 man, 1 woman and 1 boy do the same work?

(*a*) 27 days (*b*) 30 days
(*c*) 36 days (*d*) 42 days

30. A number when divided by 765 leaves a remainder

42. What will be the remainder if the number is divided by 17?

(*a*) 8 (*b*) 7 (*c*) 6 (*d*) 5

31. Match List-I (*Product*) with List-II (*Digit in the Unit Place*) and select the correct answer using the codes given below the Lists:
List-I List-II
(Product) (Digit in the Unit Place)

A. (1827)16 1. 1
B. (2153)19 2. 3
C. (5129)21 3. 5
4. 7
5. 9
Codes:
A B C
(*a*) 1 4 3
(*b*) 4 2 3
(*c*) 4 2 5
(*d*) 1 4 5

32. Let ( ) ( ) A B A B A B . . ν = .
Consider the following:
1. A is a proper subset of B.
2. B is a proper subset of A.
Which of the statements given above is/are correct?

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

33. What least number x must be subtracted from 797 so that (797 – x) on being divided by 8, 9 and 11 leaves in each case the same remainder 4?

(*a*) 0 (*b*) 1 (*c*) 2 (*d*) 3
34. A mixture (40 litres) contains wine and water in the ratio 3 : 1. To make the ratio 5 : 2, how much additional amount of water is required?

(*a*) 5 litres (*b*) 4 litres
(*c*) 3 litres (*d*) 2 litres

35. A train leaves Amritsar at 6 a.m. and reaches Delhi

at 12 Noon. Another train leaves Delhi at 8 a.m. and reaches Amritsar at 5 p.m. At what time do the two trains cross one another?

(*a*) 10 : 00 a.m. (*b*) 10 : 12 a.m.
(*c*) 10 : 20 a.m. (*d*) 10 : 24 a.m.

36. What is the first value of n, for which n2 + n + 41 is ***not*** a prime?

(*a*) 1 (*b*) 10 (*c*) 20 (*d*) 40

37. A dishonest dealer professes to sell his goods at cost price but uses a false weight and thus gains 111 9 %. For a kg, what is the weight used by him?

(*a*) 960 gm (*b*) 940 gm
(*c*) 900 gm (*d*) 990 gm

38. If 11, 109, 999 is divided by 1111, then what is remainder?
(*a*) 1098 (*b*) 11888 (*c*) 1010 (*d*) 1110

39. When a certain number is multiplied by 18, the product consists entirely 2's. What is the minimum number of such 2's in the product?

(*a*) 7 (*b*) 8 (*c*) 9 (*d*) 10

40. Which one of the following is divisible by (1 + a + a5) and (1 + a4 + a5) individually?

(*a*)( )( )( ) a a a a a a 2 3 2 3 1 1 1 + + + + + +
(*b*)( )( )( ) a a a a a a 4 3 2 3 1 1 1 − + + + + −
(*c*)( )( )( ) a a a a a a 4 3 2 3 1 1 1 + + − + + +
(*d*)( )( )( ) a a a a a a 2 3 2 3 1 1 1 + + − + − +

41. If the difference in roots of the equation x2 – px + q = 0 is unity, then which one of the following is correct?

(*a*) p2 + 4q = 1 (*b*) p2 – 4q = 1
(*c*) p2 + 4q = – 1 (*d*) p2 – 4q = – 1

42. What is the value of log4 log3 log2 512?

(*a*) 1 (*b*) 2 (*c*)
1
2 (*d*)
1
4

43. If
1 1 1
a b c
+ + =
1
a b c + + where a + b + c . 0,
abc . 0, what is the value of (a + b) (b + c) (c + a)?

(*a*) 0 (*b*) 1 (*c*) – 1 (*d*) 2

44. If x4 + y4 = 17 and x + y = 1, what is the value of
x2 y2 – 2 xy?

(*a*) 8 (*b*) 10 (*c*) 12 (*d*) 16

45. What is the GCD of (x4 + 4y4) and (x3 –x2 y + 2y3)?
(*a*) x2 + 2y2 + 2xy (*b*) x2 + 2y2 – 2xy
(*c*) x2 – 2y2 – 2xy (*d*) x2 – 2y2 + 2xy

46. If sin A =
2
2 2
mn
m n + what is the value of tan A?
(*a*)
2
2 2
mn
m n +
(*b*)
2
2 2
mn
m n –
(*c*)
m n
mn
2 2
2

–
(*d*)
m n
m n
2 2
2 2
+
–

47. AB is the hypotenuse of a right-angled triangle ABC. If BC = x and AB + AC = y, then which one of the following is correct?
(*a*) sin
( )
A xy
x y
=
+
2
2 2 (*b*) sin
( )
A xy
x y
=
–
2
2 2
(*c*) sin
( )
A
x
x y
=
+
2
(*d*) sin
( )
A
y
x y
=
+
2

48. What is the value of

sin2 x cos2 y + cos2 x sin2 y + sin2 x sin2 y +cos2 x cos2 y?

(*a*) 0 (*b*) –1 (*c*) 1 (*d*)
1
2

49. What is the angle of elevation of sun for length of shadow to be same as height of the person?
(*a*) 0° (*b*) 30° (*c*) 45° (*d*) 60°

50. There are 256 farmers in a village. In a season, out of these, 130 farmers did not use any pesticide while the remaining 126 farmers used some pesticides and total expenditure on pesticides by these 126 farmers was Rs 8,780. What is the median expenditure per farmer in the village?

(*a*)
8780
126 (*b*)
8780
256
(*c*) 0 (*d*) Median cannot be computed

51. Which one of the following statements is ***not*** correct for a bar graph?

(*a*) All bars have different thickness
(*b*) Distance between two consecutive bars is the same
(*c*) The bars can touch each other
(*d*) The thickness has no significance

52. A person made 165 telephone calls in the month of May in a year. There was Friday on 1st May of the year. The average telephone call on Sundays of the month was 7. What was the average calls per day on the rest days of the month?

(*a*)
165
31 (*b*) 5
(*c*)
137
26 (*d*)
137
27

53. Out of three circles having centres P, Q and R, each circle touches remaining two circles externally. If PQ = 4 cm, QR = 6 cm and PR = 8 cm, what is sum of the radii of the circles?

(*a*) 18 cm (*b*) 15 cm
(*c*) 12 cm (*d*) 9 cm

54. ABC is an isosceles triangle with AB =AC. Side BA is produced to D, such that AB = AD.
Consider the following:
1. .ACD is an isosceles triangle.
2. .BCD is an isosceles triangle.
3. .BCD is a right-angled triangle.
Which of the statements given above are correct?

(*a*) 1 and 2 (*b*) 1 and 3
(*c*) 2 and 3 (*d*) 1, 2 and 3

55. A circle touches all the four sides of a quadrilateral ABCD. Which one of the following is always correct?

(*a*) AB + BC = CD + DA
(*b*) AB + AD = BC + CD
(*c*) AB + CD = BC + DA
(*d*) AB + BC + CD + DA = 4 times the diameter of the circle

56. What are the values of A and B respectively, if
5 1
5 1
5 1
5 1
5
–
?
+
+
+
–
= + A B

(*a*) 3, 0 (*b*) 0, 3 (*c*) 0, 0 (*d*) 3, 3

Directions:
The following **five (5)** items consist of two statements: one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below:
Codes:

(*a*) Both A and R are individually true and R is the

correct explanation of A

(*b*) Both A and R are individually true but R is ***not*** the

correct explanation of A

(*c*) A is true but R is false

(*d*) A is false but R is true

57. Assertion (A):
The system of the equations 2x + 4y + 1 = 0
4x + 8y + 3 = 0 has no solution.
Reason (R):
The system of equations a1x + b1y + c1 = 0
a2x + b2y + c2 = 0 has no solution, if a
a
b
b
1
2
1
2
= .

58. Assertion (A):
sin x lies between 0 and + 1 for 0< x < 90°.
Reason (R):
sin x increases as x increases from 0 to 90°.

59. Assertion (A):
log10 (1 + 2 + 3) = log10 1 + log10 2 + log10 3
Reason (R):
log10 (a + b + c) = log10 a + log10 b + log10 c
where a, b, c are positive real numbers.

60. Assertion (A):
(( )) 3 3 3 is irrational number.
Reason (R):
(( )) a a a is always irrational if a is irrational.

61. Assertion (A):
3
13
2
5
2
7
5
3 2 x x x + + + is a rational expression.
Reason (R):
Every polynomial is a rational expression.

62. In a triangle ABC, the angle C is obtuse. Which one of the following is correct?
(*a*) AB2 > AC2 + BC2
(*b*) AB2 < AC2 + BC2
(*c*) AC2 > AB2 + BC2
(*d*) BC2 > AB2 + AC2

63. V1, V2, V3 and V4 are the volumes of four cubes of side lengths x cm, 2x cm, 3x cm and 4x cm respectively. Some statements regarding these volumes are given below:
1. V1 + V2 + 2V3 < V4
2. V1 + 4V2 + V3 < V4
3. 2(V1 + V3) + V2 = V4

Which of the above are correct?
(*a*) 1 and 2 (*b*) 1 and 3
(*c*) 2 and 3 (*d*) 1, 2 and 3

64. If the total length of diagonals of a cube is 12 cm, what is the total length of edges of the cube?
(*a*) 15 cm (*b*) 12 cm
(*c*) 6 3 cm (*d*) 12 3 cm

65. A circle of 5 cm radius is drawn and another circle of 3 cm radius is cut out of this circle. What is the radius of a circle which has the same area as the area of the bigger circle excluding the cut one?

(*a*) 2 cm (*b*) 3 cm

(*c*) 4 cm (*d*) 4.5 cm

66. Except for one face of a given cube, identical cubes are glued through their faces to all the other faces of the given cube. If each side of the given cube measures 3 cm, then what is the total surface area of the solid body thus formed?

(*a*) 225 cm2 (*b*) 234 cm2
(*c*) 270 cm2 (*d*) 279 cm2

67. Two concentric spheres A and B, have radii r and 2r respectively. A cone is inscribed in the latter so as to circumscribe the former. What is the curved surface area of the cone?

(*a*) 2 2 πr (*b*) 4 2 πr
(*c*) 6 2 πr (*d*) 8 2 πr

68. A spherical iron ball is dropped into a cylindrical vessel of base diameter 14 cm, containing water. The water level is increased by 9
1
3 cm. What is the radius of the ball?

(*a*) 3.5 cm (*b*) 7 cm
(*c*) 9 cm (*d*) 12 cm

69. The external and internal diameters of a hemispherical bowl are 10 cm and 8 cm respectively. What is the total surface area of the bowl?
(*a*) 257.7 cm2 (*b*) 286 cm2
(*c*) 292 cm2 (*d*) 302 cm2

70.
If in the figure given above, MN = x, what is the area of the shaded region?
(*a*)
πx2
2
(*b*)
πx2
4
(*c*) πx2 (*d*) 4 2 πx

71. The radius and height of a right solid circular cone are r and h respectively. A conical cavity of radius
r
2 and
height
h
2 is cut out of the cone. What is the whole surface area of the rest of the portion?
(*a*)
πr r h r
4
5 3 2 2 ( ) + + (*b*)
5
4
2 2 πr r h +
(*c*)
3
4
2 2 πr r h r ( ) + + (*d*)
3
7
2 2 πr r h r ( ) + +

72. The radius of a cylindrical cistern is 10 metres and its height is 15 metres. Initially the cistern is empty. We start filling the cistern with water through a pipe whose diameter is 50 cm. Water is coming out of the pipe with a velocity of 5 m/s. How many minutes will it take in filling the cistern with water?

(*a*) 20 (*b*) 40 (*c*) 60 (*d*) 80

73. A sphere of radius 13 cm is cut by a plane whose distance from the centre of the sphere is 5 cm. What is the circumference of the plane circular section?

(*a*) 10π cm (*b*) 12π cm (*c*) 24 π cm (*d*) 26π cm

74. A square of side a cm is cut from each corner of a rectangular sheet of metal of 10 cm by 14 cm. The resulting projections are folded up and the seams welded to construct an open box. What is the volume of the box thus obtained?

(*a*) 140a – 48a2 + 4a3
(*b*) 140a + 48a2 + 4a3

(*c*) 140a + 24a2 + a3
(*d*) 140a – 24a2 + a3

75. A right circular cone is cut by two planes parallel to the base and trisecting the altitude. What is the ratio of the volumes of the three parts: top, middle and bottom respectively?

(*a*) 1 : 7 : 19 (*b*) 1 : 2 : 3
(*c*) 1 : 8 : 27 (*d*) 1 : 7 : 18

76. Two rectangles A and B are such that the length of A equals the sum of the diagonal and the greater side of B, while the breadth of A equals the difference of the diagonal and the greater side of B. Which one of the following is correct?

(*a*) Area of A is greater than the area of B
(*b*) Area of A is equal to the area of B
(*c*) Area of A is equal to the area of a square with its side equal to the smaller side of B
(*d*) Area of A is equal to the area of a rectangle whose dimensions are those of the diagonal and the shorter side of B

77. What is the least number by which 3675 be multiplied so that the product is a perfect square?

(*a*) 2 (*b*) 3 (*c*) 5 (*d*) 7

78. A sum of money placed at compound interest trebles itself in 5 years. In how many years will it amount to nine times itself?

(*a*) 10 years (*b*) 12 years
(*c*) 15 years (*d*) 18 years

79. The area of a circle varies as the square of its radius.

If the area of circle of radius 10 cm is 300 cm2, then what is the area of circle with radius 12 cm?
(*a*) 360 cm2 (*b*) 423 cm2
(*c*) 432 cm2 (*d*) 452.5 cm2

80. A machine is sold at a profit of 10%. Had it been sold for Rs 40 less, there would have been a loss of 10%.

What is the cost price of the machine?

(*a*) Rs 175 (*b*) Rs 200
(*c*) Rs 250 (*d*) Rs 400

81. What is the LCM of
3
8
5
36
7
72
, , and
15
96 ?
(*a*)
105
4 (*b*)
4
105 (*c*)
105
8 (*d*)
105
288

82. 12 workers, after working for 10 hours a day assemble some instruments in 15 days. How much number of days is required to assemble the same number of instruments if 15 workers are employed working 8 hours a day?

(*a*) 10 days (*b*) 12 days
(*c*) 15 days (*d*) 18 days

83. A train started from a station with certain number of passengers. At the first halt, half of the passengers got down and 120 passengers got in. At the second halt, half of the passengers got down, and then the train left for its destination with 360 passengers. How many passengers were there in the train when it started from the first station?

(*a*) 800 (*b*) 900 (*c*) 1000 (*d*) 1200

84. A man can walk uphill at the rate of 2 1
2
km/hr

and downhill at the rate of 3 1
4 km/hr. If the total time
required to walk a certain distance up the hill and return to
the starting point was 4 hr 36 min, then what was the distance
he walked up the hill?
(*a*) 6 1
2 km (*b*) 5 1
2 km
(*c*) 4 1
2 km (*d*) 4 km

85. In an election a total of 5,00,000 voters participated.
A candidate got 2,55,000 votes which was 60% of the total
valid votes. What was the percentage of invalid votes?

(*a*) 10% (*b*) 12% (*c*) 15% (*d*) ( )% 300
17

86. x, y and z are three sums of money such that y is
simple interest on x and z is simple interest on y for
the same time and rate. Which one of the following is correct?

(*a*) x2 = yz (*b*) y2 = zx
(*c*) z2 = xy (*d*) xyz = 1

87. If one root is common in equations x2 + bx + a = 0
and x2 + ax + b = 0 and a b . , then which one of the following
is correct?

(*a*) a + b = – 1 (*b*) a + b = 1
(*c*) a – b = 1 (*d*) a – b = – 1

88. What is the nature of the roots of the equation
px2 – (p – q) x – q = 0 where p, q are integers and p . 0?

(*a*) Both roots are always integers
(*b*) Both roots are always rationals
(*c*) One root is rational and other is irrational
(*d*) Both roots are always of opposite sign

89. Let *l*, m and n be real numbers such that *l* + n . m.
What is the quotient on dividing *l*3 – m3 + n3 + 3 *l*mn by
(*l* –m + n)?

(*a*) *l*2 + m2 + n2 – *l*m – mn – *l*n

(*b*) *l*2 + m2 + n2 + *l*m + mn – *l*n
(*c*) *l*2 – m2 + n2 + *l*m + mn – *l*n
(*d*) *l*2 – m2 + n2 – *l*m – mn + *l*n

90. Consider the following statements:
1. an + bn is divisible by a + b if n = 2k + 1, where k is a positive integer.
2. an – bn is divisible by a – b if n = 2k, where k is a positive integer.
Which of the statements given above is/are correct?

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

91. If the roots of the equation x2 + x + 1 = 0 are
α and , and the roots of the equation x2 + ax + b = 0 are
α

and

α , what is the value of α ?

(*a*) 1 (*b*) 2 (*c*) –1 (*d*) –2

92. What is the remainder when x4 + 1 is divided by x – 2?

(*a*) 17 (*b*) 15 (*c*) 7 (*d*) 1

93. If the value of logy 10 =
1
x
, then what will be the value of log10 (
y
10)?
(*a*)
x
10 (*b*) 10x (*c*) x – 1 (*d*)
1
10x

94. If x + y + z = 0 and xyz . 0, then what is the value of
1 1 1

2 2 2 2 2 2 2 2 2 x y z y z x z x y +
+
+
+
+ – – –
?
(*a*) 0 (*b*) 1 (*c*) – 1 (*d*)
1
2

95. If log10 x + log10 y = log10 (x + y), then what is the value of log10 x – log10 y?

(*a*) log10 (x – y) (*b*) log10 (y – 1)
(*c*) log10 (1 – y) (*d*) – log10 (y – 1)

96. If α and are the roots of the equation x2 + ax + b = 0, then what are the roots of the equation x2 – ax + b = 0?

(*a*) α , – (*b*) – , α (*c*) – , – α (*d*) α ,

97. For what value of p is the coefficient of x2 in the product (2x – 1) (x – k) (px + 1) equal to 0 and the constant term equal to 2?

(*a*) 2 (*b*)
2
5 (*c*)
5
2 (*d*) 5

98. If m and n are natural numbers such that 2m – 2n = 960, what is the value of m?

(*a*) 10 (*b*) 12
(*c*) 16 (*d*) Cannot be determined

99. When x3 + 2x2 + 4x + b is divided by x + 1, the quotient is x2 + ax + 3 and remainder is –3 + 2b. What are the values of a and b respectively?

(*a*) 1, 0 (*b*) –1, 0 (*c*) 1, 1 (*d*) –1, –1

100. If y

z
+ 1
= 1 and x
y
+ 1
= 1 what is the value of
xyz?
(*a*) 1 (*b*) –1 (*c*) 0 (*d*)
1
2

ANSWERS With EXPLANATIONS

1. (*b*) .ABC is a rt ., .A = 90° AB : AC = 3 : 4
. = + = BC 3 4 5 2 2
Let BD = x . = DC x 5 –
AD = AB BD AC DC 2 2 2 2 – – =
=9 16 5 2 2 – –(–) x x = . x = 18
10
. = DC 32
10
BD : DC =
18
10
32
10
: = 9 : 16

2. (*a*) ar .ABC= ar .PQR . 1
2 AB.AC. sin α
= 1
2 PQ.PR.sin .. sinα = sin.
But α . . . =α . 180 –
. + = π α . 180 [Q If sin. = sinα then
either .=α or . = 180 – α

3. (*b*) A = x.4 2 πr .
4
4
2

2
2 2 π π r r + . = x.4 2 πr . x =
1
2

4. (*d*). . OAB OCD ~
. = OA
OC
AB
CD
. h
h
1
2
1
6
=
h AP
h CP
–( )
–
= 1
6 =
h
h
–( )
–
1 6 6
6
+ +
= 1
6 . h= 72
5

5. (*b*) Q AB is a diameter
.. = π ACB 90
.ADC = 130°
..ABC= 180° – 130°=50°
..BAC = 90° – 50° = 40°

6. (*b*) As .s are similar
. ar ABC
ar DEF
.

.
=
AP
DQ
2
2 = ( )
AP
DQ
2 = ( ) 2
1
2
ar .ABC = 4 (ar .DEF)

7. (*a*) d = 28 cm
. Slant height of open conical
cup =
28
2
= 14 cm
Circumference of base of cone = πr = π 14
2 14 π = R π . R = 7
R : *l* = 7 : 14 = 1 : 2

8. (*a*)
3
12
5 = .
x x = 20

9. (*a*) .BAH = 90 + .BAC
.CAE = 90° + .BAC
. .BAH = .CAE
AB = AE, AH = AC
. . . . BAH EAC (SAS)
.BH = CE (C.P.C.T.)
10. (*d*) OO' = 20 cm
Let OR = x
. O'R = 20 – x
. . OPR O QR ~ '
. OR
O R
OP
O Q ' '
= .
x

x 20 –
= 7
9
. x =
45
4
11. (*d*) In .PQRQDE PQ D and D is the mid point of PR
. E is the mid point of QR
EF PR D . F is the mid point of PQ
In .PQR, D and F are the
mid points of PR and PQ respectively
. DF =
1
2 QR =
1
2 × 10 = 5 cm

12. (*b*)

13. (*a*) M : F = x : x A.T.S. 127 2 128 x x
x
– = 126

14. (*b*) Let the side of a square be a
A.T.S.
( ) ( ) a a
a

=
110
100
90
100 99
100 2

15. (*c*) A =
1
2 ab sin.
A
B C D
3 4
A' =
1
2 (2a) (2b) sin. . A' = 4 (
1

2 ab sin.)
A’ = 4A
16. (*c*)
17. (*c*) 1
1 1
–sin cos
cos (
cos
–
sin
)
A A
A
A A
.
(sin cos)(sin cos)
(sin cos)(sin cos sin cos)
A A A A
A A A A A A
– +
+ + – 2 2
= sin A sin2 A + cos2 A = 1
a3 + b3 = (a + b) (a2 + b2 – ab)
18. (*b*) cosα + sinα = 2 cosα
.sinα = 2 (cosα) – cosα
. sinα = (2 –1) cosα
. cosα = sin
–
α
2 1
× 2 1
2 1
+
+
. cosα = 2 sinα + sinα
.cosα – sinα = 2 sinα
19. (*b*) sin (90–.) = cos. . cos 88° = sin 2°
cos 2° = sin 88°
cos (90–.) = sin.
20. (*a*) sin. + cos. = 2
. Dividing by 1 1 2 2 +
= 2 (sin.)
1
2

+(cos.) ×
1
2
= 2 .sin.. cos 45° + cos. sin 45°
= 2 .sin (. + 45°) = 2
But –1 < < sinα 1
. + sin( ) . 45 . 2 . No solution

21. (*b*) Given exp = (tan A + cot A)2 – sec2 A
= tan2 A + cot2 A + 2 tan A cotA – sec2 A
= tan2A + cot2A + 2 – sec2A
= cot2 A + 2 – (sec2A – tan2A)
= (cot2 A + 1) + 1 – (1) = cosec2A

22. (*a*) Value = 3(
1
3
)2 +
4
3
3
2
2 ( ) –
1
2 (1)3 –
2
3
( )
3
2
2
+
1
8
( ) 2
1
4 = 3
23. (*a*) (–) ( ) (–) x a
a
y b
b
z c
c
2 2 2 +
–

+
=cos cos 2 2 . ϕ+cos sin 2 2 . ϕ+sin2 .
= cos (cos sin) sin 2 2 2 2 . ϕ ϕ . + +
= cos sin 2 2 1 . . + =

24. (*c*) x2 + y2 = a2 cos sin sin cos 4 2 2 4 2 . . . . +a
= + a2 2 2 2 2 cos sin (cos sin) . . . .
= a2 2 2 cos sin . .
xy = a2cos3. . sin3
( ) x y
x y
2 23
2 2
+
=
a
a
6 6 6
4 6 6
cos sin
cos sin
. .
. .
= a2
which is independent of .
Sly
x y
xy
2 2
3
+
= a
a
cos sin
cos sin
. .
. .
2
3
= a
1
3 independent of .

25. (*b*) sin4 .+cos4 . = (sin2. + cos2.)2 – 2sin2. cos2.

= 12 –2 (sin. cos.)2 = 1 – 2 (
1
2)2 =
1
2
(2 sin. = sec. =
1
cos.
sin. cos. =
1
2
)
26. (*a*)
sin
cos
.
. 1+
+ 1+ cos
sin
.
.
= 4
sin (cos)
(cos)sin
2 2 1
1
. .
. .
+ +
+ = 4
.
+ + +
+
sin cos cos
(cos)sin
2 2 1 2
1
. . .
. . = 4
sin cos cos
(cos)sin
2 2 1 2
1
4

. . .
. .
+ ++
+
=
.
+
+
2 1
1
(cos)
(cos)sin
.
. .
= 4
. sin.=
1
2 = sin 30 . = π . 30
27. (*b*)
28. (*a*) (A – B) means the set of all elements which belong to A but do not belong to B.
29. (*b*) 1M = 2W = 3B
1M + 1W + 1B = 3B +
3
2 B + 1B =
11
2
B
3 Boys can do the work in 55 days
11
2 boys can do the work in = 55 2
11
3 = 30 days
30. (*a*) No. = x × 765 + 42 = x × 17 × 45 + 2 × 17 + 8
= 17(45x + 2) + 8 . R = 8
31. (*d*) 74 gives unit's digit 1
. (1827)4 × 4 gives unit's digit 1

34 gives unit's digit 1
33 gives unit's digit 7
. (34)4. 33 gives 7 as unit's digit
92 gives unit's digit 1
(51292)10.5129 gives 9 as unit's digit
A B C
1 4 5

32. (*d*)
33. (*b*) L.C.M. of 8, 9, 11 = 792.
No. div by 8, 9, 11 leaving remainder 4
= 792 + 4 = 796 . x = 1
34. (*d*) Milk = 40 3
4 = 30 *l* . Water = 10 *l*
A.T.S.
30
10+ x
= 5
2
. x = 2
35. (*d*) Let the distance between Amritsar and Delhi be x
Time taken by first train = 6 hrs
. S1 =
x
6 km/hr and that by second train = 9 hrs
S2 =
x
9 km/hr
Let the time taken (after 8 a.m.) by the two trains to
cross each other be t hrs.
A.T.S (2×
x
6 +
x
6 t) +
x
9 t = x .t = 2 hrs 24 mins
. Trains cross each other at 10.24 a.m.
36. (*d*) 402 + 40 + 41 = 1681 = 412
37. (*c*) Gain% =
Error
True Error –
100.100
9
= x
x 1000 –
× 100 . x = 100
. Weight used = 1000 – 100 = 900 gms
38. (*d*)
39. (*c*) 18 = 2 × 9
No. should be div by 9 also
Product consists of 2's only
. Min no. of such 2's = 9

Q 2 + 2 + ... 9 times = 2 × 9 = 18 which is div. by 9
40. (*d*)
41. (*a*) Let the roots be α and $\alpha + 1$
. Sum of roots = $\alpha + \alpha + 1 = p$. $\alpha =$
$\frac{p-1}{2}$
Product of roots = $\alpha (\alpha + 1) = q$
$\left(\frac{p-1}{2}\right)\left(\frac{p-1}{2} + 1\right) = q$. $p^2 + 4q^2 = 1$
42. (*c*) $\log_2 512 = \log_2 2^9 = 9 \log_2 2 = 9 \times 1 = 9$
. $\log_4 \log_3 9 = \log_4 \log_3 3^2$ ($\log_e e = 1$
$= \log_4 2 = \log_4 \left(\frac{1}{4}\right)$
$2 \log m^4 = n \log m$
$\log_3 3^2 = 2 \log_3 3 = 2 \times 1 = 2$
$= \frac{1}{2} \log_4 4 =$
$\frac{1}{2} \times 1 =$
$\frac{1}{2}$
43. (*a*)
$\frac{1}{a} \frac{1}{b} \frac{1}{c}$
$+ + = 1$
$a b c + +$
.
$\frac{1}{a} \frac{1}{b}$
$+ = 1$
$a b c + +$
$-$
$\frac{1}{c}$
$\frac{b a}{ab}$
$+$
$=$
$\frac{c a b c}{c a b c}$

– – –
( ) + + .
a b
ab
+
=
–( )
( )
a b
c a b c
+
+ +
.
a b
ab
+
+
a b
c a b c
+
+ + ( ) = 0
. (a + b) [
c a b c ab
abc a b c
( )
( )
+ + +
+ +
] = 0
.(a + b) [ca + bc +c2 + ab] = 0
Q abc . 0, a + b + c .0
.(a+b) (b+c) (c+a) = 0
44. (*a*) x + y = 1
Squaring we get, x2 + y2 + 2xy = 1.x2 + y2 = 1 – 2xy
Again squaring, x4 + y4 + 2x2 y2 = 1 + 4x2 y2 – 4 xy
. 17 + 2x2y2 –4x2 y2 + 4xy = 1 .x2y2 –2xy = 8
45. (*b*) x4 + 4y4 = x4 + 4y4 + 4x2y2 – 4x2y2 = (x2 + 2y2)2 – (2xy)2
.(x2 + 2y2 – 2xy) (x2 + 2y2 + 2xy)
x3 – x2y + 2y3 = x3 + y3 – x2y + y3
= (x + y) (x2 –xy + y2) – y (x2 –y2)
= (x + y) (x2 – xy + y2) – y (x –y) (x + y)
= (x + y) [x2 – xy + y2 – xy + y2]
= (x + y) (x2 + 2xy2 – 2y) . G.C.D. = x2 + 2y2 – 2xy
46. (*b*) cos A = 1 2 – sin A = 1

2
2 2
2 –( )
mn
m n +
=
m n
m n
2 2
2 2
–
+
tan A =
sin
cos
A
A
=
2
2 2
mn
m n –
47. (*a*) Let AB = a . AC = y – a
AB2 = BC2 + AC2
. a2 = x2 + (y–a)2 .a =
x y
y
2 2
2
+
sin A =
BC
AB = x×
2
2
y
x y +
=
2
2 2
xy
x y +
48. (*c*) sin2x cos2y + cos2x sin2y + sin2x sin2y + cos2x cos2y
= sin2 x cos2y + sin2x sin2y + cos2x sin2y + cos2x cos2y
= sin2x (cos2y + sin2y) + cos2x (sin2y + cos2y)

= sin2x.1 + cos2x.1 = 1 (sin2.+cos2. = 1)
49. (*c*) tan. =
P
B =
x
x = 1
= tan 45 . .= 45°
50. (*d*) 51. (*a*)
52. (*b*) On 1st May it was Friday
. On 3rd May it was Sunday—3, 10, 17, 24, 31
. In May there were 5 Sundays
A
B
C
x
x
x
No. of calls on 5 Sundays = 5 × 7 = 35
Ramaining days = 26 . Reqd average =
165 35
26
–
= 5
53. (*d*) PQ = r1 + r2 = 4
QR = r2 + r3 = 6
PR = r3 + r1 = 8
Adding, 2(r1+r2+r3) = 18
. r1 + r2 + r3 = 9
54. (*b*) In . ABC, AB = AC . .1= .2
AB = AD . AC = AD
In . ACD, AC = AD . . =. 3 4
In . BCD, .1 + (.2 +.3) + .4 = 180
. .2 + (.2 +.3) +.3 = 180°
or .2 +.3 = 90° . . BCD is a rt .
In . ACD, AC = AD . . ACD is an isosceles .
(1) and (3) true
55. (*c*) AP = AS
BP = BQ
CR = CQ
DR = DS
Adding AP + BP + CR + DR = AS + BQ + CQ + DS
or AB + CD = (AS + DS) +(BQ + CQ) = AD + BC
56. (*a*)( ) ( )
( )( )
5 1 5 1

5 1 5 1
2 2 − + +
+ −
= A + B 5
On solving, 3 = A + B 5 .A = 3, B = 0
57. (*a*)
a
a
1
2
=
2
4
1
2
= ,
b
b
1
2
4
8
1
2
= = ,
c
c
1
2
1
3
=
Q
a
a
b
b
c
c
1
2
1
2
1
2

= . . It has no solution
58. (*a*)
59. (*c*) log (1+2+3) = log 6 = log (1×2×3)
= log 1 + log 2 + log 3
But log (m + n) . log m + log n
60. (*c*) ((3) 3) 3 = (3)3= 3 × 3 × 3 = 3 3 irrational
If a = 2 ((2) 2) 2 = (2)2 = 2 rational no.
2 is an irrational
61. (*a*)
62. (*a*) AB2 = BD2 + AD2 (in rt . ABD)
= BD2 + (CD + AC)2
= BD2 + CD2 + AC2 In rt . BCD,
+ 2CD.AC BC2 = BD2 + CD2
= BC2 + AC2 + 2CD.AC > BC2 + AC2
Q 2 CD.AC > 0
63. (*d*) V1 = x3, V2 = (2x)3 = 8x3, V3 = 27x3, V4 = 64x3
64. (*d*) 65. (*c*) π π r2 = (52 – 32) = 16 π .r = 4 cm
66. (*b*) T.S.A. of body = 4 (4a2) + 5a2 + (3a × a + 2a2) = 26a2
= 26 × 9 = 234 cm2
67. (*c*) 68. (*b*)
4
3
14
2
28
3
7 3 2 π πr r = .= ( )
69. (*b*) T.S.A. of hemispherical bowl
= 2 2 πR + 2 2 πr +( ) π π R r 2 2 − . 3 2 πR +πr2
= π (3R2 + r2) =
22
7 (3 × 52 + 42) = 286 cm2
70. (*c*) LM2 +LN2 = MN2 =x2
Shaded area2 = π[( ) ( ) ( )] LM LN MN
2 2 2
2 2 2 + +
=
π
4
2 2 2 ( ) LM LN MN + + =
π
4
2 2 ( ) MN MN +
=
π

4
2 2 x =
πx2
2
71. (*a*). . OAB OCD ~
.OB
OD=
AB
CD
OB . =*l*
2
T.S.A. of rest portion
= πr2 +π( ) r
2
2 + (π π r r *l l* – –
2 2)
=
πr
4 (5r + 3*l*) =
πr
4 (5r +3 2 2 h r +
72. (*d*) D = S × t
h =5 × t (length of water)
Vol. of a cylinder = πr h 2
A.T.S. π( ) 50
2 100
2 × 5t = π(10)2×15 .t
= 4800 sec = 80 min
73. (*c*) Radius of circular section = 13 5 2 2 – = 12
. = = C r 2 24 π πcm
74. (*a*) Length of the remaining sheet = 14 – 2a
= Length of box
Breadth of box = 10–2a, Height of box = a
. Vol of box = (14 – 2a) (10 – 2a)a = 140a – 48a2 + 4a3
75. (*a*) h1 =
h
3 , h2 =
2
3
h
r1 : r2 : r3
Let r1 = r, r2 = 2r, r3 = 3r
h1 : h2 : h = r : 2r : 3r
Ratio of vol =

1
3 1
2
1 πr h : (
1
3
1
3 2
2
2 1
2
1 π π r h r h –) :
(
1
3
1
3 3
2
2
2
2 π π r h r h –)
= r rx 1
2. : [( ) . 2 2 2 2 r r r rx x –] :
[(3r2) 3rx – (2r2) 2rx] = 1 : 7 : 19
76. (*c*) *l'* = *d1* + *l*, b' = d1 – *l*
Area of A = *l*' b'
= (d1 + *l*) (d1–*l*)
= d1
2 – *l*2 = b2
= Area of a square with side = smaller side of B
P
Q R
A
B
C
r1
r2
r3
A
B C
D
2 1
3
4
A

B
C
D
P
Q
R
S
tangents from an
ext pt to a circle
are equal
B
C A D
B
C
A
D
l P r/2
h/2
h
O
R=r
r1
r2
r3
h1
h2
h3
l
b
B
d1
A
d2
l'
b'
77. (*b*) 3675 = 3 × 1225 = 3 × 352 . Reqd no. = 3
78. (*a*) 3x = x (1+
R
100)5 or (1+
R
100)5 = 3
9x = x (1+
R
100)n . 32 = (1+
R
100)n .[(1+

R
100)5]2
=(1+
R
100)n.(1+
R
100)10 = (1+
R
100)n .n = 10 years
79. (*c*) A = ka2, k(10)2 = 300 .k = 3
A = k(12)2 = 3(12)2 = 432
80. (*b*) Let C.P. = Rs 100 . S.P. (I) = Rs 110
If Loss = 10%, S.P. = Rs 90
Diff = 110 – 90 = Rs 20
If diff = Rs 20 then C.P. = Rs 100
If diff is Rs 40 then C.P. = Rs 200
81. (*a*) L.C.M. of
3
8
5
36
7
72
15
96
, , ,
=
LCM of
HCF of
3 5 7 15
8 36 72 96
, , ,
, , ,
=
105
4
82. (*c*) Workers hrs days
12 10 15
15 8 x
more workers less days
15 : 12
Less hrs more days
8 : 10
. =

x
15 12 10
15 8
= 15
83. (*d*) Let the reqd no. of passengers be x
A.T.S.
x
x 2
120
2
360 1200
+
= . =
84. (*a*) d d
5
2
13
4
+ = 4 +
36
60
6 1
2
. = d km (t =
D
Speed
)
85. (*c*) Valid votes = 25500 ×
100
60 = 425,000
%age of invalid votes =
500 000 425 000
500 000
100
, – ,
,
=15
86. (*a*) y =
x r t rt y
x

= =
100
100

, z =
y rt
rt
z
y

. =
100
100
100y
x
=
100z
y .y2 = xz
87. (*a*) Let the common root be α
. + + = α α 2 0 b a ... (*i*)
. + + = α α 2 0 a b ... (*ii*)
Solving we get α =1 (, –) Qa b a b . .0
. 12 + a × 1 + b = 0 . a + b = – 1
88. (*b*) S =
p q
p
–
, P =
q
p
p, q are integers, p .0
89. (*b*) *l* + n .m . *l* + n –m .0 or *l* –*m* + *n* .0
*l*3 –m3 + n3 +3*l*mn = *l*3 + (–m)3 + n3 –3*l*(–m)n
=[*l*+(–m) + n] [*l*2 + (–m)2 + n2 – *l* (–m) – (–m) n –n*l*]
=(*l* – m + n) (*l*2 + m2 + n2 + *l*m + mn – n*l*)
Clearly quotient = *l*2 + m2 + n2 + *l*m + mn – n*l*
90. (*c*)
91. (*a*) α + =– , 1 α = 1
α

α
+ =
α
α
2 2 +
=
( )–

–
α α
α
+
=
2 2
a
(–1) – –
2 2 1
1
1

= . = a a
92. (*a*) R = f(2) = 24 + 1 = 17
93. (*c*) logy10 =
1
x
log10y = x, log10 (
y
10) = log10y – log1010 = x –1
94. (*a*) x + y + z = 0, x + y = –z
Squaring we get, x2 + y2 + 2xy = z2
or x2 + y2 – z2 = –2xy
Sly y2 + z2 –x2 = –2 yz
z2 + x2 – y2 = –2xz
Value =
1 1
2
1
–2 –2 xy yz xz
+
–
+ = – 1
2
( )
z x y
xyz
+ +
=0
95. (*a*)
96. (*c*) α + =– a, α = b . = – – α a , (–α) (–) = b
Clearly the reqd roots are –α , –
97. (*b*) (2x –1) (x – k) (px + 1) = 2px3 –x2p (2k + 1) + 2x2
(pk –2k – 1) x + k
Constant term = k = 2

Coeff of x2 = 2 –p (2k+1)
= 2 – p (2 × 2 + 1) = 0. p =
2
5
98. (*a*) 2m –2n = 960 = 26 × 3 × 5 = 26 × 15 = 26 (16 –1)
= 26 (24 –1) = 210 –26 . m = 10
99. (*a*) x3 + 2x2 + 4x + b = (x + 1) (x2 + ax + 3) + (–3 + 2b)
Comparing the coeff of x2 and constant terms,
a = 1, b = 0
100. (*b*) y +
1
2 = 1 .yz + 1 = z
x +
1
y
= 1 . xy + 1 = y
(xy + 1) z + 1 = z
or xyz + z + 1 = z
or xyz + 1 = 0
xyz = –1
: : 15 : x