Commonly used maths formula have been provided for quick reference

Series:
a) sum of first n natural numbers, $1 + 2 + \cdots + n = \frac{n(n+1)}{2}$
b) sum of squares of first n natural numbers, $1^2 + 2^2 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6}$
c) sum of cubes of first n natural numbers, $1^3 + 2^3 + \cdots + n^3 = (\frac{n(n+1)}{2})^2$
d) sum of first n terms of AP, $S_n = \frac{n}{2}[2a + (n-1)d]$
e) sum of first n terms of GP, $S_n = \frac{a(1-r^n)}{(1-r)}$ when $r \neq 1$

Area / Volume:
a) Surface area of sphere $= 4\pi r^2$
b) Volume of sphere $= 4\pi r^3/3$
c) Curved surface area of cone $= \pi r l$
d) slant height of cone, $l = \sqrt{(r^2 + h^2)}$
e) Total surface area of cone $= \pi r(r + l)$
f) Volume of cone $= \frac{1}{3}\pi r^2 h$
g) Curved surface area of cylinder $= 2\pi r h$
h) Volume of cylinder $= \pi r^2 h$

i) Total surface area of cylinder $= 2\pi r(r + h)$
j) Area of a rhombus $= \frac{\text{product of its diagonals}}{2}$
k) Rhombus diagonals are at right angles

l) Area of triangle with sides a, b and $c = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = (a+b+c)/2$

Trigonometry / Geometry:
a) $\sin 90 = 1$; $\sin 60 = \sqrt{3}/2$, $\sin 45 = 1/\sqrt{2}$, $\sin 30 = 1/2$
b) In a right angle triangle $(\text{hypotenuse})^2 = (\text{side1})^2 + (\text{side2})^2$

Equations / Polynomials / Maxima/Minima:
a) Roots of a quadratic equation $ax^2 + bx + c = 0$ are $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
b) A function $y = f(x)$ will have maxima or minima when $\frac{dy}{dx} = 0$

Logarithm:
a) $\log b + \log c = \log(bc)$
b) $\log b - \log c = \log(b/c)$
c) $\log b^a = a \log b$

d) If $\log_a b = c$, then $b = a^c$
e) log is to base 10 unless specified otherwise

Algebra:
a) $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
b) $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

Permutation & Combination:
a) $^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \cdots {}^nC_n = 2^n$

1. Find the number of ways you can fill a 3x3 grid (with 4 corners defined as a,b,c,d) if you have 3 white marbles and 6 black marbles
(a) $^9C_3$
(b) $^6C_3$
(c) $^9C_3 + {}^6C_3$
(d) $(^9C_3 + {}^6C_3)/3!$

2. How many values of c in the equation $x^2 - 5x + c$ result in rational roots which are integers?
(a) 1
(b) 3
(c) 6
(d) infinite

3. If $1/a + 1/b + 1/c = 1/(a+b+c)$ where $a + b + c \neq 0$, $abc \neq 0$, what is the value of $(a + b)(b + c)(c + a)$?
(a) Equals 0
(b) Greater than 0
(c) Less than 0
(d) Cannot be determined

4. A natural number has exactly 10 divisors including 1 and itself. How many distinct prime factors can this natural number have?
(a) Either 1 or 2
(b) Either 1 or 3
(c) Either 2 or 3
(d) Either 1 , 2 or 3

5. Eden park is a cricket field while Jubilee park is a football field in Mastnagar. In Mastnagar, all cricket fields are circular and football fields are rectangular or square. Along the boundary of all fields there are advertisment displays. In Mastnagar, the length of advertisement displays has to be the same across all playing fields. Area of Jubilee park is 468 sqm. The farthest distance between any two points in Jubilee park football field is 10√10 m. Find the approximate area of Eden park?
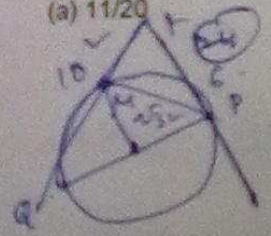(a) 1936 m²   (b) 616 m²   (c) 281 m²   (d) Inadequate data

6. If v, w, x, y and z are non-negative integers, each less than 11, then how many distinct combinations of (v,w,x,y,z) satisfy v(11^4) + w(11^3) + x(11^2) + y(11) + z = 151001
(a) 0   (b) 1   (c) 2   (d) 3

7. The circle O having a diameter of 2cm, has a square inscribed in it. Each side of the square is then taken as a diameter to form 4 smaller circles O". Find the total area of all four O" circles which is outside the circle O.
(a) 2   (b) pi - 2   (c) 2 - pi/4   (d) 2 - pi/2

8. How many six digit numbers can be formed using the digits 1 to 6 , without repetition such that the number is divisible by the digit at its units place ?
(a) 402   (b) 528   (c) 648   (d) 720

9. Amit can complete a piece of work in 2.25 days. Badri takes double the time taken by Amit. Chetan takes double that of Badri, and Das takes double that of Chetan to complete the same task. They are split into two groups (of one or more persons) such that the difference between the times taken by the two groups to complete the same work is minimum. What could be the composition of the faster group?
(a) Amit and Das   (b) Badri and Chetan
(c) Badri, Chetan and Das   (d) Amit alone

10. PR is a tangent to a circle at point P. Q is another point on the circle such that PQ is the diameter and RQ cuts the circle at point M. If the radius of the circle is 4 units and PR = 6 units, then find the ratio of the perimeter of triangle PMR to triangle PQR.
(a) 11/20   (b) 3/5   (c) 13/20   (d) 18/25

11. Heinz produces tomato puree by boiling tomato juice. The tomato puree has only 20% water while the tomato juice has 90% water. How many liters of tomato puree will be obtained from 20 liters of tomato juice?
(a) 2 liters
(b) 2.4 liters
(c) 2.5 liters
(d) 6 liters

12. Abhishek and Aishwarya pick up a ball at random from a bag containing M red and N yellow coloured balls, one after the other, replacing the ball every time till one of them gets a red ball. The first one to get a red ball is declared the winner. If Abhishek begins the game and the odds in favor of his winning the game are 3 to 2, then find the ratio M:N.
(a) 1:1
(b) 1:2
(c) 2:3
(d) 3:2

13. A fresher recruitment event of Hire All Smart People Ltd (HASPL) at eLitmus happens in 2 cities, Bangalore and Delhi. The interview call is sent to everyone who is above 70th percentile (top 30% of the pool). 70% and 80% of called people accept the interview call in Bangalore and Delhi resepctively. 90% and 80% of the people who accepted the call, turned out on the day of interview respectively in Bangalore and Delhi. The 'Offer' ratio is 2 out of 3 and 3 out of 4 of the people who turned up in Bangalore and Delhi respectively. If amongst people who apply there are 1000 people above 70th percentile in each of the locations, what percentage of 70th percentile from eLitmus got offered in HASPL when results of both location are taken together?
(a) 60%
(b) 50%
(c) 45%
(d) 41%

14. What is the value of $\log_e(e(e(e\ldots\ldots)^{1/2})^{1/2})^{1/2}$?
(a) 0
(b) 1/3
(c) 1/2
(d) 1

15. For Rs 600 Mr. Karan can buy a maximum of 24 cups of tea and for Rs 1000 he can buy a maximum of 15 cups of Coffee. He has Rs 2200 in his pocket and purchases 8 cups of tea. What is the maximum number of cups of coffee Mr. Karan can purchase with the remaining money ?
(a) 33
(b) 32
(c) 31
(d) 27

16. The square of a two digit number is divided by half the number. After 36 is added to the quotient, this sum is then divided by 2. The digits of the resulting number are the same as those in the original number, but they are in reverse order. How many numbers fulfill the above criteria?

(a) 2   (b) 4   (c) 6   (d) 7

17. In an opinion poll, 78% of those asked were in favor of at least one of the three sportspersons to be included in the Commonwealth Organizing committee Saina, Dhoni and Anand. 50% of those asked favored Saina, 30% favored Dhoni, and 20% favored Anand. If 5% of those asked favored all three of them , what percentage of those asked favored exactly one sportsperson.

(a) 61   (b) 56   (c) 51   (d) 22

18. A basket ball is dropped from a height of 20 feet. It bounces back each time to a height which is one half of the height of the last bounce. How far approximately will the ball have travelled before it comes to rest?

(a) 30 feet   (b) 40 feet   (c) 60 feet   (d) can not be determined

19. PT Usha and Shelly John decide to run a marathon between Ramnagar and Jamnagar. Both start from Ramnagar at 1 pm. On the way are two towns: Ramgarh and Rampur, separated by a distance of 15 km. PT Usha reaches Ramgarh in 90 minutes running at a constant speed of 40 Km/hr. She takes additional 30 minutes to reach Rampur. Between Rampur and Jamnagar she maintains an average speed of V km/hr (where V is a whole number). Shelly John being a professional marathon runner, maintains a constant speed of 18 Km/hr. They both reach Jamnagar together after 'n' hours 'n' being a whole number. What could be the total time taken by PT Usha?

(a) 5 hours   (b) 15 hours   (c) 41 hours   (d) all of the above

20. In a certain examination paper, there are n questions. For j = 1,2 ...n, there are 2^{n-j} students who answered j or more questions wrongly. If the total number of wrong answers is 4095, then the value of n is

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

SECTION B (Problem Solving)
(20 questions)

Direction for questions 21 to 24 Answer the questions based on following information.

Given below are various income tax slabs applicable to salaried people. The tax slabs vary by income level, gender, and age

Tax Slab	Male	Female	Senior Citizen
0%	Rs. 0 - Rs. 1,50,000	Rs. 0 - Rs. 1,80,000	Rs. 0 - Rs. 2,25,000
10%	Rs. 1,50,001 - Rs. 3,00,000	Rs. 1,80,001 - Rs. 3,00,000	Rs. 2,25,001 - Rs. 3,00,000
20%	Rs. 3,00,001 - Rs. 5,00,000	Rs. 3,00,001 - Rs. 5,00,000	Rs. 3,00,001 - Rs. 5,00,000
30%	Rs. 5,00,001 and above	Rs. 5,00,001 and above Rs.	5,00,001 and above

Further
1) Income Tax Surcharge - A 10% surcharge is applicable on the total tax payable, if the taxable income after taking into consideration all the deductions is above Rs. 10,00,000.
2) The following components of a salary are considered Taxable: Basic, Dearness Allowance (DA), House Rent Allowance (HRA), Medical Allowance (MA), Conveyance, and Bonus
3) Any medical expenses adding up to Rs. 15,000 per year is exempt from income tax
4) Any investments in Public Provident Fund, Government Bonds, Premium paid towards Life insurance, adding up to Rs. 1,00,000 is exempt from income tax
5) HRA is exempt from income tax as per the rule below
   The lower of the three (i) 40% of the Basic (ii) Actual HRA received (iii) Actual rent paid
6) Conveyance of up to Rs. 800 per month is not taxable
7) One has to be of age 65 years or more to be considered a senior citizen

21. Mr. Salman Khan, 44 years old, has recently moved to a rented house near to his office. He pays 20% of his monthly salary as rent for this house. After his recent pay revision for the financial year 2009-10 his monthly payslip looks as below and remains the same through out the year. He expects to spend not more than Rs. 6,600 towards medical expenses that year. What is the estimated income tax liability of Mr. Salman Khan for that year?

Basic	DA	HRA	MA	Conveyance
40,000	4,000	15,000	1,100	1,000

(a) 57208   (b) 76180   (c) 79600   (d) 86966

22. Mr. Amitabh retired last year at the age of 60 years after working as a teacher for 35 long years. This financial year, He has received a monthly pension of Rs. 21,000 all of it under the head Basic. Amitabh has purchased Government bonds worth Rs. 2,200 every month without fail. How much income tax does Mr. Amitabh owe to the government for this financial year?
(a) 60   (b) 2700   (c) 7560   (d) 10200

23. Aishwarya and Abhishek is a young working couple. They are both employed with Winfy at similar position and receive same salary. They also have made identical investments and expenses during the year. If Abhishek pays an income tax of Rs. 1,500 for financial year 2008-09, how much income tax did Aishwarya pay?
(a) 0   (b) 750   (c) 1500   (d) Cannot be determined

24. Shwetha's estimated income tax for the financial year 2009-10 is Rs. 1,42,000 after adjusting her income for the annual life insurance premium of Rs. 12,000 she pays. Her salary components are DA and Basic. DA is Rs.2000 per month. What is her annual income, if all her income is from salary?
(a) 790000   (b) 800000   (c) 802000   (d) 812000

Sajeed and Majeed are gamblers. They love betting on final team rankings in cricket tournaments. LPI cricket tournament is their favorite. A total of five teams are participating in this years LPI (A, B, C, D and E). Before the tournament begins, Sajeed and Majeed guess the result. According to Sajeed, the ranking will be A, B, C, D, E where as according to Majeed it will be D, A, E, C, B. At the end of the tournament, it turned out that Sajeed had not predicted even a single rank correctly nor had he predicted the correct ordering of any pair of consecutive teams. On the other hand, Majeed had predicted ranking of two teams correctly and he had also predicted ordering of two pairs of consecutive teams.

25. Which team won LPI tournament this year?

(a) A   (b) B   (c) E   (d) None of the above.

26. Which team was ranked one behind team B?

(a) A   (b) C   (c) D   (d) None of the above.

New Public School has a circular layout. The school has teachers specializing in various subjects. All classrooms of the school are equally spaced apart and located along its perimeter. Each teacher needs to take 4 classes in a day. There is a strange rule. The first and last class has to be in the same class room. The other two classes have to be at two other distinct class rooms.

27. Bharti is a history teacher. In addition to above rules of the school, she teaches exactly one pair of successive classes in adjacent classrooms. How many distinct trips to class rooms are possible for Bharti if there are 12 class rooms in the school?

(a) 120   (b) 90   (c) 576   (d) 496

28. Ram is a math teacher. He never teaches two successive classes at two adjacent classrooms. How many distinct trips to class rooms are possible for Ram if there are 9 class rooms in the school?

(a) 72   (b) 324   (c) 30   (d) 180

29. ABCD are four points in a plane such that ABD and DBC form two triangles. Area of ABD is 10 units and area of BDC is 20 units. What is the ratio of lengths (AD/DC)?
(1) Points ADC are collinear
(2) DB is 5 units long and is perpendicular to AC
(a)   (b)   (c)   (d)

30. If x and y are real then is x positive?
(1) x^{2m} and y^{3n} have same sign given both m and n are positive integers
(2) Both x^m and y^n are positive, given m and n are consecutive integers
(a)   (b)   (c)   (d)

31. What was the percentage profit in selling a liter of milk?
(1) 15 liters of milk was sold at cost price after adding 20% of water
(2) Milk was purchased at Rs 16 per liter
(a)   (b)   (c)   (d)

32. Nandu bought a Pen. He paid for it with currency notes of denominations Rs.1, Rs.2, Rs.5 and Rs.10 using at least one note of each denomination . The total number of five and ten rupee notes used was one more than the total number of one and two rupee notes used. How many one rupee notes did Nandu use to pay for the Pen?
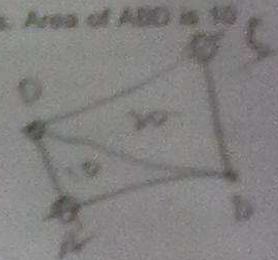(1) Nandu used a total of 13 currency notes
(2) The price of the Pen was a multiple of ten
(a)   (b)   (c)   (d)

<u>**Direction for questions 33 to 37**</u> Answer the questions based on following information.

Dream teams are formed by television viewers by selecting five players from the sixteen players namely F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13, F14, F15 and F16. The players belong to exactly one of the three teams namely Chelsea, Liverpool and United. Every dream team must have two players each from Chelsea and Liverpool and one player from United. Following information is provided.

(a) F12 is not from United.
(b) F7 is from Chelsea.
(c) F2 and F9 are from Liverpool.
(d) The 'match fee' of each player belonging to Chelsea, Liverpool and United is Euro 800, Euro 775 and Euro 725 per match played respectively.

8 such dream teams formed are mentioned below.

Team1	F3	F9	F7	F1	F12
Team2	F12	F11	F13	F6	F9
Team3	F6	F3	F5	F11	F7
Team 4	F2	F10	F7	F8	F1
Team 5	F1	F4	F16	F11	F10
Team 6	F6	F3	F7	F15	F12
Team 7	F2	F9	F12	F14	F15
Team 8	F4	F8	F13	F11	F10

33. In dream team 6 name the United player
(a) F3   (b) F6   (c) F12   (d) F15

34. How many players belong to Chelsea from the given sixteen player?
(a) 4   (b) 5   (c) 6   (d) 7

35. In team 8 who are from Liverpool?
(a) F4, F8   (b) F10, F11   (c) F11, F13   (d) F4, F11

36. What is the total fees per match (in Euros) for team 5?
(a) 3875   (b) 3825   (c) 3800   (d) None of the above.

37. Which of the following combinations have only Liverpool players?
(a) F13, F3   (b) F3, F16   (c) F16, F14   (d) F14, F2

```
                    W  H  Y
            x          N  U  T
            _____
                    O  O  N  P
                 O  Y  P  Y
              O  U  H  A
            _____
              O  N  E  P  O  P
```

38. Which of these is not divisible by 2?

(a) W   (b) Y   (c) U   (d) N

39. All of these digits appear only once in the multiplication above except:

(a) 2   (b) 5   (c) 6   (d) 8

40. Which of these can be sides of a triangle?

(a) HYT   (b) OWY   (c) EUO   (d) APW

Directions for the questions 41 to 44. Choose the most appropriate choice to fill-in or replace the underlined portion(s) of the sentences below.

41. This ___ a treat!
(a) calls at
(b) calls against
(c) calls
(d) calls for

42. The mangoes _____ over time said Ashok.
(a) will ripen
(b) will ripe
(c) ripes
(d) ripe

43. The least considered in the latest Maoist attacks _____ the innocent victims.
(a) was
(b) were
(c) are
(d) have been

44. Uprooting plants ___ like uprooting your life.
(a) are
(b) have been
(c) is
(d) was

Directions for the questions 45 to 55. Read each of the following passages carefully and choose the best answer for the questions that follow it.

Macaques and chimpanzees have a sense of social order and rules of expected behavior, mostly to do with the hierarchical natures of their societies, in which each member knows its own place. Young rhesus monkeys learn quickly how to behave, and occasionally get a finger or toe bitten off as punishment. Other primates also have a sense of reciprocity and fairness. They remember who did them favors and who did them wrong. Chimps are more likely to share food with those who have groomed them. Capuchin monkeys show their displeasure if given a smaller reward than a partner receives for performing the same task, like a piece of cucumber instead of a grape.

These four kinds of behavior — empathy, the ability to learn and follow social rules, reciprocity and peacemaking — are the basis of sociality.

Dr. de Waal, who is director of the Living Links Center at Emory University, sees human morality as having grown out of primate sociality, but with two extra levels of sophistication. People enforce their society's moral codes much more rigorously with rewards, punishments and reputation building. They also apply a degree of judgment and reason, for which there are no parallels in animals.

Religion can be seen as another special ingredient of human societies, though one that emerged thousands of years after morality, in Dr. de Waal's view. There are clear precursors of morality in nonhuman primates, but no precursors of religion. So it seems reasonable to assume that as humans evolved away from chimps, morality emerged first, followed by religion. "I look at religions as recent additions," he said. "Their function may have to do with social life, and enforcement of rules and giving a narrative to them, which is what religions really do."

As Dr. de Waal sees it, human morality may be severely limited by having evolved as a way of banding together against adversaries, with moral restraints being observed only toward the in group, not toward outsiders. "The profound irony is that our noblest achievement — morality — has evolutionary ties to our basest behavior — warfare," he writes. "The sense of community required by the former was provided by the latter."

45. According to Dr. de Waal, humans display morality
(a) because of their high sense of empathy towards other humans
(b) as a survival mechanism, and only towards a few others
(c) is severely limited as it is still evolving
(d) as a result of religion, which does not exist among apes

46. The phrase 'primate sociality' used in the 3rd paragraph means
(a) sociality found among apes
(b) the most important form of sociality
(c) the most basic form of sociality
(d) none of the above

47. When did religion first appear among chimpanzees?
(a) after religion emerged among humans
(b) before religion emerged among humans
(c) after morality emerged among chimpanzees
(d) never

48. If you were a Capuchin monkey, which would you like eating most
(a) anything given by another Capuchin monkey that groomed you
(b) a piece of cucumber
(c) a grape
(d) a small reward

The pioneers of the teaching of science imagined that its introduction into education would remove the conventionality, artificiality, and backward-lookingness which were characteristic, of classical studies, but they were gravely disappointed. So, too, in their time had the humanists thought that the study of the classical authors in the original would banish at once the dull pedantry and superstition of medieval scholasticism. The professional schoolmaster was a match for both of them, and has almost managed to make the understanding of chemical reactions as dull and as dogmatic an affair as the reading of Virgil's Aeneid.

The chief claim for the use of science in education is that it teaches a child something about the actual universe in which he is living, in making him acquainted with the results of scientific discovery, and at the same time teaches him how to think logically and inductively by studying scientific method. A certain limited success has been reached in the first of these aims, but practically none at all in the second. Those privileged members of the community who have been through a secondary or public school education may be expected to know something about the elementary physics and chemistry of a hundred years ago, but they probably know hardly more than any bright boy can pick up from an interest in wireless or scientific hobbies out of school hours. As to the learning of scientific method, the whole thing is palpably a farce.

Actually, for the convenience of teachers and the requirements of the examination system, it is necessary that the pupils not only do not learn scientific method but learn precisely the reverse, that is, to believe exactly what they are told and to reproduce it when asked, whether it seems nonsense to them or not. The way in which educated people respond to such quackeries as spiritualism or astrology, not to say more dangerous ones such as racial theories or currency myths, shows that fifty years of education in the method of science has produced no visible effect whatever. The only way of learning the method of science is the long and bitter way of personal experience, and, until the educational or social systems are altered to make this possible, the best we can expect is the production of a minority of people who are able to acquire some of the techniques of science and a still smaller minority who are able to use and develop them.

49. The author implies that the 'professional schoolmaster' has
(a) no interest in teaching science
(b) thwarted attempts to make education lively
(c) aided true learning
(d) supported the humanists

50. The author blames all of the following for the failure to impart scientific method through the education system except
(a) poor teaching
(b) examination methods
(c) lack of direct experience
(d) lack of interest on the part of students

51. The word 'palpably' used in the passage most nearly means
(a) empirically   (b) obviously   (c) tentatively   (d) ridiculously

52. Astrology is mentioned in the passage as an example of
(a) a science that needs to be better understood
(b) a belief which no educated people hold
(c) something unsupportable to those who have absorbed the methods of science
(d) an acknowledged failure of science

: There are two gaps in each of the following sentences. From the pairs of words given, choose the one that fills the gaps most appropriately. The first word in the pair should fill the first gap

57. Mr.Robinson was a ___ romantic while his wife was quite the ___
(a) hopeless, realist   (b) bright, materialist   (c) marry, mystic   (d) desperate, cynic

58. Aretha Franklin is ___ to Lata Mangeshkar in America and is ___ as a cultural icon.
(a) compared, lauded
(b) equivalent, appreciated
(c) ditto, glorified
(d) akin, revered

: Sentences A,B,C and so on given in each question, when properly sequenced, form a coherent paragraph. Choose the most logical order of sentences from among the four given choices

59.
Jenny decided to be a great producer, and The Sheik was the story she chose to produce.
A. Andrew refused to play the part of The Sheik.
B. Jenny was equally determined to be the heroine, so they argued back and forth.
C. But she ran into a snag at once.
D. He wanted to be the lady who gets carried off on the Sheik's horse.
(a) ACBD   (b) CADB   (c) ADBC   (d) ACDB

60.
1. Jinnah initially tried to win British support for a seat in the House of Commons but failed.
A. He finally accepted fervent appeals from Muslim friends to return home and help them to revitalize the demoralized leaderless Muslim league.
B. He was re-elected to the expanded national assembly, which met for the first time in Delhi in January 1924.
C. The Khilafat movement launched by Gandhi in 1920 had by then collapsed and so had the final phase of the Satyagraha in Gujarat.
D. Most congress leaders remained in prison cells, while Jinnah reorganized his Muslim league as its president, and won the respect of Ramsay MacDonald
6. Jinnah advised MacDonald as soon as he became prime minister to draft a constitution for what Jinnah still hoped would emerge as a single nation-state of independent India, with safeguards and separate electorates for its Muslims and other minorities
(a) ADCB   (b) BCDA   (c) ABCD   (d) DBAC