Institute of Actuaries of India

ACET JUNE 2017

Mathematics

1. If $f(x) = 2x - 3$, then $f^{-1}(x)$ is

   A. $\frac{1}{2x-3}$

   B. $\frac{x+3}{2}$

   C. $3 - 2x$

   D. Non-existent. 1 mark

2. If $p = \frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ and $q = \frac{1}{p}$, what is the value of $(p+q)^2$?

   A. 8

   B. 81

   C. 64

   D. 1. 1 mark

3. If the sum of two unit vectors is a unit vector, the magnitude of their difference is

   A. $\frac{1}{2}$

   B. 3

   C. 2

   D. $\sqrt{3}$. 2 marks

4. The value of $\int \log_2 x \ dx$ is (assuming c is a constant)

   A. $(x \log_e x - x) \log_2 e + c$

   B. $(x \log_2 x - x) \log_2 e + c$

   C. $(x \log_e x - x) + c$

   D. $(x \log_2 x - x) + c$. 1 mark

5. The angle between the vectors $\hat{\imath} - \hat{\jmath}$ and $\hat{\jmath} - \hat{k}$ is

   A. $\pi/3$

   B. $2\pi/3$

   C. $\pi/4$

   D. $3\pi/4$. 2 marks

6. The differential coefficient of $f(\log_e x)$ w.r.t. x, where $f(x) = \log_e x$ is

   A. $\frac{x}{\log_e x}$

   B. $x \log_e x$

   C. $\frac{\log_e x}{x}$

   D. $\frac{1}{x \log_e x}$. 1 mark

7. The definite integral $\int_0^a [f(x) + f(-x)]dx$ is equal to

   A. 0

   B. $2\int_0^a f(x)dx$

   C. $\int_{-a}^a f(x)dx$

   D. $-\int_{-a}^a f(-x)dx$. 1 mark

8. The rank of the matrix $\begin{pmatrix} 1 & 3 & 0 & 0 \\ 0 & 4 & 1 & 0 \\ 0 & 5 & 0 & 1 \end{pmatrix}$ is

   A. 2

   B. 3

   C. 4

   D. 1. 1 mark

9. The value of $'a'$ for which the expression $(a^2 - 3a + 2)x^2 + (a^2 - 5a + 6)x + a^2 - 4 = 0$ is true for all x is

   A. 0

   B. 1

   C. 2

   D. 3. 1 mark

10. If $I = \int_0^{\pi} \frac{\sin x}{1+\sin x+\cos x} dx$ and $J = \int_0^{\pi} \frac{\sin x}{1+\sin x-\cos x} dx$, then

    A. $I = -J$

    B. $I = J/2$

    C. $I = J$

    D. $I = 2J$. 1 mark

11. If $|\vec{a}| = 5$ and K is a scalar such that $-4 \leq K < 1$, then the maximum value of $|K\vec{a}|$ is

A. 1
B. 4
C. 5
D. 20. 1 marks

12. The range of $f(x) = \cos^{-1}\left(\frac{x^2}{1+x^2}\right)$ for real x is

A. $0 < f(x) \leq \frac{\pi}{2}$
B. $\frac{\pi}{2} \leq f(x) \leq \pi$
C. $0 \leq f(x) < \frac{\pi}{2}$
D. $0 < f(x) < \frac{\pi}{2}$. 2 marks

13. If m be the slope of a tangent to the curve $e^y = 1 + x^2$, then

A. $m < -1$
B. $-1 \leq m \leq 1$
C. $m > 1$
D. $0 < m < 1$. 2 marks

14. $\int_1^{e^{73}} \frac{\pi}{x} \sin(\pi \log_e x)\, dx$ is equal to

A. 2
B. -2
C. $2/\pi$
D. 2π. 2 marks

15. On what sum will the simple interest for x years at $x\%$ per annum be Rs. x?

A. Rs. x
B. Rs. $100x$
C. Rs. $\frac{100}{x^2}$
D. Rs. $\frac{100}{x}$. 1 mark

16. If $f(x)$ be a quadratic polynomial such that $f(0) = 2, f'(0) = 3$ and $f''(0) = 4$, then $\int_{-1}^{1} f(x)dx$ is equal to

A. 0

B. $\frac{16}{3}$

C. $\frac{4}{3}$

D. 3. 3 marks

17. Let $C = \begin{pmatrix} a & 0 \\ 1 & 1 \end{pmatrix}$ and $D = \begin{pmatrix} 1 & 0 \\ 7 & 1 \end{pmatrix}$. Then the number of possible values of a, for which $C^2 = D$, is

A. 3

B. 2

C. 1

D. 0. 1 mark

18. If $f(x) = \frac{\tan 3x}{\sin 2x}$, what is the limit of $f(x)$ as x tends to zero?

A. $\frac{2}{3}$

B. $-\frac{2}{3}$

C. $\frac{3}{2}$

D. $-\frac{3}{2}$. 1 mark

Statistics

19. For a given set of distinct numbers, which one of the following is true?

    A. A.M. $>$ G.M. $>$ H.M.
    B. A.M. $\geq$ G.M. $\geq$ H.M.
    C. A.M. $<$ G.M. $<$ H.M.
    D. A.M. $\leq$ G.M. $\leq$ H.M. 1 mark

20. What is the mode for the following distribution?

Marks obtained	0	23	65	73	77	81	84	95
Number of students	13	5	12	18	21	8	2	11

    A. 21
    B. 77
    C. 73
    D. 95. 1 mark

21. In a binomial distribution the probability of success is $\frac{1}{5}$, while the number of trials is unspecified. Then the variance of the distribution cannot be

    A. $\frac{4}{25}$
    B. $\frac{8}{25}$
    C. $\frac{6}{25}$
    D. 8. 1 mark

22. The regression equation of the volume (in liters) y of a balloon on the temperature (in Centigrade) x is given by $y = \alpha + \beta x$. What is the slope parameter of the regression equation if the temperature is measured in Fahrenheit?

    A. $\frac{5}{9}\beta$
    B. $\frac{9}{5}\beta$
    C. $\frac{9}{5}\beta + 32$
    D. $\frac{5}{9}(\beta - 32)$. 1 mark

23. What is the median number of goals scored in the matches summarized in the table below?

Number of goals	0	1	2	3	4	5
Number of matches	2	4	7	6	8	3

A. 2
B. 2.5
C. 3
D. 3.5. 1 mark

24. The probability that exactly one of the events A or B occurs is equal to

A. $P(A) + P(B) - P(A \cap B)$
B. $P(A) + P(B) - 2P(A \cap B)$
C. $P(A \cap B^c) + P(A^C \cap B) + P(A \cap B)$
D. $P(A) + P(B)$. 2 marks

25. From all 9 digit numbers, one is selected at random. The probability that the selected number has distinct digits is

A. $\frac{8!}{10^7}$
B. $\frac{8 \times 8!}{10^8}$
C. $\frac{9!}{10^8}$
D. $\frac{8!}{10^8}$. 2 marks

26. A die is thrown twice and the sum of the numbers appearing is observed to be 7. The conditional probability that the number 2 has appeared at least once is

A. $\frac{1}{18}$
B. $\frac{1}{3}$
C. $\frac{2}{11}$
D. $\frac{1}{6}$. 2 marks

27. The mean of the numbers obtained on throwing a die having 1 on three faces, 2 on two faces and 5 on one face is

A. 1
B. $\frac{8}{3}$
C. $\frac{7}{2}$
D. 2. 2 marks

28. On a multiple choice examination with four possible answers (out of which only one is correct) for each of the five questions, the probability that a candidate would get four or more correct answers just by guessing is

A. $\frac{15}{4^5}$
B. $\frac{14}{4^5}$
C. $\frac{1}{4^3}$
D. $\frac{1}{4^4}$. 3 marks

29. Which one of the following is not a measure of central tendency?

A. Mean
B. Median
C. Mode
D. Mean absolute deviation. 1 mark

30. If the correlation between X and Y is 0.3, what is the correlation between $\frac{2X+3}{5}$ and $\frac{4Y+7}{11}$?

A. 0.3
B. $\frac{0.3}{5\times11}$
C. $\frac{2\times4\times0.3}{5\times11}$
D. None of the above. 1 mark

31. Let X be a random variable with mean μ and standard deviation $\sigma > 0$ and $X^* = \frac{X-\mu}{\sigma}$. Then $Var(X^*)$ is

A. σ
B. σ^2
C. $\sqrt{\sigma}$
D. 1. 1 mark

Data Interpretation

Answer Questions 32-34 based on the following information.

A survey of movie goers from five cities, P, Q, R, S and T, is summarised below. The second column gives the *percentage* of viewers in each city who watch, on the average, less than one movie a week. The third column gives the *total number* of viewers who view, on the average, one or more than one movie per week.

City	%age of viewers watching less than 1 movie a week (on the average)	Viewers watching 1 or more movies a week (on the average)
P	50	2000
Q	20	3000
R	75	1400
S	40	3000
T	60	7000

32. Which city has the highest number of viewers who watch less than one movie a week?

    A. City T
    B. City S
    C. City Q
    D. City R. 1 mark

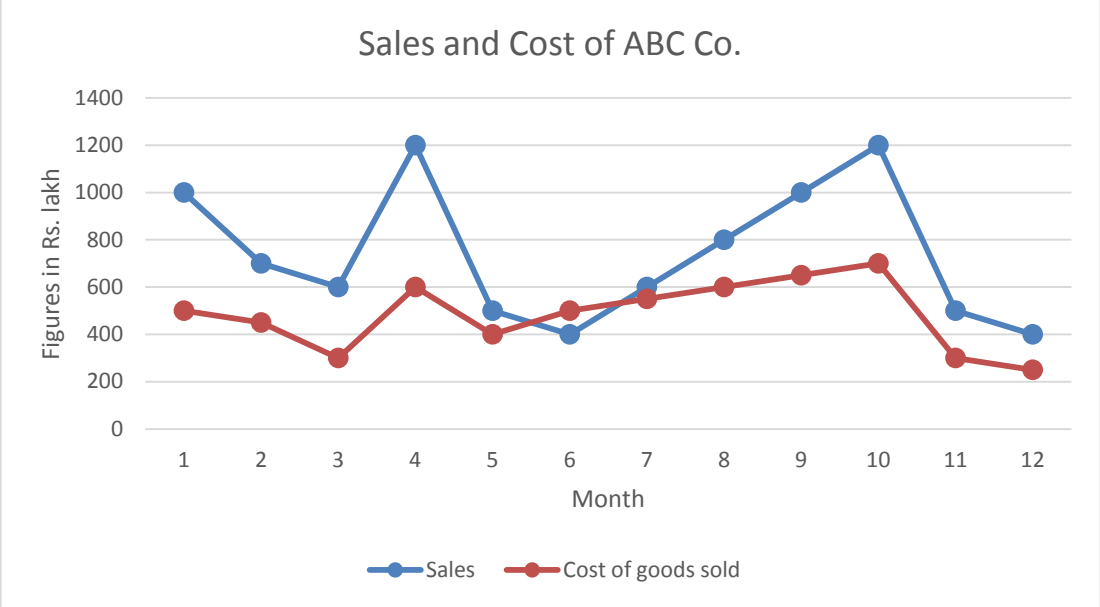
33. The city with the second lowest number of movie watchers is

    A. City T
    B. City P
    C. City Q
    D. City R. 1 mark

34. The total number of all movie goers in the five cities who watch less than one movie per week is

    A. 16450
    B. 17450
    C. 18450
    D. 19450. 2 marks

The sales and cost of goods (in lakhs of rupees) of a manufacturing company in twelve consecutive months are shown in the following chart. Use this information to answer Question 35.



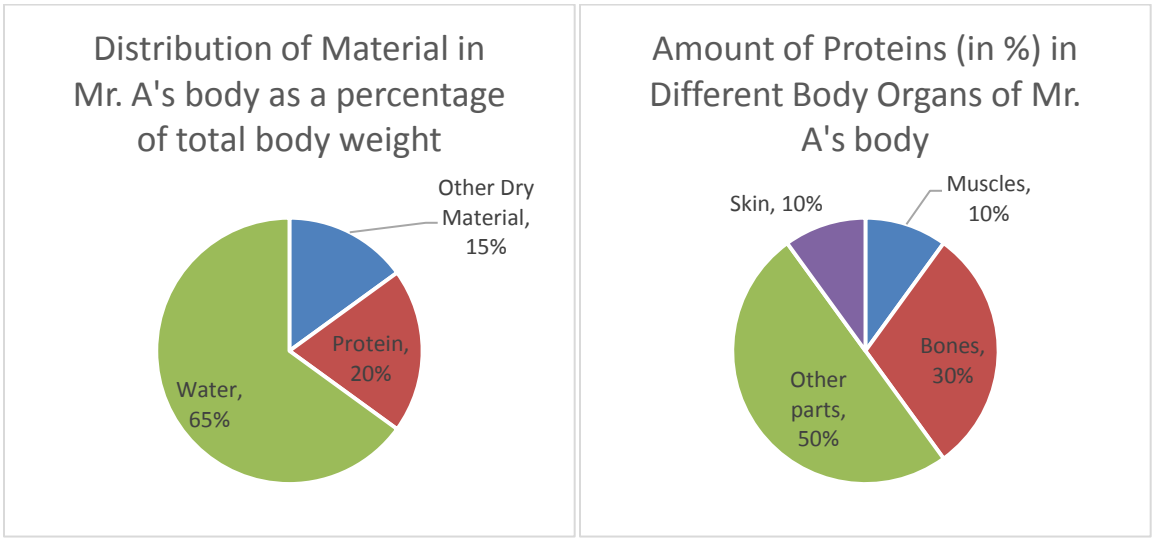
35. Which pair of numbers, among those given below, best represents the average sales and costs figures for ABC Co. over the period of twelve months?

A. 742, 483
B. 742, 383
C. 642, 483
D. 642, 383.

2 marks

Answer Questions 36-37 based on the following information.

The first pie chart shows distribution of material of Mr. A's body (as a percentage of his total body weight). The second pie chart shows the amount of proteins (in percentage) in different body organs of Mr. A's body.



36. What percentage of Mr. A's weight consists of muscular and skin protein?

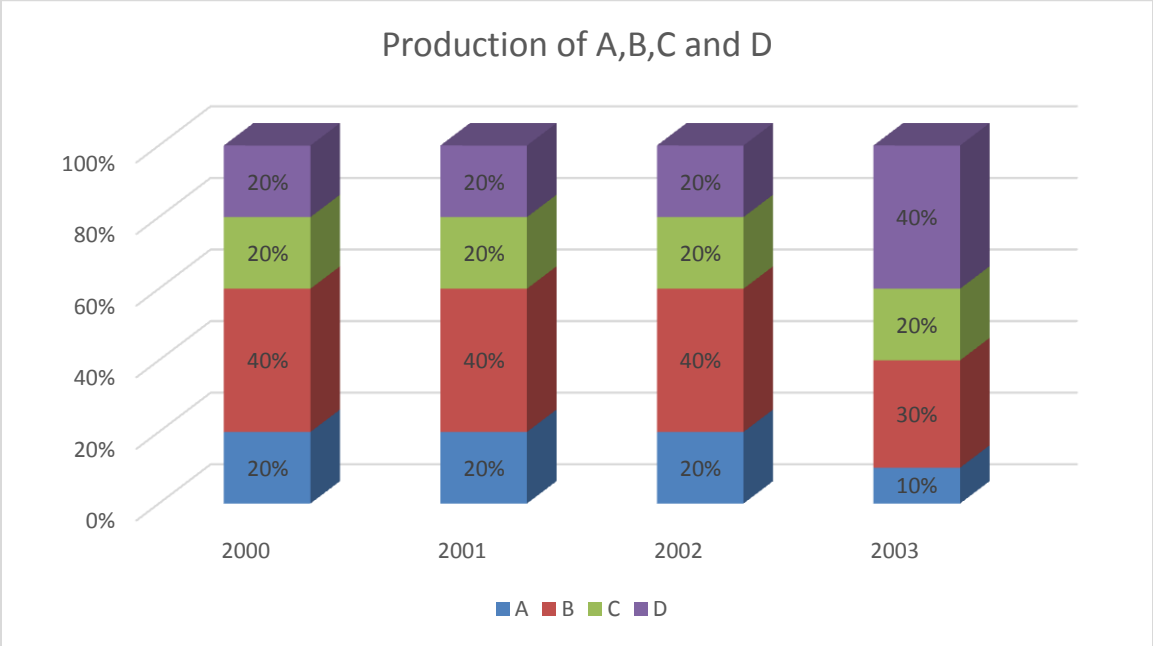
A. 40%
B. 20%
C. 4%
D. None of the above. 1 mark

37. What percentage of Mr. A's body weight is made up of bones?

A. 30%
B. 6%
C. 20%
D. Cannot be determined. 1 mark

Answer Question 38 based on the following information

The cumulative bar chart below gives us the production of four products, A, B, C and D, for four years. It is known that the total production increases @20% over its value in every successive year. The difference between the production of C in 2003 and the production of A in 2001 is 2200 units.



38. If all the units of B produced in 2001 are sold at a price of Rs. 100 per unit, what is the sales revenue that year due to sale of B (in Rupees lakhs)?

A. 5
B. 10
C. 15
D. None of these. 3 marks

English

39. Choose the word that cannot be used as a synonym of "Association".

A. Organization
B. Connection
C. Link
D. Member 1 mark

40. Choose the word that cannot be used as a synonym of "Branch".

A. Department
B. Unit
C. Outlet
D. Conjunction 1 mark

41. Choose the word that cannot be used as an antonym of "Voluntary".

A. Compulsory
B. Required
C. Disdainful
D. Mandatory 1 mark

42. Choose the word that cannot be used as an antonym of "Intentional".

A. Accidental
B. Designed
C. Inadvertent
D. Incidental 1 mark

43. A story about mythical or supernatural beings or events is called

A. Engraving
B. Legend
C. Chronicle
D. History 1 mark

44. A widespread outbreak of an infectious disease is called

A. Epidemic
B. Malady
C. Plague
D. Calamity 1 mark

45. Identify the alternative which will replace '?'

Flowing : River :: Placid : ?

A. Stream
B. Lake
C. Spring
D. Waterfall 1 mark

46. Identify the alternative which will replace '?'

Enough : Excess :: Sufficient : ?

A. Adequate
B. Surplus
C. Decent
D. Plenty 1 mark

47. Identify the alternative which will replace '?'

Agenda : Meeting :: Programme : ?

A. Party
B. Lecture
C. Function
D. Reading 1 mark

48. Meaning of "Lion's share" is

A. Major share
B. Extortion money
C. Forced share
D. Food that a lion shares with lioness 1 mark

49. Meaning of "By leaps and bounds" is

A. Rapidly
B. By jumping
C. In minute detail
D. By crossing the boundaries 1 mark

50. Meaning of "Bag and baggage" is

A. With all one's memory
B. With all one's possessions
C. With all one's clothes
D. With a hand-bag and a suitcase 1 mark

51. Fill the blank in the following sentence.

Granted that the visibility is not good due to fog, I want to drive the car _____.

A. all of it
B. all the same
C. all the odds
D. all the way 1 mark

52. Fill the blank in the following sentence.

Mumbai is a safe city _____ Bengaluru.

A. comparing with
B. comparatively with
C. compared to
D. comparison to 1 mark

53. Fill the blank in the following sentence.

Hey folks! _____, I have an announcement to make.

A. listen on
B. listen to
C. listen up
D. listen upon 1 mark

54. Choose the proper replacement of the underlined part to correct the following sentence.

The school attempted to create an authentic style of Indian paper-art based on the study of the art of ancient India, Indian medieval miniature traditions, as well as Chinese and Japanese art.

A. the art of ancient India and Indian medieval miniature traditions, as well as Chinese and Japanese art
B. the art of ancient India, Indian medieval miniature traditions, and Chinese and Japanese art as well
C. the art of ancient India and Indian medieval miniature traditions, and Chinese as well as Japanese art
D. the art of ancient India, Indian medieval miniature traditions, Chinese and Japanese art 2 marks

55. Choose the proper replacement of the underlined part to correct the following sentence.

Unlike traditional bullet-proof jackets which can prevent serious injury, but which cannot prevent the wearer being knocked over by the impact, new jacket designs are being developed in India where bullets bounce off.

A. new jacket designs, where bullets bounce off, are being developed in India
B. India is developing new jackets, designed to make bullets bounce off
C. new jackets, designed to make bullets bounce off, are being developed in India
D. new jackets, where bullets bounce off, are being developed in India

2 marks

56. Choose the proper replacement of the underlined part to correct the following sentence.

A school teacher accepted that, despite continuous efforts to improve classroom performance, an extraordinary high percentage of their students fail to gain admission to higher education programmes in good institutions.

A. an extraordinary high percentage of its students fails to gain admission to higher education programmes
B. the percentage of their students failing to gain admission to higher education programmes is extraordinary high
C. a high percentage of its students, extraordinarily high in fact, fails to gain admission to higher education programmes
D. an extraordinarily high percentage of its students fail to gain admission to higher education programmes

2 marks

57. Select the most logical order of sentences from among the given choices to construct a coherent paragraph.

P: Just a handful of nutrient-rich almonds a day helps promote heart health and prevent weight gain.

Q: Loaded with minerals, they are also among the healthiest of tree nuts.

R: It may even help fight diseases like diabetes and Alzheimer's.

S: Natural, unsalted almonds are a tasty and nutritious snack with plenty of health benefits.

The proper sequence should be

A. PQSR
B. PSQR
C. SQPR
D. SPQR.

2 marks

58. Select the most logical order of sentences from among the given choices to construct a coherent paragraph.

P: Men and women use different areas of the brain for solving tasks.
Q: For example, women use their larger, more organized cerebral cortex to perform tasks, while men rely on the larger proportion of grey matter in the left hemisphere of their brains.
R: Men have a larger brain size by about 10%, but women have substantially more nerve endings and connections (white matter) than men.
S: As a consequence, women are generally better at identifying and controlling their emotions, while men are more task-focused.

The proper sequence should be PRSQ

A. RPQS
B. PRSQ
C. PQRS
D. RSPQ

2 marks

59. Read the following paragraph:

Smelling floral scents puts us in a good mood and makes us feel less anxious. Flowers clearly aren't going to eliminate the need for medication, but they may take the edge off during exams or before a major presentation. Less saturated and brighter colours are generally more relaxing, while bold saturated colours will energize you. A bunch with colours that fall near each other on the colour wheel will also be more calming; with the opposite effect ensuing if the colours are opposite each other. Curvy shapes have generally been shown to be relaxing. Flowers in your home have positive psychological payback. Think of them as part of your mental health treatment program.

Choose the sentence which summarizes above paragraph best:

A. Flowers have attractive colours and sweet smells.
B. Colourful and fragrant flowers are good for mental well-being.
C. Putting flowers at home is good for mental well-being.
D. Seeing and smelling flowers reduces anxiety.

2 marks

60. Read the following paragraph:

The gems and jewellery sector contributes around 6-7 per cent of India's GDP. Based on its potential for growth and value addition, the Government of India has declared the Gems and Jewellery sector as a focus area for export promotion. Low costs and availability of high-skilled labour gives India a competitive edge. India is the world's largest cutting and polishing centre for diamonds, with the cutting and polishing industry being well supported by government policies. Moreover, India exports 95 per cent of the world's diamonds, as per statistics from the Gems and Jewellery Export promotion Council.

Choose the sentence which summarizes above paragraph best:

A. Gems and jewellery sector is an extremely export oriented sector.
B. Indian Government is promoting gems and jewellery sector as an export oriented sector.
C. Gems and jewellery sector has potential growth possibilities.
D. India is a major global player in the gems and jewellery sector, which plays an important role in Indian economy. 2 marks

Read the passage below and answer Question 61:

The basic concepts of Indian classical music include shruti, swara, alankar, raga, and tala. There are two main traditions of Indian classical music – Carnatic music and Hindustani music. In Hindustani music traditions, singing was based on tones and it was popular from the Vedic times where the hymns of Samaveda were sung and not chanted. A strong and diverse tradition has developed over several centuries. Hindustani music was not only influenced by ancient Hindu musical traditions, historical Vedic philosophy and native Indian sounds but also enriched by the Persian performance practices of the Mughals. Classical genres are dhrupad, dhamar, khyal, tarana and sadra, and there are also several semi-classical forms. The Carnatic music originated in South India during the rule of Vijayanagar Empire. Like Hindustani music, it is melodic, with improvised variations, but tends to have more fixed compositions. It consists of a composition with improvised embellishments added to the piece in the forms of Raga Alapana, Kalpanaswaram, Neraval and, in the case of more advanced students, Raga, Tala, Pallavi. The main emphasis is on the vocals as most compositions are written to be sung, and even when played on instruments, they are meant to be performed in a singing style (known as gāyaki). There are about 7.2 million ragas (or scales) in Carnatic Music, with around 300 still in use today.

I. Carantic tradition of Indian classical music is

i. influenced by Persian practices
ii. a collection of several semi-classical forms of singing style
iii. both i and ii
iv. neither of i and ii.

II. Hindustani tradition of Indian classical music

i. originated during the rule of Vijayanagar Empire
ii. was influenced by Vedic philosophy
iii. both i and ii
iv. neither of i and ii.

III. Raga and tala are aspects of

i. Carantic tradition of Indian classical music
ii. Hindustani tradition of Indian classical music
iii. both i and ii
iv. neither of i and ii.

61. The correct answers to I, II and III are:

A. iii, iii and iii, respectively
B. iv, ii and iii, respectively
C. i, ii and iii, respectively
D. iv, i and iii, respectively. 3 marks

Read the passage below and answer Question 62:

Despite the truism that every human on this planet needs drinking water to survive and that water may contain many harmful constituents, there are no universally recognized and accepted international standards for drinking water. Even where standards do exist, and are applied, the permitted concentration of individual constituents may vary by as much as ten times from one set of standards to another. Many developed countries specify standards to be applied in their own country. In Europe, this includes the European Drinking Water Directive and in the United States the United States Environmental Protection Agency (EPA) establishes standards as required by the Safe Drinking Water Act. For countries without a legislative or administrative framework for such standards, the World Health Organisation publishes guidelines on the standards that should be achieved. China adopted its own drinking water standard GB3838-2002 (Type II) enacted by Ministry of Environmental Protection in 2002.
Where drinking water quality standards do exist, most are expressed as guidelines or targets rather than requirements, and very few water standards have any legal basis or, are subject to enforcement. Two exceptions are the European Drinking Water Directive and the Safe Drinking Water Act in the USA, which require legal compliance with specific standards. In Europe, this includes a requirement for member states to enact appropriate

local legislation to mandate the directive in each country. Routine inspection and, where required, enforcement is enacted by means of penalties imposed by the European Commission on non-compliant nations.
Countries with guideline values as their standards include Canada, which has guideline values for a relatively small suite of parameters, New Zealand, where there is a legislative basis, but water providers have to make "best endeavours" to comply with the standards, and Australia.

I. As far as drinking water quality standards are concerned,

i. Canada has clear laws to enforce.
ii. European commission may impose penalty on non-compliant nations.
iii. both i and ii.
iv. neither of i and ii.

II. As far as drinking water quality standards are concerned,

i. Europe and USA have common standards.
ii. China's standards are more rigorous than that of Europe.
iii. both i and ii.
iv. neither of i and ii.

III. As far as drinking water quality standards are concerned,

i. New Zealand expressed as guidelines or targets rather than requirements without any legal basis.
ii. there are some common minimum standards.
iii. both i and ii
iv. neither of i and ii.

62. The correct answers to I, II and III are:

A. ii, iv and iv, respectively
B. iv, i and ii, respectively
C. i, ii and iii, respectively
D. iii, iii and ii, respectively. 3 marks

Logical Reasoning

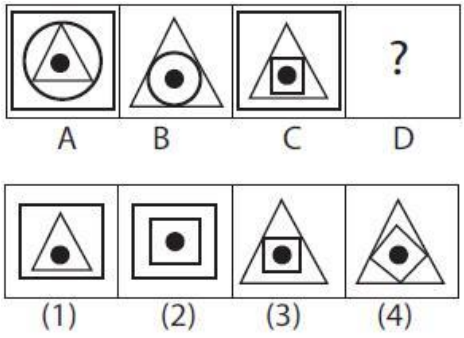
63. Given below are two statements.

Statement I: Some mangoes are ripe.
Statement II: All bananas are ripe.

Which of the following conclusions is correct?

A. A fruit that is not ripe is not a banana.
B. All ripe fruits are bananas.
C. A fruit that is not ripe is not a mango.
D. All ripe fruits are mangoes. 1 mark

64. There is some relationship between diagrams A and B. The same relationship persists between diagrams C and D. Find the right diagram for D from the given alternatives.



A. (1)
B. (2)
C. (3)
D. (4). 1 mark

65. Choose the pair that best matches the pair, Rain: Drizzle.

A. Swim: Dive
B. Weep: Cry
C. Smile: Laugh
D. Run: Walk. 1 mark

66. In a particular year, the first day of the year is Monday and the last day of the year is Tuesday. How many days are there from 16th January to 15th March of that year?

A. 58
B. 60
C. 59
D. 61. 1 mark

67. Amit said: "This lady is the wife of the grandson of my mother". Which of the following options possibly describes how Amit is related to the lady? (Assume no marriage between close relatives.)

    A. Brother
    B. Grandfather
    C. Husband
    D. Father-in-law. 1 mark

68. In a pizza parlour with 100 customers, 80 ordered mushrooms on their pizza, 72 ordered pepperoni and 60 ordered both mushrooms and pepperoni. How many customers ordered neither of these two toppings?

    A. 7
    B. 8
    C. 9
    D. 17. 1 mark

69. A, B, C, D and E are sitting on a bench. A is sitting next to B, C is sitting next to D, D is not sitting with E who is on the left end of the bench. C is on the second position from the right. A is to the right of B and E. A and C are sitting together. In which position is A sitting?

    A. Between B and D.
    B. Between B and C.
    C. Between E and D.
    D. Between C and E. 2 marks

70. A watch, which loses time uniformly, was observed to be 5 minutes fast at 8.00 p.m. on Thursday. It was noticed to be 7 minutes slow at 8.00 a.m. on the subsequent Monday. When did the watch show the correct time?

    A. 7 a.m. on Saturday
    B. 7 a.m. on Friday
    C. 10 a.m. on Sunday
    D. 11 a.m. on Friday. 2 marks

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