**Q.1 – Q.15: VERBAL ABILITY**

***Instructions for Questions 1 and 2:*** **In each of the questions a word has been used in sentences in four different ways. Choose the option corresponding to the sentence in which the usage of the word is incorrect or inappropriate.**

**Q.1. Match**

A) "This marriage is a match made in heaven" she gushed.
B) "Please light the match so that I can see the switch" said my friend.
C) It was an even match between the two contestants.
D) This movie sequel is not a match on the original.

**Q.2. Accede**

A) She was confident that her manager would accede to her earnest request.
B) It would have been difficult for the teacher to accede to their latest proposal.
C) The ballerina could not accede to the demands of her hectic tour schedule.
D) The princess could not accede to the throne vacated by her late father.

**Q.3. Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (A, B, C, D) choose the most appropriate sequence.**

(i) It would secure a 25% increase in overall revenue; and devoted but cash-strapped supporters would have more opportunities to watch their team.
(ii) The Football Supporters Federation maintains that, under government regulations about spectator density, safe-standing sections would allow 1.8 people to occupy the same space as one seated match-goer.
(iii) The willingness of the Premier League to consider reintroducing terraces has less to do with reminiscing, however, than with pragmatism.
(iv) If the Football Supporters Federation's is correct, then both clubs and fans would stand to gain since the teams could offer a reduction on the price of standing tickets.

A) (ii), (iii), (iv), (i)
B) (iv), (ii), (i), (iii)
C) (iii), (ii), (iv), (i)
D) (iv), (ii), (iii), (i)

**Q.4. Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (A, B, C, D) choose the most appropriate sequence.**

(i) In an integrated market one country might specialise in a high-wage industry with increasing returns to scale and others in areas in which wages are lower.
(ii) New models of trade do not imply that close economic integration should cause incomes to converge.
(iii) As freer trade expands the size of the market, producers with initial size advantages outcompete rivals.
(iv) Firms and places are often subject to economies of scale: they become more productive as they grow larger.

A) (ii), (iv), (iii), (i)
B) (iv), (ii), (i), (iii)
C) (ii), (iv), (i), (iii)
D) (iv), (ii), (iii), (i)

**Q.5. Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (A, B, C, D) choose the most appropriate sequence.**

(i) Taken together, these elements enable developers to discover and build on what works, to jettison what does not work, and, when necessary, to "fail fast"—before they have expended significant resources or large amounts of time on a project.
(ii) Over the past few decades, the business world has seen the emergence of several process and product improvement platforms.
(iii) Both of those platforms emphasize experimentation and rapid iteration, strong feedback loops that facilitate early and continuous engagement with end users, and the use of minimally designed prototypes to test products or processes.
(iv) Examples include human-centred design, a product innovation method developed by the design firm IDEO, and lean experimentation, an entrepreneurship method that originated in Silicon Valley.

A) (i), (ii), (iii), (iv)
B) (ii), (iv), (iii), (i)
C) (i), (iv), (ii), (iii)
D) (ii), (i), (iii), (iv)

***Instructions for Questions 6 to 9:*** **Read the passage and answer the questions that follow.**

There are two main kinds of development agency: the one which tries to introduce specific changes and is mainly interested in material development; and the other which is primarily interested in people. On the whole the first wants to "get things done"; the other to develop the people's own abilities for leadership, wise judgement and co-operative action. For agencies of the second kind, the material result is less important than the way it is achieved.

Agencies and workers, who themselves decide the specific form development should take, assume, of course, that they know better than the people what the people need. Most social development workers and technical officers have worked on this assumption in the past, and although they were often right they were not always right, for they sometimes made the mistake of assuming that what was good within their own culture was certain to be good in other cultures too. Missionaries, for instance, insisted on their converts wearing clothes because they were used to them themselves, and they established schools with syllabuses that suited the missionaries' own countries, rather than the countries where the schools were built.

Agencies and their workers tend to be more careful nowadays, but experts and specialists trained in Western ways still often make mistakes in cultures other than their own. Agencies everywhere are now realizing that they are risking failure if they assume that their own ideas are right in environments and cultures other than their own. The East African Groundnut Scheme failed because it did not take the local conditions of soil and climate sufficiently into account. The West African Anchau Rural Development Scheme illustrates, less spectacularly, the result of failing to consider the human factor when working in a different culture.

This Scheme was started in 1937 to eradicate sleeping sickness from a part of the Zaria province of the Northern Region of Nigeria. The people in charge made a detailed survey of the area, made detailed studies of the farming conditions in sample hamlets and made a careful census of the people. Indeed, they scientifically examined in minute detail every aspect of the situation that seemed to them important. But it failed because people were thought of as being there "to be done good to" in the mass, but they were not envisaged as persons, each with one's own small world of hopes and fears, who might in some way be consulted.

**Q.6.** In the passage "development agency" refers to

A) the agenda for development
B) the freedom of people to participate
C) social workers engaged in development activities
D) aid organizations engaged in development work

**Q.7.** According to the author, development agencies who want to "get things done" are

A) interested in economic outcomes and progress for the area
B) concerned with initiating specific changes to improve natural conditions in an area
C) focused on quantifiable benefits to local communities
D) reliant on external experts and consultants for solutions to community issues

**Q.8.** The West African Anchau Rural Development Scheme failed because

A) local conditions were different from those in Western cultures
B) the men heading the project went into too much of detail and forgot the big picture
C) the project coordinators did not consult or involve local people in the change initiative
D) the development experts thought they knew better than the locals, what was required

**Q.9.** In this passage the main point that the author wants to make is that

A) there are two approaches to bringing about change in a community
B) western experts are successful in their own cultures but make mistakes in other cultures
C) one cannot have a universal approach to development, it has to be nuanced
D) involvement and participation of local communities is essential for implementing change

***Instructions for Questions 10 to 15:*** **Read the passage and answer the questions that follow.**

Humans are pretty inventive creatures. That might be cause for optimism about the future of global change. We've found solutions to lots of problems in the past. And with a much larger and better-educated population than the world has ever seen — the supply of good ideas can only increase. So innovation will figure out a way to sustainable futures.

But what is innovation? The media and companies routinely equate innovation with shiny new gadgets. In the same spirit, politicians charged with managing economies frequently talk as if all innovation is good. The history of almost any technology, however — from farming to applied nuclear physics — reveals a mixture of good and bad.

The study of the concept of innovation, and of whether it can be steered, is a relatively recent academic effort. There are three ways that scholars have thought about innovation. The first was basically linear: science begets invention that begets innovation. Physics, for instance, gives us lasers, which give us — eventually — compact discs. Result: Growth! Prosperity! Rising living standards for all! From this perspective, it's assumed that science is the basis for long-term growth, and that innovation largely involves commercialisation of scientific discoveries. There is a role for the state, but only in funding the research. The rest can be left to the private sector.

By the 1970s, economists interested in technology and some policy-makers were talking about something more complicated: national systems of innovation competing with each other. Such "systems" included measures to promote transfer of technology out of the lab, especially by building links between centres of discovery and technologists and entrepreneurs.

The key failing of these two approaches is that they treat less desirable outcomes of innovation as externalities and are blind to the possibility that they may call for radically different technological priorities. The environmental effects of energy and materials-intensive industries may turn out to be more destructive than we can handle.

Radical system change is a third way to think about innovation. Technological trajectories aren't pre-ordained: Some paths are chosen at the expense of others. And that's harder because it needs more than incremental change. The near future is about transformation. The more complex historical and social understanding of innovation now emerging leads to a richer concept of infrastructure, as part of a system with social and technical elements interwoven.

An emphasis on the new, the experimental, the innovative — and on promoting social and technical solutions to global problems must overcome the sheer inertia of the systems we have already built — and are often still extending. Aiming for transformation leads to another take on creative destruction; it isn't enough to promote innovation as creation, the existing system has to be destabilised as well. System shifts of the radical kind envisaged will call for creation of a new infrastructure. But that won't do the job unless the old systems are deliberately removed on roughly the same time-scale. Achieving that will call for a lot more thought about how to if not destroy the old systems, at least set about dismantling them.

**Q.10.** From the passage we can conclude that the author believes

A) science is the only basis for long term growth
B) innovations should focus only on transformation
C) creative destruction is one way of describing innovation
D) science begets invention that begets innovation

**Q.11.** According to the author, the first two approaches related to the study of innovation are inadequate because

A) they treat the negative fallouts as unintended outcomes to be managed separately
B) innovation is neither linear nor confined to national systems of innovation
C) the priorities of innovation in the first two approaches are inappropriate
D) all of the above

**Q.12.** The key difference between the first and second approaches related to the study of innovation is

A) in placing science as the basis for inventions and innovation
B) in how they treat the less desirable outcomes of innovations
C) in assuming that all innovation is good
D) in placing a greater emphasis on the role of government and policy in innovation

**Q.13.** Which of the following statements best describe the author's view on innovation?

A) Innovation will figure out a way to sustainable futures
B) Given the destructive potential of incremental innovation we need radical change
C) Innovation largely involves commercialisation of scientific discoveries
D) For innovation to work, the existing system has to be destabilised

**Q.14.** By the expression, "The media and companies routinely equate innovation with shiny new gadgets", the author is

A) making an assertion about media and companies
B) questioning the wisdom of media and companies
C) trying to explain why politicians frequently talk as if all innovation is good
D) denigrating the commercial approach of media and companies

**Q.15.** According to the author, radical systems change is primarily about

A) reducing the negative environmental effects of energy and materials-intensive industries
B) a more complex historical and social understanding of innovation
C) transformation concomitant with the creation of a new infrastructure
D) experimenting to promote social and technical solutions to global problems

## Q.16 – Q.20: LOGICAL REASONING

***Instructions for Questions 16 to 20:*** **Answer the questions based on the following information.**

Examinations were held during the two weeks of January — Sunday the 3rd to Saturday the 16th. There was one examination each for the six subjects namely, Sociology, Psychology, Economics, Political Science, Anthropology and Biology. There was no more than one examination on any day. No examinations were held on Saturdays, Sundays and on January 5th, which was a national holiday. Exactly three examinations were held in each week. The Psychology examination was held before the Economics examination, and the Political Science examination was held the day after the Biology examination. The Economics and the Political Science examinations were held on the same day of the week. Similarly, the Sociology and the Psychology examinations were held on the same day of the week. There were no examinations for three days between the

Sociology examination and the examination prior to it. The Biology and the Anthropology examinations were held on a Tuesday and a Thursday respectively.

**Q.16.** On which of the following set of dates were there no examinations?

A) 11th, 14th and 15th January
B) 8th, 14th and 15th January
C) 7th, 14th and 15th January
D) 7th, 8th and 15th January

**Q.17.** On which of the following dates was the Biology examination held?

A) 5th January
B) 6th January
C) 12th January
D) 13th January

**Q.18.** Which examination was held on 4th January?

A) Sociology
B) Psychology
C) Political Science
D) Biology

**Q.19.** The number of days (including weekends and holidays, if any) between the Psychology and the Anthropology examination is

A) One
B) Two
C) Three
D) Four

**Q.20.** Which examinations were held in the first week?

A) Economics, Psychology and Anthropology
B) Economics, Political Science and Psychology
C) Economics, Political Science and Sociology
D) Economics, Political Science and Anthropology

## Q. 21 – Q. 25: DATA INTERPRETATION AND DATA VISUALIZATION

***Instructions for Questions 21 to 25:*** **Answer the questions based on the following information.**

The following table gives the urban population of a country and the percentages of total population in rural and urban areas as recorded in the 10-yearly censuses during 1901-81.

**Table 1**. Urban and rural population: 1901-1981

| Year | Urban Population (in million) | Percentage of Total Population | |
|---|---|---|---|
| | | Rural | Urban |
| 1901 | 25 | 90 | 10 |
| 1911 | 26 | 90 | 10 |
| 1921 | 28 | 89 | 11 |
| 1931 | 33 | 88 | 12 |
| 1941 | 44 | 86 | 14 |
| 1951 | 62 | 82 | 18 |
| 1961 | 79 | 82 | 18 |
| 1971 | 100 | 80 | 20 |
| 1981 | 150 | 75 | 25 |

**Q.21.** The percentage increase in total population of the country between 1901 and 1981 is

A) 500% B) 150% C) 140% D) cannot be determined

**Q.22.** The percentage increase in density of population in the urban areas between 1951 and 1981 is

A) about 60% B) about 250%
C) above 500% D) cannot be determined

**Q.23.** The largest rate of increase in urban population in a decade during 1901-1981 occurred in

A) 1971-81 B) 1961-71 C) 1951-61 D) 1941-51

**Q.24.** The rate of urban population growth per year over the period 1901-81 is about

A) 0.65 million B) 1.56 million
C) 2.65 million D) 15.62 million

**Q.25.** The smallest rate of increase in urban population in a decade during 1921-1961 occurred in

A) 1951-61 B) 1941-51 C) 1931-41 D) 1921-31

## Q.26 – Q.50: QUANTITATIVE APTITUDE

**In the following, $\mathbb{R}$ will denote the set of real numbers.**

**Q.26.** If $a \in \mathbb{R}$, then the equations $x^2 + x + a = 0$ and $x^2 + ax + 1 = 0$ have a common real root for

A) no value of $a$
B) exactly one value of $a$ in the interval $[0, 2]$
C) exactly one value of $a$ in the interval $[-3, -1]$
D) exactly two values of $a$

**Q.27.** A man standing $x$ metres north of a tower finds the angle of elevation of its top to be 30°. He then starts walking towards the tower. After walking a distance of $x/2$ metres, he turns east and walks another $x/2$ metres. Then he turns south and walks another $x/2$ metres. The angle of elevation of the top of the tower from his new position is

A) 15° B) 60° C) $\tan^{-1}\sqrt{\frac{2}{3}}$ D) $\tan^{-1}\frac{2}{\sqrt{3}}$

**Q.28.** Let the equations of two circles $C_1$ and $C_2$ be given by

$x^2 + y^2 - 4x - 4y + 6 = 0$ and $x^2 + y^2 - 10x - 10y + k = 0$

respectively, where $k$ is a constant. Suppose that $C_1$ and $C_2$ have exactly two common tangents. Then possible values of $k$ are

A) $0 < k < 18$
B) $18 < k < 42$
C) $42 < k < 50$
D) none of the above

**Q.29.** Consider the function

$$f(x) = \begin{cases} 2x - 1 & \text{if } x < -1 \\ x^2 + 1 & \text{if } -1 \le x \le 1 \\ x + 1 & \text{if } x > 1. \end{cases}$$

Then

A) $f$ is continuous everywhere
B) $f$ is continuous everywhere except $x = -1$ and $x = 1$
C) $f$ is continuous everywhere except $x = -1$
D) $f$ is continuous everywhere except $x = 1$

**Q.30.** The sum of the first 50 terms of the series: $3 + 7 + 13 + 21 + 31 + 43 + \cdots$ is

A) $50 \times 870$ B) $50 \times 875$ C) $50 \times 880$ D) $50 \times 885$

**Q.31.** If

$$A_n = \frac{1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 + \cdots \text{upto } n \text{ terms}}{n(1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \cdots \text{upto } n \text{ terms})}$$

then $\lim_{n\to\infty} A_n$ is

A) $\frac{3}{4}$ B) $\frac{1}{4}$ C) $\frac{1}{2}$ D) $\frac{5}{4}$

**Q.32.** The function $f: \mathbb{R} \to \mathbb{R}$, defined by $f(x) = x^3 - 3x^2 + 6x - 5$, is

A) one-to-one, but not onto B) one-to-one and onto
C) onto, but not one-to-one D) neither one-to-one nor onto

**Q.33.** The number of distinct words that can be formed using all the letters except vowels of the word 'PROBABILITY' is

A) 2520 B) 5040 C) $\frac{9!}{2!}$ D) $\frac{11!}{4}$

**Q.34.** The area enclosed between the curves $y = 2x^2$ and $y = 6$ is

A) $2\sqrt{3}$ B) $4\sqrt{3}$ C) $6\sqrt{3}$ D) $8\sqrt{3}$

**Q.35.** The value of

$$\lim_{x\to 0} \frac{\sin(x^2)}{x \sin x}$$

is

A) 0 B) 1 C) 2 D) $\infty$

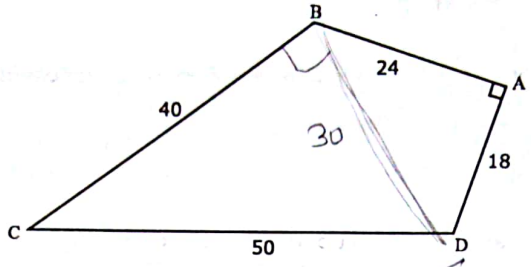
**Q.36.** The value of

$$\frac{{}^{30}C_1}{2} + \frac{{}^{30}C_3}{4} + \frac{{}^{30}C_5}{6} + \cdots + \frac{{}^{30}C_{29}}{30}$$

is

A) $\frac{2^{31}}{30}$ B) $\frac{2^{30}}{31}$ C) $\frac{2^{31}-1}{31}$ D) $\frac{2^{30}-1}{31}$

**Q.37.** In the quadrilateral $ABCD$ below, $\angle DAB = 90°$ and $AB = 24$ cm, $BC = 40$ cm, $CD = 50$ cm and $AD = 18$ cm (The diagram is not drawn to scale). Find the area of the quadrilateral.




A) 1089 cm² B) 914 cm² C) 816 cm² D) 726 cm²

**Q.38.** Let $x = \pi/40$. Then the value of

$$\cot x \cot 2x \cot 3x \cdots \cot 19x$$

is

A) 1 B) −1 C) 0 D) ∞

**Q.39.** Consider the function: $f(x) = |2 - |x - 1||$ for all $x \in \mathbb{R}$. Then the value of $f'(-2) + f'(0) + f'(2) + f'(4)$ is

A) −2 B) 0 C) 1 D) 2

**Q.40.** Let

$$P = \begin{bmatrix} a & b & 0 \\ -1 & 2 & 1 \\ 2 & -3 & -2 \end{bmatrix}$$

with $\det(P) = -2$. Then the minor $M_{22}$ of $P$ is

A) −4 B) −2 C) 2 D) 4

**Q.41.** If $\alpha$ and $\beta$ are two roots of the equation

$$x^2 + x + 1 = 0,$$

then the value of $\alpha^{2017} + \beta^{2017}$ is

A) 0 B) 1 C) −1 D) 2

**Q.42.** The number of different solutions $(x, y, z)$ of the equation $x + y + z = 10$, where $x, y$ and $z$ are positive integers, is

A) 36 B) 121 C) 990 D) 75

**Q.43.** In the $xy$-plane, the equation $x^2 - y^2 = 2y + 1$ represents a

A) parabola
B) hyperbola
C) point
D) pair of straight lines

**Q.44.** There are 100 students in a class. In an examination, 50 of them failed in Mathematics, 45 failed in Physics and 40 failed in Biology. 32 failed in exactly two of the three subjects. Only one student passed in all the subjects. The number of students failing in all the three subjects is

A) 12 B) 4 C) 2 D) cannot be determined

**Q.45.** The point $R(4, 10)$ lies on the curve $C : y = x^2 - 6x + 18$. The tangent and normal to $C$ at $R$ meets the $Y$-axis at points $P$ and $Q$ respectively. A circle passes through the points $P, Q$ and $R$. The radius of this circle is

A) 3 B) 4 C) 5 D) 6

**Q.46.** An equilateral triangle, having each side as $a$, has its corners cut away so as to form a regular hexagon. The area of the hexagon is

A) $\frac{\sqrt{3}a^2}{6}$ B) $\frac{2\sqrt{3}a^2}{3}$ C) $\frac{\sqrt{3}a^2}{12}$ D) $\frac{\sqrt{3}a^2}{4}$

**Q.47.** Let $f(x) = a_0 + a_1|x| + a_2|x|^2 + a_3|x|^3$, where $a_0, a_1, a_2$ and $a_3$ are constants. Which of the following statements is correct?

A) $f(x)$ is differentiable at $x = 0$ for any choice of $a_0, a_1, a_2$ and $a_3$
B) $f(x)$ is not differentiable at $x = 0$ for any choice of $a_0, a_1, a_2$ and $a_3$
C) If $f(x)$ is differentiable at $x = 0$, then $a_1 = 0$
D) If $f(x)$ is differentiable at $x = 0$, then $a_1 = 0$ and $a_3 = 0$

**Q.48.** If

$$P = \begin{bmatrix} a & b & c \\ x & y & z \\ p & q & r \end{bmatrix} \text{ and } Q = \begin{bmatrix} -x & a & -p \\ y & -b & q \\ z & -c & r \end{bmatrix}$$

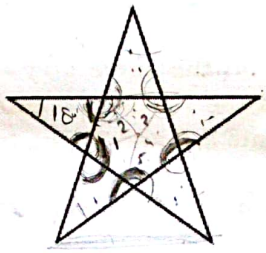
then

A) $\det(P) = \det(Q)$
B) $\det(P) = 2\det(Q)$
C) $2\det(P) = \det(Q)$
D) $\det(P) = -\det(Q)$

**Q.49.** Let $S = \{1, 2, \ldots, 100\}$. The number of nonempty subsets T of S such that the product of numbers in T is even is

A) $2^{50}(2^{50} - 1)$ B) $2^{100} - 1$ C) $2^{50} - 1$ D) $2^{51} - 1$

**Q.50.** What is the sum of the interior angles at the vertices of a 5-pointed star as shown below? The star need not have sides of the same length.



A) 120°
B) 180°
C) 540°
D) depends on the sides of the star.

**END OF THE QUESTION PAPER**