1. If $x + \dfrac{1}{x} + 1 = 0$, then the value of $x^5 + \dfrac{1}{x^5} + 1$ is

   (A) 0   (B) -1 (C) 5   (D) -5

2. A factor of $100^4 + 4$ is

   (A) 9798   (B) 9802   (C) 9898   (D) 9902

3. If three successive coefficients in the expansion of $(1 + x)^n$ are in the ratio $1 : 2 : 3$, then n is equal to

   (A) 12   (B) 13   (C) 14   (D) 15

4. At the height of summer, it has been observed that, if the daily maximum and minimum temperatures are respectively around 35°C and 30°C, the average daily humidity is 70% and there is no rainfall, the level of water in a particular well decreases by 3% by the end of the day. If these weather conditions persist for 3 successive days, by what percentage will the level of water in the well have decreased at the end of the 3rd day?

   (A) 9%   (B) 9.13%   (C) 8.73%   (D) 8.91%

5. If a and b are real roots of the equation $x^2 + px + q = 0$, then the minimum value of the expression $x^2 + px + q$ is

   (A) $\dfrac{(a+b)^2}{2}$ (B) $\dfrac{(a+b)^2}{4}$ (C) $\dfrac{(a-b)^2}{2}$ (D) $\dfrac{(a-b)^2}{4}$

6. A person standing on the top of a building throws a ball upwards. If the height of the ball from the ground (in metre) t seconds after the ball is thrown is given by the function

$$h(t) = -t^2 + 3t + 10,$$

what is the height of the building?

(A) 10 metres
(B) 5 metres
(C) 12.25 metres
(D) Cannot be determined from the available information.

7. In a survey of 80 people, it was found that 35 people drink coffee, 20 drink black tea, 15 drink green tea, while 4 consume all three beverages. The number of people who do not consume any of the beverages is

(A) exactly 6.   (B) at least 6.   (C) at most 45.   (D) exactly 45.

8. For a palindromic number (one which reads the same from both left and right) having 12 digits, consider the following statements:

(I)   There are 9×10^5 such numbers.
(II)   No such number is prime.

(A) Both (I) and (II) are true.
(B) (I) is true but not (II).
(C) (II) is true but not (I).
(D) Neither (I) nor (II) is true.

9. If the letters of the word BOTANY are permuted and all such permutations are arranged in alphabetical order (as in a dictionary), what will be the position of the word BOTANY in the arrangement?

(A) 187   (B) 181   (C) 157   (D) 121

10. Consider the graph of a function f as follows:
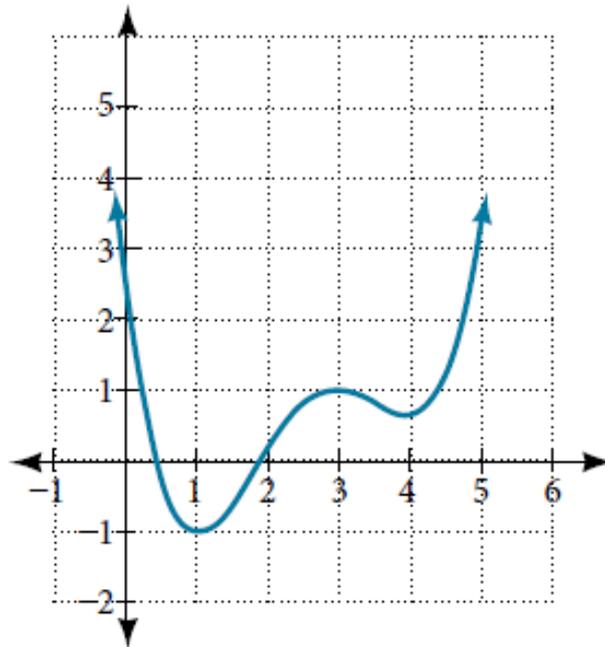
Which of the following statements is true?

(A) f is one-one and onto on the whole real line.
(B) f is one-one but not onto on the whole real line.
(C) f is onto but not one-one on the whole real line.
(D) f is neither one-one nor onto on the whole real line.

11. Consider a function defined as:

$$f(x) = [2 \cos x], \qquad 0 \le x < \pi,$$

where $[t]$ denotes the largest integer $\le t$.

The number of points at which $f(x)$ is NOT continuous is

(A) 0.   (B) 2.   (C) 3.   (D) 4.

12. Define
$$S_n = \{0! + 1.1! + 2.2! + 3.3! + \ldots + n.n!\}$$

and
$$T_n = (n+1)!$$

for $n \geq 1$. Which between S_n and T_n is larger?

      (A) S_n for all n
      (B) T_n for all n
      (C) They are equal for all n.
      (D) Depends on n.

13. Suppose 10 randomly chosen individuals undergo the RT-PCR test for COVID-19. If the probability of obtaining exactly one among these 10 individuals as COVID-19 positive is equal to the probability of obtaining exactly two of these individuals as COVID-19 positive, what is the probability that a randomly chosen individual from the population is COVID-19 positive?

    (A) $\dfrac{1}{3}$ (B) $\dfrac{2}{3}$ (C) $\dfrac{2}{11}$ (D) $\dfrac{9}{11}$

14. Consider three unequal numbers x_1, x_2 and x_3 such that the mean of x_1 and x_2 is x_3. If M is the mean of the three numbers and m is their median, then

      (A) M is greater than m.
      (B) M is less than m.
      (C) M is equal to m.
      (D) None of the above statements is necessarily true.

15. The proportion of smokers is 0.3 in City A, 0.2 in City B and 0.1 in City C. The overall proportion of smokers in the three cities

  (A) is necessarily 0.2.
  (B) is necessarily 0.006.
  (C) is necessarily greater than 0.1 but less than 0.3.
  (D) cannot be equal to 0.1 or 0.2 or 0.3.

16. The following chart represents the minimum daily temperatures (in degrees Celsius) during the month of April 2022 in two cities, A and B.
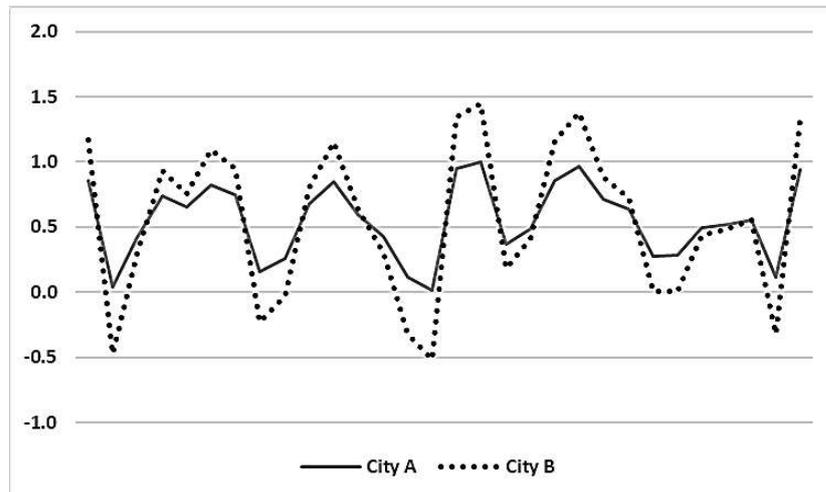
Based on the figure, which of the following conclusions is most likely to be true?

(A) The average minimum daily temperatures in the two cities are different.
(B) The average minimum daily temperatures in the two cities are equal but the variation is more in City A.
(C) The average minimum daily temperatures in the two cities are equal but the variation is more in City B.
(D) The average of the minimum daily temperatures as well as their variations are equal for both the cities.

17. Each student in a class tosses a coin 20 times where the probability of getting a head in any toss is p. Suppose X_i and Y_i are, respectively, the number of heads and the number of tails obtained by the ith student.

What is the correlation between the two sets of observations, $\{X_i\}$ and $\{Y_i\}$?

        (A) 1
        (B) −1
        (C) Highly positive but the exact value depends on p.
        (D) Highly negative but the exact value depends on p.

18. Which of the following causes rainfall?

        (A) Condensation and filtration but not evaporation
        (B) Filtration and evaporation but not condensation
        (C) Evaporation and condensation but not filtration
        (D) Evaporation, condensation and filtration

19. The relative proportion of sand, silt and clay in soil is called

        (A) Soil texture
        (B) Soil aggregation
        (C) Soil structure
        (D) Soil taxonomy

20. Which soil covers maximum area in India?

        (A) Black cotton soil
        (B) Alluvial soil
        (C) Arid and desert soil
        (D) Lateritic soil

21. Which of the following are the chemical weathering processes?

    (A) Carbonation and hydrolysis but not hydration
    (B) Hydrolysis and hydration but not carbonation
    (C) Hydration and carbonation but not hydrolysis
    (D) Carbonation, hydrolysis and hydration

22. Which of the following minerals is the richest source of potassium in soil?

    (A) Mica
    (B) Kaolinite
    (C) Smectite
    (D) Goethite

23. Which of the following is a biodegradable waste?

    (A) fly ash
    (B) used syringe
    (C) kitchen waste
    (D) glass

24. The use of microorganisms to remediate environmental pollutants is known as

    (A) phytoremediation
    (B) micro-remediation
    (C) nano-remediation
    (D) bioremediation

25. Calcium, magnesium and sulphur are known as

    (A) minor nutrients
    (B) micronutrients
    (C) secondary nutrients
    (D) primary nutrients

Questions 26-30 pertain to the following passage:

Spanish flu, also known as the Great Influenza epidemic or the 1918 influenza pandemic, was an exceptionally deadly global influenza pandemic caused by the H1N1 influenza A virus. The earliest documented case was March 1918 in Kansas, United States, with further cases recorded in France, Germany and the United Kingdom in April. Two years later, nearly a third of the global population, or an estimated 500 million people, had been infected in four successive waves. Estimates of deaths range from 17 million to 50 million, and possibly as high as 100 million, making it one of the deadliest pandemics in human history.

"Spanish flu" is a misnomer. The pandemic broke out near the end of World War I, when wartime censors suppressed bad news in the belligerent countries to maintain morale, but newspapers freely reported the outbreak in neutral Spain, creating a false impression of Spain as the epicentre. Limited historical epidemiological data make the pandemic's geographic origin indeterminate, with competing hypotheses on the initial spread.

Most influenza outbreaks disproportionately kill the young and old, with a higher survival rate in-between, but this pandemic had unusually high mortality for young adults. Scientists offer several explanations for the high mortality, including a six-year climate anomaly affecting migration of disease vectors with increased likelihood of spread through bodies of water. The virus was particularly deadly because it triggered a cytokine storm, ravaging the stronger immune system of young adults, although the viral infection was apparently no more aggressive than previous influenza strains. Malnourishment, overcrowded medical camps and hospitals, and poor hygiene, exacerbated by the war, promoted bacterial superinfection, killing most of the victims after a typically prolonged death bed.

26. Which word in the passage is closest in meaning to *aberration*?

(A) migration   (B) mortality   (C) anomaly   (D) superinfection

27. Which word in the passage is opposite in meaning to *friendly*?

   (A) deadly   (B) belligerent   (C) indeterminate   (D) competing

28. According to the passage, the unusually high mortality for young adults due to the Spanish flu was most probably NOT on account of

   (A)   the fact that the virus triggered a cytokine storm, ravaging their stronger immune system.
   (B)   a six-year climate anomaly affecting migration of disease vectors.
   (C)   overcrowded medical camps and hospitals.
   (D)   the fact that most of them had been injured as soldiers in World War I which was just ending when the Spanish flu pandemic started.

29. From the information provided in the passage, it appears that the pandemic started in

   (A) France   (B) The United Kingdom
   (C) Germany   (D) None of these countries

30. Fill in the blank in the sentence below with the most appropriate word from the passage out of the four words listed below:

   *With respect to the airport in City A, the phrase **International Airport** is something of _____, since all the arriving and departing flights are domestic.*

   (A) an epicentre   (B) an anomaly
   (C) a misnomer   (D) a likelihood