

Directions for Q. 1 and Q. 2: In a game called ‘the odd man out’, n persons toss coins to determine one person who will buy refreshments for the whole group. If there is a person in the group whose outcome (be it head or tail) is not the same as that of any other member of the group, then that person is an odd man out and must buy refreshments for each member of the group.

1. What is the probability that in a game there will be an odd man?

- (A) $(n - 1)/2^{n-1}$ (B) $1/2^n$
(C) $1/2^{n-1}$ (D) $n/2^{n-1}$

2. What is the probability r rounds of plays will be required to conclude the game (i.e., the r^{th} play will be the first in which there will be an odd man)?

- (A) $\frac{n}{2^{n-1}} \left(1 - \frac{n}{2^{n-1}}\right)^{r-1}$ (B) $\frac{n}{2^n} \left(1 - \frac{n}{2^n}\right)^{r-1}$
(C) $\frac{n-1}{2^{n-1}} \left(1 - \frac{n-1}{2^{n-1}}\right)^{r-1}$ (D) $\frac{1}{2^{n-1}} \left(1 - \frac{1}{2^{n-1}}\right)^{r-1}$

3. Find the correct solution to the equation:

$$x^2 - 4x - 12\sqrt{x^2 - 4x + 19} + 51 = 0$$

- (A) The equation has two real solutions, and the solution set is $\{1, 3\}$
(B) The equation has four real solutions, and the solution set is $\{1, 3, -5, 9\}$
(C) The equation has four real solutions, and the solution set is $\{1, 3, 5, 9\}$
(D) The equation has only two real solutions, and the solution set is $\{1, 9\}$

4. Find the correct solution for $\int \frac{dx}{(1-x)\sqrt{1-x^2}}$

- (A) $\sqrt{(1+x)(1-x)}$ (B) $\sqrt{\frac{(1-x)}{(1+x)}}$
(C) $\sqrt{\frac{(1+x)}{(1-x)}}$ (D) $\sqrt{\frac{(1+x^2)}{(1-x)}}$

Directions for Q. 5 and Q. 6: Let the probability that a family has n children be $p_n = \alpha p^n$, when $n \geq 1$, and let

$$p_0 = 1 - \alpha p(1 + p + p^2 + \dots).$$

Assume that the chance of a child to be a male or female is equal.

5. What is the probability that the family has exactly k boys?

- (A) $p^k/(2-p)^{k+1}$ (B) $2\alpha p^k/(2-p)^{k+1}$
(C) $2\alpha p/(2-p)^{k+1}$ (D) $\alpha p^{k+2}/(1-p)^{k-1}$

6. Given that a family has at least one boy, what is the probability that there are two or more boys?

- (A) $2\alpha p/(2-p)$ (B) $2\alpha p^{k-1}/(2-p)^{k+1}$
(C) $2p/(2-p)$ (D) $\alpha p/(1-p)$

7. If $y = 2x + \frac{4}{x}$, which of the following is true?

- (A) $\frac{d^2y}{dx^2} + x^3 \frac{dy}{dx} + y = 0$
(B) $\frac{d^2y}{dx^2} + \frac{dy}{dx} - y = 0$
(C) $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = 0$
(D) None of these are true

8. If $x^2 + y^2 = 11xy$, then $\log\left(\frac{x-y}{3}\right) = ?$

- (A) $\frac{1}{2} \log x$ (B) $\frac{1}{2} \log y$
(C) $\frac{1}{3}(\log x + \log y)$ (D) $\frac{1}{2}(\log x + \log y)$

9. Correlation coefficient is an indicator of
- (A) the strength of the relationship between two variables.
 - (B) the direction of the relationship between two variables.
 - (C) only (A) is the correct indicator.
 - (D) both (A) and (B) are correct indicators.
10. If the sum of any two roots of $x^3 + px^2 + qx + r = 0$ is zero, then pq is
- (A) $-r$
 - (B) r
 - (C) $2r$
 - (D) $-2r$
11. If one of the factor of $x^2 + x - 20$ is $(x + 5)$. Find the other factor
- (A) $x - 4$
 - (B) $x + 2$
 - (C) $x + 4$
 - (D) $x - 5$
12. If $a + b + c = 9$ and $a^2 + b^2 + c^2 = 35$, then find the value of $a^3 + b^3 + c^3 - 3abc$.
- (A) 180
 - (B) 108
 - (C) 81
 - (D) -108

Direction for Q. 13 and Q. 14: In each of the following number series, there is a missing number. Find out the missing number.

13. 24, 600, 15000, 375000, ?
- (A) 9300000
 - (B) 9350000
 - (C) 9375000
 - (D) 9000000
14. 100, 400, 1600, ?, 25600
- (A) 6500
 - (B) 6400
 - (C) 8000
 - (D) 6800

Direction for Q. 15 and Q. 16: Each question has some statements followed by conclusions/group of conclusions. Select the correct answer from the four given options.

15. Consider the following statements and the conclusions:

Statements: Some chairs are tables.
No table is an almirah.
No box is a chair.

Conclusions: I. All chairs can never be almirahs.
II. Some boxes are almirahs.

Choose the correct option (answer):

- (A) Only conclusion I follows.
- (B) Neither conclusion I nor conclusion II follows.
- (C) Only conclusion II follows.
- (D) Both conclusions I and II follow.

16. Consider the following statements and the conclusions:

Statements: Some chairs are handles.
All handles are boxes.
All boxes are tables.
Some tables are almirahs.

Conclusions: I. Some almirahs are handles.
II. Some tables are chairs.
III. No almirah is a handle.
IV. Some tables are handles.

Choose the most correct option (answer):

- (A) Only conclusions I, II and IV follow.
- (B) Only conclusions II, III and IV follow.
- (C) Conclusions III and IV follow, given I does not follow.
- (D) Conclusions I, II and IV follow, given III does not follow.

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17. The best general indicator of the climate of a place is its
- (A) Natural vegetation (B) Soil
(C) Bedrock (D) Atmospheric pressure
18. Solar cells are simple photovoltaic devices that convert solar energy directly into electricity. These are manufactured from the second most abundant element in the earth's crust. Name that element.
- (A) Bauxite (B) Silicon
(C) Calcium (D) Iron
19. The increase in concentration of which of the following gases is NOT responsible for Global Warming?
- (A) Sulphur dioxide (B) Nitrogen
(C) Carbon dioxide (D) Methane
20. The layer of the atmosphere in which weather change occurs is
- (A) Troposphere (B) Stratosphere
(C) Mesosphere (D) Ionosphere
21. Which of the following is the most commonly used nitrogenous fertilizer in India?
- (A) Ammonium sulphate
(B) Urea
(C) Ammonium chloride
(D) Calcium ammonium nitrate

22. The chemical name of Baking soda is

- (A) Potassium nitrate (B) Sodium bicarbonate
(C) Sodium chloride (D) Calcium oxide

23. Demography is the statistical study of

- (A) Human society (B) Human population
(C) Human settlement (D) Human life

24. Which of the following nutrients is not an important for plant growth?

- (A) Nitrogen (B) Phosphorous
(C) Methane (D) Potassium

Instructions for Q. 25 to Q. 30. Please read the following passage carefully. Choose the correct answer out of the given four choices for each question (from Q. 25 to Q.30).

Passage: Climate Change and Agriculture

Climate change is one of the biggest challenges facing modern agriculture. Rising global temperatures, unpredictable rainfall patterns, and extreme weather events like droughts and floods are affecting food production worldwide. Farmers who once relied on regular monsoon cycles now struggle with delayed or excessive rainfall. In some regions, higher temperatures have led to soil moisture loss, reducing crop yields.

Moreover, pests and diseases that thrive in warmer conditions are spreading to new areas, further threatening food security. Scientists and farmers are working together to develop climate-smart agricultural practices, such as drought-resistant crops, efficient irrigation methods, and organic farming techniques that improve soil health.

While climate change poses risks, it also offers opportunities for innovation. Technologies like precision farming—where sensors and data analysis help farmers make better decisions—are becoming more common. Sustainable practices, such as crop rotation and agroforestry, not only improve productivity but also help reduce greenhouse gas emissions.

Addressing climate change requires global cooperation. Governments, researchers, and farmers must work together to find solutions that ensure food security for future generations. Every small effort, from reducing food waste to planting trees, contributes to a more sustainable future.

25. Which one of the following has a major climate change impact on agriculture?
- (A) An increase in the number of farmers.
 - (B) More predictable weather patterns.
 - (C) Delayed or excessive rainfall affecting crops.
 - (D) Decrease in land available for farming.
26. How does higher temperature affect soil?
- (A) It increases soil fertility.
 - (B) It causes soil to lose moisture, reducing crop yields.
 - (C) It helps in plant growth.
 - (D) It has no impact on soil conditions.
27. Which of the following is a climate-smart agricultural practice?
- (A) Overuse of chemical fertilizers.
 - (B) Dependence on traditional irrigation only.
 - (C) Growing drought-resistant crops.
 - (D) Clearing forests for farming.

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28. What role does technology play in modern agriculture?
- (A) It reduces the need for farmers.
 - (B) It allows farmers to rely only on rainwater.
 - (C) It helps farmers make better decisions using data.
 - (D) It replaces the need for soil in farming.
29. How can individuals contribute to a sustainable future in agriculture?
- (A) By using more plastic in farming.
 - (B) By reducing food waste and planting trees.
 - (C) By consuming more processed foods.
 - (D) By ignoring climate change and its effects.
30. Choose the correct synonym for the term “sustainable” used in the passage.
- (A) Temporary
 - (B) Long-lasting
 - (C) Harmful
 - (D) Uncertain