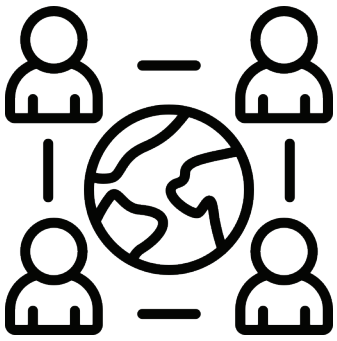
2021 TO 2026

PREVIOUS YEAR QUESTION WITH
DETAILED EXPLANATIONS

GATE 2027

SOCIOLOGY



GATE 2027

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P R E F A C E

This book has been meticulously designed to serve as a **comprehensive resource** for aspirants preparing for the **GATE Sociology** examination. Given the increasing competition, success in GATE requires not only a conceptual understanding of **sociological theories, methods, and contemporary issues** but also a strategic approach to tackling different question formats. This book is structured to provide an **in-depth review** of essential topics while addressing the needs of both **beginners and advanced learners**.

This book presents a **curated collection of solutions** to **past GATE Sociology exam questions** from **2021 to 2026**, offering candidates a **systematic approach** to understanding **question trends, conceptual applications, and analytical techniques**. It serves as an essential tool for **efficient and structured preparation**, enabling aspirants to strengthen their grasp of core sociological themes and problem-solving strategies.

Organized into **thematic chapters**, this collection comprehensively covers the **entire GATE Sociology syllabus**, including **Classical and Contemporary Sociological Theories, Research Methods, Social Institutions, Social Stratification, Globalization, and Indian Society**. Each chapter is further divided into **units** for **topic-wise clarity**, and questions are **arranged year-wise** to help students track the evolution of concepts and exam patterns. The book also classifies questions into **Multiple Choice Questions (MCQs), Multiple Select Questions (MSQs), and Numerical Answer Type (NAT)** formats, ensuring alignment with the latest **GATE Sociology exam structure**. Every solution is presented in a **detailed, step-by-step** manner, clarifying not only the correct answer but also the **conceptual reasoning and sociological framework** necessary for a deeper understanding.

By engaging with these solutions, students can **solidify their knowledge**, **analyze question trends**, and **develop effective time-management strategies**. This book aims to be a **practical and analytical guide**, equipping aspirants with the **conceptual clarity and confidence** required to excel in the **GATE Sociology** examination.

GATE Exam Pattern

- **Examination Mode:** Computer Based Test (Online)
- **Duration**: 3 Hours
- **Total Marks**: 100 Marks
- **Type of Questions**:
    - Multiple Choice Questions (MCQs)
    - Multiple Select Questions (MSQs)
    - Numerical Answer type
- **Number of Questions**: (10 GA+ 55 SUBJECT)= 65 Questions

  Marking Scheme- All of the questions will be worth 1 or 2 marks

GATE EXAM: Negative Marking

The Graduate Aptitude Test in Engineering (GATE) uses a particular scheme of negative marking to ensure that the answers are accurate. The candidates need to know this scheme to achieve maximum scores.

Multiple Choice Questions (MCQs):

- 1-Mark Questions: For every wrong answer, there is a deduction of 1/3 mark.
- 2-Mark Questions: For every wrong answer, there is a deduction of 2/3 mark.

Multiple Select Questions (MSQs): There is no negative marking for wrong answers.

Numerical Answer Type (NAT) Questions: There is no negative marking for wrong answers.

GATE EXAM: Category-wise Cut Off

YEAR	GEN	OBC-NCL/EWS	SC/ST/PWD
2021	34.3	30.8	22.8
2022	59.7	53.7	39.8
2023	50	45	33.3
2024	36	32.4	24
2025	40	36	26.6
2026	40	36	26.6

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NUMBER OF QUESTIONS ASKED IN GATE SOCIOLOGY (2021 to 2026)							
PART - A		**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
GA	**GENERAL APTITUDE**						
	1.1: Verbal Aptitude	1	1	2	2	3	2
	1.2: Quantitative Aptitude	3	4	4	5	5	4
	1.3: Analytical Aptitude	5	4	3	2	2	1
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General Aptitude

Syllabus

VERBAL APTITUDE

BASIC ENGLISH GRAMMAR: TENSES, ARTICLES, ADJECTIVES, PREPOSITIONS, CONJUNCTIONS, VERB-NOUN AGREEMENT, & OTHER PARTS OF SPEECH. BASIC VOCABULARY: WORDS, IDIOMS, & PHRASES IN CONTEXT, READING & COMPREHENSION, NARRATIVE SEQUENCING.

QUANTITATIVE APTITUDE

DATA INTERPRETATION: DATA GRAPHS (BAR GRAPHS, PIE CHARTS, & OTHER GRAPHS REPRESENTING DATA), 2- & 3-DIMENSIONAL PLOTS, MAPS & TABLES NUMERICAL COMPUTATION & ESTIMATION: RATIOS, PERCENTAGES, POWERS, EXPONENTS & LOGARITHMS, PERMUTATIONS & COMBINATIONS, & SERIES MENSURATION & GEOMETRY ELEMENTARY STATISTICS & PROBABILITY.

ANALYTICAL APTITUDE

LOGIC: DEDUCTION & INDUCTION, ANALOGY, NUMERICAL RELATIONS & REASONING.

SPATIAL APTITUDE

TRANSFORMATION OF SHAPES: TRANSLATION, ROTATION, SCALING, MIRRORING, ASSEMBLING, & GROUPING PAPER FOLDING, CUTTING, & PATTERNS IN 2 & 3 DIMENSIONS

GA GENERAL APTITUDE

Unit 1.1: Verbal Aptitude

Previous Year Exam Question

(1 MARK 2021-MCQ)

1. Consider the following sentences:

(i) After his surgery, Raja hardly could walk.
(ii) After his surgery, Raja could barely walk.
(iii) After his surgery, Raja barely could walk.
(iv) After his surgery, Raja could hardly walk.

Which of the above sentences are grammatically CORRECT?

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

(1 MARK 2022-MCQ)

2. Inhaling the smoke from a burning _____ could _____you quickly.

(A) tire/tier (B) tire/tyre
(C) tyre /tire (D) tyre / tier

(1 MARK 2023-MCQ)

3. Rafi told Mary, "I am thinking of watching a film this weekend."

The following reports the above statement in indirect speech:

Rafi told Mary that he _____ of watching a film that weekend.

(A) thought (B) is thinking
(C) am thinking (D) was thinking

(1 MARK 2023-MCQ)

4. Permit : _____ : : Enforce : Relax

(By word meaning)

(A) Allow (B) Forbid
(C) License (D) Reinforce

(1 MARK 2024-MCQ)

5. If '→' denotes increasing order of intensity, then the meaning of the words [simmer → seethe → smolder] is analogous to [break → raze → _____].

Which one of the given options is appropriate to fill the blank?

(A) obfuscate (B) obliterate
(C) fracture (D) fissure

(2 MARK 2024-MCQ)

6. In the given text, the blanks are numbered (i)-(iv). Select the best match for all the blanks.

From the ancient Athenian arena to the modern Olympic stadiums, athletics (i) the potential for a spectacle. The crowd (ii) with bated breath as the Olympian artist twists his body, stretching the javelin behind him. Twelve strides in, he begins to cross-step. Six cross-steps (iii) in an abrupt stop on his left foot. As his body. (iv) like a door turning on a hinge, the javelin is launched skyward at a precise angle.

(A) (i) hold (ii) waits (iii) culminates (iv) pivot
(B) (i) holds (ii) wait (iii) culminates (iv) pivot
(C) (i) hold (ii) wait (iii) culminate (iv) pivots
(D) (i) holds (ii) waits (iii) culminate (iv) pivots

[1 MARK 2025 MCQ]

7. Here are two analogous groups, Group-I and Group-II, that list words in their decreasing order of intensity. Identify the missing word in Group-II.

Group-I: Abuse → Insult → Ridicule
Group-II: _____ → Praise → Appreciate

(A) Extol (B) Prize
(C) Appropriate (D) Espouse

[1 MARK 2025 MCQ]

8. Had I learnt acting as a child, I _____ a famous film star.

Select the most appropriate option to complete the above sentence.

(A) will be (B) can be
(C) am going to be (D) could have been

[2 MARK 2025 MCQ]

9. Identify the option that has the most appropriate sequence such that a coherent paragraph is formed:

P. Over time, such adaptations lead to significant evolutionary changes with the potential to shape the development of new species.
Q. In natural world, organisms constantly adapt to their environments in response to challenges and opportunities.
R. This process of adaptation is driven by the principle of natural selection, where favorable traits increase an organism's chances of survival and reproduction.
S. As environments change, organisms that can adapt their behavior, structure and physiology to such changes are more likely to survive.

(A) P→ Q→ R→ S (B) Q→ S→R→ P
(C) R→ S→ Q→ P (D) S→ P→R→ Q

[1 MARK 2026-MCQ]

10. "He often _____ the numbers. False claims are not going to help. Honesty_____ trust", said the manager.
Choose the option with the correct order of words to fill the blanks.
(A) exaggerates; engenders
(B) excels; encourages
(C) aggravates; alleviates
(D) diminishes; eliminates

[2 MARK 2026-MCQ]

11. Charity: P:: Retaliation: Q
Choose the appropriate pair of words, P and Q, that fit the analogy.
(A) P = Parsimonious; Q = Vengeful
(B) P = Altruistic; Q = Amicable
(C) P = Resentful; Q = Spiteful
(D) P = Magnanimous; Q = Vindictive

Answer Key								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
(D)	(C)	(D)	(B)	(B)	(D)	(A)	(D)	(B)
10	**11**							
(A)	(D)							

EXPLANATIONS

1. Explanation: (D)
"barely" and "hardly" should come after "could" for proper grammatical structure.

2. Explanation: (C)
The correct answer is: (C) tyre / tire
- "Inhaling the smoke from a burning tyre could tire you quickly."
- "Tyre" refers to the rubber covering of a wheel.
- "Tire" means to exhaust or make someone fatigued.

3. Explanation: (D)
When converting direct speech to indirect speech:
1. If the reporting verb is in the past tense (e.g., "told"), the tense of the reported speech typically shifts back.
- Present continuous ("am thinking") becomes past continuous ("was thinking").
2. Words indicating time, such as "this weekend," are also adjusted to fit the perspective of the reported speech.
- "This weekend" changes to "that weekend."

Thus, the sentence becomes:
Rafi told Mary that he was thinking of watching a film that weekend.

4. Explanation: (B)
- "Permit" means to allow or give permission for something.
- The opposite of "permit" is "forbid," which means to prohibit or not allow.
- Similarly, "enforce" means to compel observance of rules, laws, or regulations, while "relax" means to make something less strict or to ease up on enforcement.

So, the relationship between "permit" and "forbid" is similar to the relationship between "enforce" and "relax."

5. Explanation: (B)
To solve this analogy, let's analyze the relationship between the words:
Simmer → Seethe → Smolder describes an increasing order of intensity for states of heat or suppressed emotion.
Simmer: A low, barely active state.
Seethe: A more intense, agitated state.
Smolder: An even more intense and destructive state.
Now compare this progression to Break → Raze → [Blank]:
Break: To fracture or split something into pieces, often partially.
Raze: To completely destroy something, especially a structure.
The missing word must signify a more extreme or absolute destruction than **Raze**.
Now, we analyze options:
1. **Obfuscate**: To make something unclear or obscure, unrelated to destruction.
2. **Obliterate**: To completely wipe out, destroy, or erase, fitting the progression from Break → Raze → Obliterate.
3. **Fracture**: To break or crack, similar to "Break" but less intense than "Raze."
4. **Fissure**: A narrow crack or split, less intense than "Break."

6. Explanation: (D)
(i) "the potential for a spectacle"
The subject is "athletics," which is singular. Therefore, the verb should agree with the singular subject. The correct choice is "holds".

(ii) "the crowd"
The subject is "the crowd," which is singular. Therefore, the verb should be "waits", matching the singular subject.

(iii) "Six cross-steps"
This part is describing an action that happens in the singular. So, we need a singular verb form. The correct choice here is "culminate".

(iv) "As his body..."
The subject "his body" is singular, and the verb should match. The verb form should be "pivots", which agrees with the singular subject.

7. Explanation: (A)
Group-I: Abuse → Insult → Ridicule
Abuse is a strong negative term.
Insult is less severe than abuse but still negative.
Ridicule is milder than insult but still negative.
Group-II: _____ → Praise → Appreciate
Praise is a positive term.
Appreciate is less intense than praise but still positive.
Checking options:
Extol: This means to praise highly or enthusiastically, which fits as being more intense than **Praise**.
Prize: While positive, it doesn't necessarily fit the sequence of intensifying praise.
Appropriate: This doesn't fit the context of intensifying positive terms.
Espouse: This means to support or advocate for something, which doesn't fit the sequence of praise.
Therefore, the missing word should be **Extol**, as it is a stronger form of praise than **Praise** itself.

8. Explanation: (D)
The sentence is a **third conditional** statement, which describes a hypothetical past situation and its possible outcome.

Structure: **Had + past participle, subject + could/would/might + have + past participle**
Given sentence:
"Had I learnt acting as a child, I ____ a famous film star."
Now, let's analyze the options:

(A) will be → Incorrect (used for future certainty, not a past hypothetical).
(B) can be → Incorrect (used for present or future ability, not past).
(C) am going to be → Incorrect (used for planned future events, not past).
(D) could have been → Correct (expresses a past possibility that did not happen).
Answer: (D) could have been

9. Explanation: (B)
(A) P → Q → R → S (Starts with long-term changes instead of introducing adaptation first)
(B) Q → S → R → P (Follows a logical sequence from general adaptation → survival → natural selection → evolution)
(C) R → S → Q → P (Jumps to natural selection before introducing adaptation)
(D) S → P → R → Q (Does not start with a general introduction, making it less coherent)
Correct Answer: (B) Q → S → R → P

10. Explanation: (A)
First Blank: "exaggerates the numbers" The context says *"false claims are not going to help"*, which implies someone is overstating or inflating figures. "Exaggerates" fits perfectly; vit means to represent something as larger or better than it really is.
Second Blank: "Honesty engenders trust" "Engenders" means to cause or give rise to something. The sentence is drawing a contrast: false claims are harmful, but honesty *produces/builds* trust. This is a classic, idiomatic pairing: *"honesty engenders trust."*

11. Explanation: (D)

Word	Meaning	Trait
Charity	Giving generously, being selfless	**Magnanimous** (generous in spirit, noble-hearted)
Retaliation	Hitting back, seeking revenge	**Vindictive** (having a strong desire for revenge)

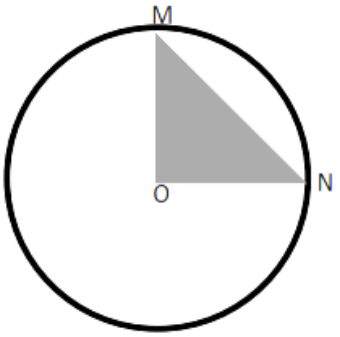
Parsimonious = **stingy/miserly** — the **opposite** of charity, Altruistic fits charity, but **Amicable** (friendly) does NOT relate to retaliation, Resentful does **not** describe someone who gives charity.

Unit 1.2: Quantitative Aptitude

Previous Year Exam Question

(1 MARK 2021-MCQ)

1. In the below figure, O is the center of the circle and, M and N lie on the circle.



The area of the right triangle MON is $50\ cm^2$.
What is the area of the circle in cm²?

(A) 2π (B) 50π
(C) 75π (D) 100π

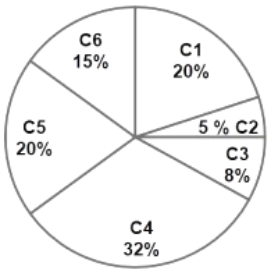
(2 MARK 2021-MCQ)

2. The number of hens, ducks and goats in farm P are 65, 91 and 169, respectively. The total number of hens, ducks and goats in a nearby farm Q is 416. The ratio of hens : ducks : goats in farm Q is 5:14:13. All the hens, ducks and goats are sent from farm Q to farm P.
The new ratio of hens : ducks : goats in farm P is

(A) 5:7:13 (B) 5:14:13
(C) 10:21:26 (D) 21:10:26

(2 MARK 2021-MCQ)

3.



Company	Ratio
C1	3:2
C2	1:4
C3	5:3
C4	2:3
C5	9:1
C6	3:4

The distribution of employees at the rank of executives, across different companies C1, C2, ..., C6 is presented in the chart given above. The ratio of executives with a management degree to those without a management degree in each of these companies is provided in the table above. The total number of executives across all companies is 10,000.
The total number of management degree holders among the executives in companies C2 and C5 together is _____.

(A) 225 (B) 600
(C) 1900 (D) 2500

(1 MARK 2022-MCQ)

4. A sphere of radius r cm is packed in a box of cubical shape. What should be the minimum volume (in cm³) of the box that can enclose the sphere?

(A) $\frac{r^3}{8}$ (B) r^3
(C) $2r^3$ (D) $8r^3$

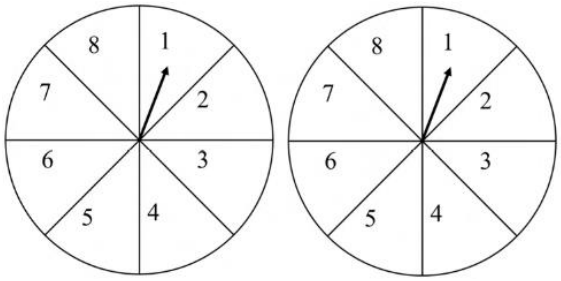
(1 MARK 2022-MCQ)

5. Pipes P and Q can fill a storage tank in full with water in 10 and 6 minutes, respectively. Pipe R draws the water out from the storage tank at a rate of 34 litres per minute. P, Q and R operate at a constant rate.
If it takes one hour to completely empty a full storage tank with all the pipes operating simultaneously, what is the capacity of the storage tank (in litres)?

(A) 26.8 (B) 60.0
(C) 120.0 (D) 127.5

(2 MARK 2022-MCQ)

6. A game consists of spinning an arrow around a stationary disk as shown below.
When the arrow comes to rest, there are eight equally likely outcomes. It could come to rest in any one of the sectors numbered 1, 2, 3, 4, 5, 6, 7 or 8 as shown.
Two such disks are used in a game where their arrows are independently spun.
What is the probability that the sum of the numbers on the resulting sectors upon spinning the two disks is equal to 8 after the arrows come to rest?



(A) $\frac{1}{16}$ (B) $\frac{5}{64}$
(C) $\frac{6}{32}$ (D) $\frac{7}{64}$

(2 MARK 2022-MCQ)

7. Consider the following inequalities.
(i) $3p - q < 4$
(ii) $3q - p < 12$

Which one of the following expressions below satisfies the above two inequalities?

(A) $p + q < 8$ (B) $p + q = 8$

(C) $8 \leq p + q < 16$ (D) $p + q \geq 16$

(1 MARK 2023-MCQ)

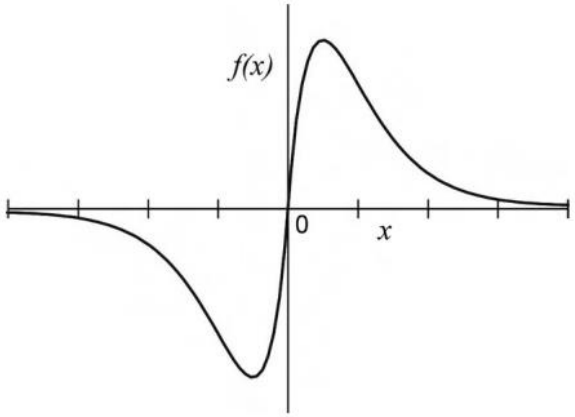
8. Given a fair six-faced dice where the faces are labelled '1', '2', '3', '4', '5', and '6', what is the probability of getting a '1' on the first roll of the dice and a '4' on the second roll?

(A) $\frac{1}{36}$ (B) $\frac{1}{6}$

(C) $\frac{5}{6}$ (D) $\frac{1}{3}$

(2 MARK 2023-MCQ)

9. Which one of the following options represents the given graph?



(A) $f(x) = x^2 2^{-|x|}$ (B) $f(x) = x2^{-|x|}$

(C) $f(x) = |x|2^{-x}$ (D) $f(x) = x2^{-x}$

(2 MARK 2023-MCQ)

10. The digit in the unit's place of the product $3^{999} \times 7^{1000}$ is _____.

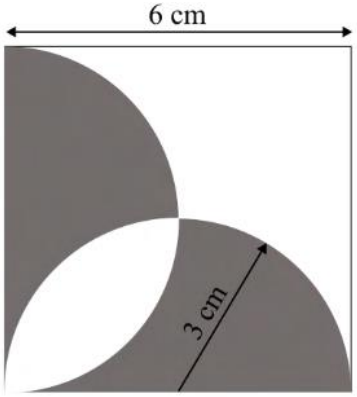
(A) 7 (B) 1

(C) 3 (D) 9

(2 MARK 2023-MCQ)

11. A square with sides of length 6 cm is given. The boundary of the shaded region is defined by two semi-circles whose diameters are the sides of the square, as shown.

The area of the shaded region is _____ cm^2.



(A) 6π (B) 18

(C) 20 (D) 9π

(1 MARK 2024-MCQ)

12. In a locality, the houses are numbered in the following way:

The house-numbers on one side of a road are consecutive odd integers starting from 301, while the house-numbers on the other side of the road are consecutive even numbers starting from 302. The total number of houses is the same on both sides of the road.

If the difference of the sum of the house-numbers between the two sides of the road is 27, then the number of houses on each side of the road is

(A) 27 (B) 52

(C) 54 (D) 26

(1 MARK 2024-MCQ)

13. For positive integers p and q, with $\frac{p}{q} \neq 1$, $\left(\frac{p}{q}\right)^{\frac{p}{q}} = p^{\left(\frac{p}{q}-1\right)}$. Then,

(A) $q^p = p^q$ (B) $q^p = p^{2q}$

(C) $\sqrt{q} = \sqrt{p}$ (D) $\sqrt[p]{q} = \sqrt[q]{p}$

(2 MARK 2024-MCQ)

14. Three distinct sets of indistinguishable twins are to be seated at a circular table that has 8 identical chairs. Unique seating arrangements are defined by the relative positions of the people.

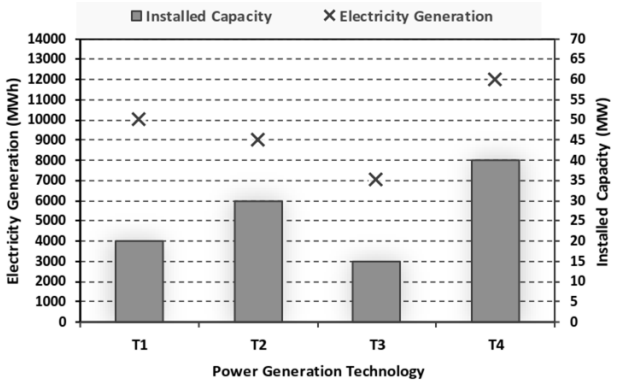
How many unique seating arrangements are possible such that each person is sitting next to their twin?

(A) 12 (B) 14

(C) 10 (D) 28

(2 MARK 2024-MCQ)

15. The chart given below compares the Installed Capacity (MW) of four power generation technologies, T1, T2, T3, and T4, and their Electricity Generation (MWh) in a time of 1000 hours (h).



The Capacity Factor of a power generation technology is:

$$\text{Capacity Factor} = \frac{\text{Electricity Generation (MWh)}}{\text{Installed Capacity (MW)} \times 1000\ \text{(h)}}$$

Which one of the given technologies has the highest Capacity Factor?

(A) T1 (B) T2
(C) T3 (D) T4

(2 MARK 2024-MCQ)

16. During a half-moon phase, the Earth-Moon-Sun form a right triangle. If the Moon-Earth-Sun angle at this half-moon phase is measured to be 89.85°, the ratio of the Earth-Sun and Earth-Moon distances is closest to

(A) 328 (B) 382
(C) 238 (D) 283

[1 MARK 2025 MCQ]

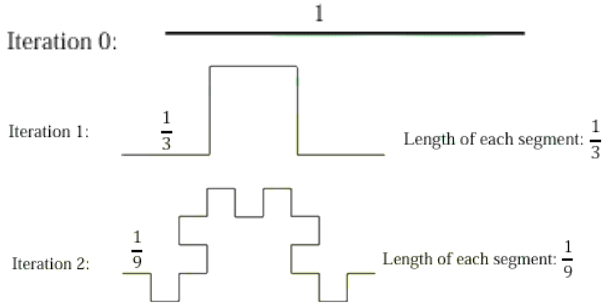
17. The 12 musical notes are given as $C, C^{\#}, D, D^{\#}, E, F, F^{\#}, G, G^{\#}, A, A^{\#}$, and B. Frequency of each note is $\sqrt[12]{2}$ times the frequency of the previous note. If the frequency of the note C is 130.8 Hz, then the ratio of frequencies of notes $F^{\#}$ and C is:

(A) $\sqrt[6]{2}$ (B) $\sqrt{2}$
(C) $\sqrt[4]{2}$ (D) 2

[1 MARK 2025 MCQ]

18. The following figures show three curves generated using an iterative algorithm. The total length of the curve generated after 'Iteration n' is:

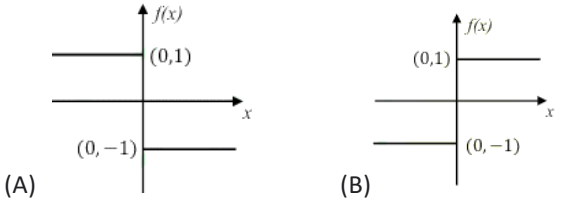
Note: The figures shown are representative.



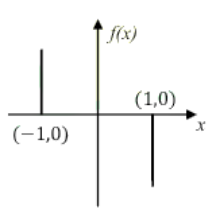
(A) $\left(\frac{5}{3}\right)^{\frac{n}{2}}$ (B) $\left(\frac{5}{3}\right)^{n}$
(C) $\left(\frac{5}{3}\right)^{2n}$ (D) $\left(\frac{5}{3}\right)^{n(2n-1)}$

[1 MARK 2025 MCQ]

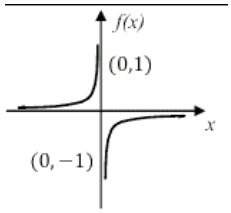
19. Which of the following plots represents $f(x) = \frac{|x|}{x}$, where x is a non-zero real number?



(A) (B)



(C)

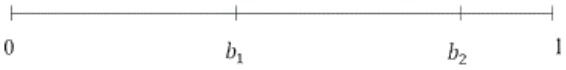


(D)

[2 MARK 2025 MCQ]

20. A stick of length one meter is broken at two locations at distances of b_1 and b_2 from the origin (0), as shown in the figure. Note that $0 < b_1 < b_2 < 1$. Which one of the following is NOT a necessary condition for forming a triangle using the three pieces?

Note: All lengths are in meter. The figure shown is representative.



(A) $b_1 < 0.5$ (B) $b_2 > 0.5$
(C) $b_2 < b_1 + 0.5$ (D) $b_1 + b_2 < 1$

[2 MARK 2025]

21. An organization allows its employees to work independently on consultancy projects but charges an overhead on the consulting fee. The overhead is 20% of the consulting fee, if the fee is up to 5,00,000. For higher fees, the overhead is ₹1,00,000 plus 10% of the amount by which the fee exceeds ₹ 5,00,000. The government charges a Goods and Services Tax of 18% on the total amount (the consulting fee plus the overhead). An employee of the organization charges this entire amount, i.e., the consulting fee, overhead, and tax, to the client. If the client cannot pay more than ₹ 10,00,000, what is the maximum consulting fee that the employee can charge?

(A) ₹ 7,01,438 (B) ₹ 7,24,961
(C) ₹ 7,51,232 (D) ₹ 7,75,784

[1 MARK 2026 MCQ]

22. A school has 100 students distributed among the 1st to 10th standards.

Based on this, which one of the following statements is always correct?

(A) There are at least 10 students who belong to the same standard.
(B) There is at least one student in each standard.
(C) There are at most 10 students in 10th standard.
(D) The total number of students from 1st to 5th standards is at least 50.

[1 MARK 2026 MCQ]

23. How many 3-digit numbers can be formed using three distinct single digit prime numbers?

(A) 64 (B) 24
(C) 12 (D) 4

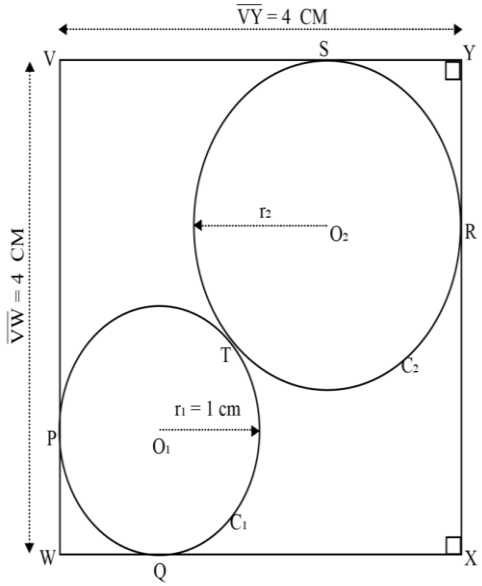
[1 MARK 2026 MCQ]

24. In a group of students, 10 students like Mathematics, 12 students like English, 4 students like both Mathematics and English, and 6 students like neither Mathematics nor English. The number of students in the group is _____

(A) 18 (B) 20
(C) 24 (D) 32

[2 MARK 2026 MCQ]

25. As shown in the figure, circle C_1 with center O_1 and radius r_1 touches the square $VWXY$ at points P and Q while circle C_2 with center O_2 and radius r_2 touches the square $VWXY$ at points R and S. The two circles touch each other at T.
Given $r_1 = 1\ cm$ and $\underline{VY} = \underline{VW} = 4\ cm, r_2 =$ ___ cm.



(A) $4 - 3\sqrt{2}$ (B) $1 + 2\sqrt{2}$
(C) $7 - 4\sqrt{2}$ (D) $5 + 3\sqrt{2}$

Answer Key									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(D)	(C)	(C)	(D)	(C)	(D)	(A)	(A)	(B)	(A)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(B)	(A)	(A)	(A)	(A)	(B)	(B)	(B)	(A)	(D)
21	**22**	**23**	**24**	**25**					
(B)	(A)	(B)	(C)	(C)					

EXPLANATIONS

1. Explanation: (D)

Let r be the radius of circle.

$A(\Delta\, MON) = \frac{1}{2} \cdot r \cdot r = 50$ gives $r = 10$.

$\therefore A(\text{circle}) = \pi r^2 = 100\pi$.

2. Explanation: (C)

We are tasked with determining the new ratio of hens, ducks, and goats in farm P after the animals from farm Q are sent to farm P.

Step 1: Determine the number of each animal in farm Q

The total number of animals in farm Q is 416, and the ratio of hens : ducks : goats is 5:14:13.

The sum of the ratio parts is $5 + 14 + 13 = 32$.

Each part represents $\frac{416}{32} = 13$.

- Number of hens in farm Q = $5 \times 13 = 65$
- Number of ducks in farm Q = $14 \times 13 = 182$
- Number of goats in farm Q = $13 \times 13 = 169$

Step 2: Calculate the total number of animals in farm P after transfer

- Hens in farm P = $65 + 65 = 130$
- Ducks in farm P = $91 + 182 = 273$
- Goats in farm P = $169 + 169 = 338$

Step 3: Determine the new ratio

The new ratio of hens : ducks : goats in farm P is:

Hens : Ducks : Goats $= 130 : 273 : 338$

Simplify the ratio by dividing all terms by their greatest common divisor (GCD), which is 13:

$$\frac{130}{13} : \frac{273}{13} : \frac{338}{13} = 10 : 21 : 26$$

3. Explanation: (C)

Number of employees in C2 $= \frac{5}{100} \times 10000 = 500$

In C2, ratio is $1:4$. Take x as common multiple.

$\therefore x + 4x = 500$ gives $x = 100$.

So, the total number of management degree holders in C2 $= 100$.

Number of employees in C5 $= \frac{20}{100} \times 10000 = 2000$

In C5, ratio is $9:1$. Take x as common multiple.

$\therefore 9x + x = 2000$ gives $x = 200$.

So, the total number of management degree holders in C2 $= 1800$.

Combining both, there are 1900 management degree holders among the executives in companies C2 and C5 together.

4. Explanation: (D)

The volume of a cube is given by: Volume = (side length)^3

Here, the side length of the cube is $2r$.

Therefore: Volume = $(2r)^3 = 8r^3$ cm^3

So, the minimum volume (in cm³) of the box that can enclose the sphere is $8r^3$.

5. Explanation: (C)

Given:

- Pipe P fills the tank in 10 minutes, so its rate is $\frac{1}{10}$ of the tank per minute.
- Pipe Q fills the tank in 6 minutes, so its rate is $\frac{1}{6}$ of the tank per minute.
- Pipe R draws water out of the tank at a rate of 34 liters per minute.

Let C be the capacity of the tank in liters.

- Pipe P's rate of filling: $\frac{C}{10}$ liters per minute.
- Pipe Q's rate of filling: $\frac{C}{6}$ liters per minute.
- Pipe R's rate of emptying: 34 liters per minute, which is $\frac{34}{C}$ of the tank per minute.

Thus, we can write the equation for the combined rate:

$\frac{C}{10}+\frac{C}{6}-\frac{34}{C}=-\frac{C}{60} \Rightarrow \frac{C^2}{10}+\frac{C^2}{6}-34=-\frac{C^2}{60}$

$60\left(\frac{C^2}{10}+\frac{C^2}{6}-34\right)=60\left(-\frac{C^2}{60}\right) \Rightarrow \quad 6C^2+10C^2-2040=-C^2$

$16C^2-2040=-C^2 \Rightarrow 16C^2+C^2=2040$

$17C^2=2040 \Rightarrow C^2=\frac{2040}{17}=120$

Taking the square root of both sides:

$C=\sqrt{120}\approx 10.95$ liters

Thus, the capacity of the tank is approximately 120 liters.

6. Explanation: (D)

Given:

- Each disk has 8 sectors, numbered from 1 to 8.
- When the arrow is spun, there are 8 equally likely outcomes for each disk, so the possible outcomes for each disk are 1, 2, 3, 4, 5, 6, 7, and 8.

Total outcomes $= 8 \times 8 = 64$

The possible pairs that satisfy $x + y = 8$ are:

- $x = 1$ and $y = 7$
- $x = 2$ and $y = 6$
- $x = 3$ and $y = 5$
- $x = 4$ and $y = 4$
- $x = 5$ and $y = 3$
- $x = 6$ and $y = 2$
- $x = 7$ and $y = 1$

Thus, there are 7 favorable outcomes.

The probability is the ratio of favorable outcomes to the total number of outcomes:

$\therefore$ Probability $= \frac{7}{64}$

7. Explanation: (A)

Adding two inequalities on respective sides, we have, $2p + 2q < 16$, i.e., $p + q < 8$.

8. Explanation: (A)

1. **Probability of getting a '1' on the first roll:** Since the dice is fair and has six faces, the probability of getting any specific number (including '1') on a single roll is:

$$P(\text{getting '1'}) = \frac{1}{6}.$$

2. **Probability of getting a '4' on the second roll:** Similarly, the probability of getting a '4' on the second roll is:

$$P(\text{getting '4'}) = \frac{1}{6}.$$

3. **Total probability for both events:** Since the two rolls are independent events, the total probability is the product of the individual probabilities:

$$P(\text{getting '1' on first roll and '4' on second roll}) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}.$$

9. Explanation: (B)

The graph represents odd function.

The only option represents odd function is (B).

$f(-x) = -x2^{-|-x|} = -\left(x2^{-|x|}\right) = -f(x)$

10. Explanation: (A)

The unit's digits of powers of 3 follow a repeating cycle. Let's calculate the first few powers of 3:

- $3^1 = 3$ (unit digit: 3)
- $3^2 = 9$ (unit digit: 9)
- $3^3 = 27$ (unit digit: 7)
- $3^4 = 81$ (unit digit: 1)

The unit's digits of powers of 3 repeat every 4 terms: 3, 9, 7, 1.

To find the unit's digit of 3^{999}, we determine the remainder when 999 is divided by 4:

$999 \div 4 = 249$ remainder 3.

Thus, 3^{999} has the same unit digit as 3^3, which is **7**.

The unit's digits of powers of 7 also follow a repeating cycle. Let's calculate the first few powers of 7:

- $7^1 = 7$ (unit digit: 7)
- $7^2 = 49$ (unit digit: 9)
- $7^3 = 343$ (unit digit: 3)
- $7^4 = 2401$ (unit digit: 1)

The unit's digits of powers of 7 repeat every 4 terms: 7, 9, 3, 1.

To find the unit's digit of 7^{1000}, we determine the remainder when 1000 is divided by 4:

$1000 \div 4 = 250$ remainder 0.

Thus, 7^{1000} has the same unit's digit as 7^4, which is **1**.

Now, we find the unit's digit of the product $3^{999} \times 7^{1000}$. We already know:

- The unit's digit of 3^{999} is **7**.
- The unit's digit of 7^{1000} is **1**.

The unit's digit of the product is the unit's digit of $7 \times 1 = 7$.

The unit's digit of $3^{999} \times 7^{1000}$ is **7**.

Thus, the correct answer is **(A) 7**.

11. Explanation: (B)

The white intersecting part of two semi circles can be adjusted above main diagonal in such a way that it becomes clear that shaded region is exactly half the given square.

Area of shaded region = $\frac{1}{2}$ Area of Square $= \frac{1}{2} \times 6 \times 6 = 18\ cm^2$

12. Explanation: (A)

- Common difference (d) = 2,
- Number of terms = n.

The sum of the series is:

Sum (Even) $= \frac{n}{2}[2a + (n-1)d]$

Substitute $a = 302$ and $d = 2$:

Sum (Even) $= \frac{n}{2}[2(302) + (n-1)(2)]$

$= \frac{n}{2}[604 + 2n - 2] = \frac{n}{2}(602 + 2n)$

Sum (Even) $= 301n + n^2$

The difference between the sums is given as 27:

Sum (Even) $-$ Sum (Odd) $= 27$

$(301n + n^2) - (300n + n^2) = 27$

$301n - 300n = 27$

$n = 27$

If $n = 27$, the number of houses on each side is 27, and the sums of the house numbers will indeed differ by 27, as calculated above.

13. Explanation: (A) We are given the equation:

$\left(\frac{p}{q}\right)^{\frac{p}{q}} = p^{\frac{p}{q}-1}$

$\therefore \frac{p^{\frac{p}{q}}}{q^{\frac{p}{q}}} = \frac{p^{\frac{p}{q}}}{p}$

$\therefore \frac{1}{q^{\frac{p}{q}}} = \frac{1}{p}$

$\therefore p = q^{\frac{p}{q}}$

Taking qth power both sides, we get,

$p^q = q^p$

14. Explanation: (A)

To solve this problem, we need to determine the number of unique seating arrangements for three distinct sets of indistinguishable twins at a circular table with 8 identical chairs, with the restriction that each person must sit next to their twin.

Since each person must sit next to their twin, we can treat each pair of twins as a single "block". This means instead of seating 6 individual people, we are seating 3 blocks (each block consisting of two indistinguishable people).

For a circular arrangement, the total number of seating arrangements for n objects is $(n-1)!$, because we can fix one object in place and arrange the remaining $n-1$ objects around it.

Since we are now seating 3 blocks (as we treated each set of twins as a block), the number of ways to arrange these blocks in a circle is $(3-1)! = 2! = 2$.

Each block contains two indistinguishable people, and they can be arranged in only one way (since they are indistinguishable).

Now, we multiply the number of ways to arrange the blocks (2) by the number of ways to arrange the twins within each block (1 for each block, since the twins are indistinguishable):

Total number of arrangements $= 2! \times 1 \times 1 \times 1 = 2$.

However, we have three distinct blocks, so we also need to consider the number of ways to arrange the three blocks in a unique order. Since the blocks are distinct, the number of ways to arrange the three blocks is $3! = 6$.

Therefore, the total number of unique seating arrangements is: 12.

15. Explanation: (A)

Given,

$\text{Capacity Factor} = \frac{\text{Electricity Generation (MWh)}}{\text{Installed Capacity (MW)} \times 1000\ \text{(h)}}$

Let's find out the capacity factor of each technology:

$$\text{Capacity factor(T1)} = \frac{10000}{20 \times 1000} \times 100 = 50$$

$$\text{Capacity factor(T2)} = \frac{9000}{30 \times 1000} \times 100 = 30$$

$$\text{Capacity factor(T3)} = \frac{7000}{15 \times 1000} \times 100 = 46.67$$

$$\text{Capacity factor(T4)} = \frac{12000}{40 \times 1000} \times 100 = 30$$

Capacity factor of T1 technology is more than the other technologies.

16. Explanation: (B)

Let:

d_{EM} = distance between Earth and Moon,

d_{ES} = distance between Earth and Sun,

To find the ratio $\frac{d_{ES}}{d_{EM}}$, we use the right triangle formed during the half-moon phase, where the Moon-Earth-Sun angle is $89.85°$. The tangent of this angle relates the distances as:

$$\tan(89.85°) = \frac{d_{EM}}{d_{ES}} \Rightarrow \frac{d_{ES}}{d_{EM}} = \frac{1}{\tan(89.85°)}.$$

For $\theta = 89.85°$, $\tan(89.85°)$ is large, so:

$$\tan(89.85°) \approx \cot(0.15°) = \frac{1}{\tan(0.15°)}.$$

Using $\tan(0.15°) \approx 0.00261799$, we find:

$$\tan(89.85°) \approx \frac{1}{0.00261799} \approx 382.$$

Thus, $\frac{d_{ES}}{d_{EM}} = \frac{1}{\tan(89.85°)} \approx 382$, making the correct option **(B) 382**.

17. Explanation: (B)

The frequency of each successive musical note is given by:

$f_n = f_{n-1} \times \sqrt[12]{2}$

The given notes are: $C, C^{\#}, D, D^{\#}, E, F, F^{\#}$

From C to $F^{\#}$, there are **6 steps**.

Using the formula:

$f_{F^{\#}} = f_C \times (\sqrt[12]{2})^6$

$\frac{f_{F^{\#}}}{f_C} = (\sqrt[12]{2})^6 = \sqrt{2}$

The answer is **(B)** $\sqrt{2}$.

18. Explanation: (B)

After each iteration, segments count increasing by a factor of 5 and length of each segment decreasing by a factor of $\frac{1}{3}$.

So, after n operations

$L_n = \left(\frac{5}{3}\right)^n \times L_0 = \left(\frac{5}{3}\right)^n \times 1 = \left(\frac{5}{3}\right)^n$

19. Explanation: (A)

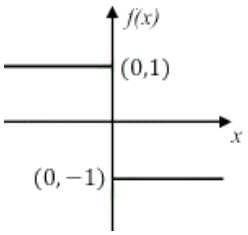
The function behaves differently based on the sign of x:

For $x > 0$: $|x| = x$, so, $f(x) = \frac{x}{x} = 1$.

For $x < 0$: $|x| = -x$, so$f(x) = \frac{-x}{x} = -1$.

Thus, the function is defined as:

$$f(x) = \begin{cases} 1, & x > 0 \\ -1, & x < 0 \end{cases}$$



20. Explanation: (D)

We have a stick of length one meter that is broken at two locations, b_1 and b_2, from the origin (0), where $0 < b_1 < b_2 < 1$. This results in three pieces with lengths:

1. From 0 to b_1: length b_1
2. From b_1 to b_2: length $b_2 - b_1$
3. From b_2 to 1: length $1 - b_2$

For three lengths to form a triangle, the sum of any two lengths must be greater than the third length. Applying this to our three pieces:

1. $b_1 + (b_2 - b_1) > 1 - b_2$
2. $b_1 + (1 - b_2) > b_2 - b_1$
3. $(b_2 - b_1) + (1 - b_2) > b_1$

Let's simplify each inequality:

1. $b_1 + b_2 - b_1 > 1 - b_2$ simplifies to $b_2 > 1 - b_2$ or : $2b_2 > 1$ or $b_2 > 0.5$
2. $b_1 + 1 - b_2 > b_2 - b_1$simplifies to $2b_1 + 1 > 2b_2$ or $b_2 < b_1 + 0.5$
3. $b_2 - b_1 + 1 - b_2 > b_1$simplifies to $1 - b_1 > b_1$ or $1 > 2b_1$ or $b_1 < 0.5$

Thus, condition (D) $b_1 + b_2 < 1$ is not necessary.

21. Explanation: (B)

Let's denote the consulting fee as C.

Consulting Fee Up to ₹5,00,000

Overhead: $20\% \times C = 0.20C$

Total Amount Before GST: $C + 0.20C = 1.20C$

GST: $18\% \times 1.20C = 0.216C$

Total Amount: $1.20C + 0.216C = 1.416C$

Consulting Fee Exceeds ₹5,00,000

Overhead: ₹1,00,000 + $10\% \times (C - 5{,}00{,}000) = 1{,}00{,}000 + 0.10(C - 5{,}00{,}000)$

Overhead Simplified: $1{,}00{,}000 + 0.10C - 50{,}000 = 50{,}000 + 0.10C$

Total Amount Before GST: $C + 50{,}000 + 0.10C = 1.10C + 50{,}000$
GST: $18\% \times (1.10C + 50{,}000) = 0.198C + 9{,}000$
Total Amount: $1.10C + 50{,}000 + 0.198C + 9{,}000 = 1.298C + 59{,}000$
Given that the client cannot pay more than ₹10,00,000, we need to solve for C in both cases.
Solving for (Up to ₹5,00,000)
$1.416C \leq 10{,}00{,}000$
$C \leq \frac{10{,}00{,}000}{1.416}$
$C \leq 7{,}06{,}349.65$
Since the fee must be below ₹5,00,000 in this case, this maximum is irrelevant for Case 1.
Solving for (Exceeds ₹5,00,000)
$1.298C + 59{,}000 \leq 10{,}00{,}000$
$1.298C \leq 9{,}41{,}000$
$C \leq \frac{9{,}41{,}000}{1.298}$
$C \leq 7{,}24{,}961.31$
Thus, the maximum consulting fee that the employee can charge is approximately ₹7,24,961.
The correct answer is **(B) ₹ 7,24,961**.

22. Explanation: (A) This question is based on the Pigeonhole Principle — if n items are distributed into k containers, at least one container must hold ⌈n/k⌉ items.

- 100 students (pigeons)
- 10 standards (pigeonholes)
- 100 ÷ 10 = exactly 10

Even in the most spread-out distribution possible (10 students per standard), at least one standard still has ≥ 10 students.

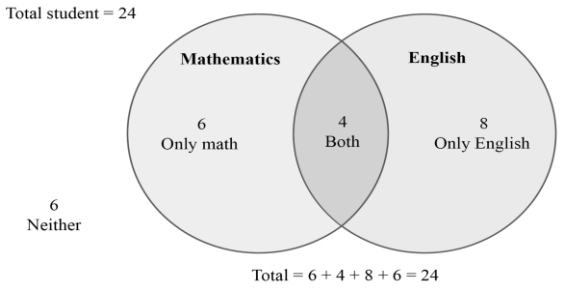
(B) Students could all be in one standard, leaving others empty.

(C) 10th standard could have all 100 students — no upper limit stated.

(D) All 100 students could be in 6th–10th standards, making 1st–5th have 0 students

23. Explanation: (B) The single-digit primes are: 2, 3, 5, 7 → Total = 4 primes
We need to select 3 distinct primes from these 4: $\binom{4}{3}$= 4 ways
Each group of 3 digits can be arranged in: 3!=6 ways
Thus, the total number of 3-digit numbers that can be formed is: 4×6 = 24.

24. Explanation: (C)



Using the Set Formula: |M∪E|=|M|+|E|−|M∩E|
|M∪E|=10+12−4=18
Adding "Neither" students: Total=|M∪E|+Neither
= 18+6 = **24**

25. Explanation: (C) The two circles touch each other externally at point T: $|O_1O_2| = r_1 + r_2$
$\sqrt{(4 - r_2 - 1)^2 + (4 - r_2 - 1)^2} = 1 + r_2$
$\sqrt{2(3 - r_2)^2} = 1 + r_2$
$(3 - r_2)\sqrt{2} = 1 + r_2$
$3\sqrt{2} - 1 = r_2(1 + \sqrt{2})$
$r_2 = \frac{3\sqrt{2}-1}{1+\sqrt{2}}$
Rationalizing :
$r_2 = \frac{(3\sqrt{2}-1)(\sqrt{2}-1)}{(\sqrt{2}+1)(\sqrt{2}-1)} = \frac{(3\sqrt{2}-1)(\sqrt{2}-1)}{1}$
$= 6 - 3\sqrt{2} - \sqrt{2} + 1 = 7 - 4\sqrt{2}$
Correct Answer $r_2 = 7 - 4\sqrt{2}$ cm (C)