Computational Thinking and Artificial Intelligence

Class 6

Teacher Handbook

CENTRAL BOARD OF SECONDARY EDUCATION

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PREFACE

The National Education Policy (NEP) aims to position India as a leader in emerging knowledge fields by integrating technologies like AI, Machine Learning, Big Data, and Computational Thinking into school education. It promotes technology-enabled, interactive, and gamified learning using tools such as Augmented Reality (AR), Virtual Reality (VR), and virtual labs to foster creativity, problem-solving, and interdisciplinary exploration. NCFSE 23 carries this recommendation further for implementation.

While Artificial Intelligence (AI) is an important requirement, Computational Thinking (CT) should be a broader skill, developing a foundation for learning AI. It can cover various aspects like Cybersecurity, basic networking, etc. Hence, CBSE approaches this by integrating Computational Thinking with AI and other technological advancements, without dependence on any platform.

The book engages learners with problems involving constraints, dependencies, logical conditions, grids, data interpretation, and optimisation across numerical, spatial, and real-life contexts. It introduces foundational Artificial Intelligence concepts such as classification, pattern identification, data driven decision making, and ethical awareness, enabling students to understand how logical rules and data influence intelligent systems. The document further provides pedagogical guidance, learning resources, assessment support, and classroom implementation guidelines to facilitate competency-based learning in alignment with NEP 2020.

TEAM CBSE

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Introduction

Computational Thinking (CT) is a problem-solving approach that comprises Decomposition, Pattern Recognition, Abstraction, Algorithm Design, Data Analysis and Troubleshooting. Computational Thinking Skills involve solving complex problems that promote thinking skills such as critical & creative thinking, abstraction and pattern recognition, as well as algorithmic thinking. Problem identification and problem solving necessitate the application of multidisciplinary understanding for creating effective solutions.

Artificial intelligence (AI) is a cutting-edge technology that empowers machines and computers to perform tasks that usually require mimicking human intelligence. These machines can perform complex thinking processes such as data analysis, pattern recognition, prediction of trends, solving problems and decision making. Thus, AI involves simulating cognitive processes associated with human intelligence and is widely applicable in various sectors such as banking, healthcare, defence, education, entertainment, agriculture and others for processing information, solving intricate problems and for planning.

The National Education Policy (NEP) aims for India to emerge as a global leader in new emerging knowledge domains such as artificial intelligence, machine learning, data analytics, 3-D machining etc. To realise this goal, the policy suggests teaching students Mathematics and Computational Thinking, along with new subjects like Artificial Intelligence, Machine Learning, and Data Science during their school education. The policy also focuses on technology-enabled learning and classrooms by using tools like artificial intelligence, machine learning, and adaptive testing to create knowledge.

The National Curriculum for School Education draws from this policy aspiration and emphasizes the need to introduce these emerging domains of study and technologies in the school curriculum. It recommends inclusion of subjects such as design thinking, augmented reality, virtual reality, artificial intelligence, and computational thinking. Additionally, it promotes the use of gamified content, interactive content, and immersive experiences (such as AR, VR, or virtual labs) to enhance student learning. In a variety of subjects, including design, music, art, and sciences, these resources support students in knowledge creation and exploration, and development of capacities such as problem-solving, critical and creative thinking.

CBSE, under the aegis of the Department of School Education and Literacy, Ministry of Education, Govt. of India, is implementing a Curriculum on Computational Thinking and Artificial Intelligence (CT & AI) to inculcate AI-readiness in school students. This curriculum will be implemented from classes 3rd to 8th, in the session 2026-27, and aims to develop AI-Ready learners, by focusing on Computational Thinking Skills. The AI-readiness, so inculcated through CT Skills, will help develop the capacities of learners to use computational thinking, such as logical thinking, problem solving, pattern recognition, and so on, and understand the role and use of Artificial Intelligence in daily life. The Curriculum aims to build strong foundations in computational thinking, digital literacy, and responsible use of technology, along with nurturing innovation, critical thinking, and ethical decision-making capacities.

1. Relevance: Importance of introducing CT and AI

Introducing these concepts at the Grade 6 level is vital for several reasons:

- **Future Readiness:** It prepares students for the modern world of work where using data effectively and applying AI ethically are essential capabilities.
- **Holistic Development:** It fosters core cognitive capacities such as reasoning, logical thinking, and ethical decision-making, contributing to individual flourishing and responsible digital citizenship
- **Interdisciplinary Connection:** Integrating CT and AI across subjects like Mathematics and Science helps students see knowledge as interconnected rather than compartmentalized
- **Innovation:** It encourages an entrepreneurial mindset by teaching students to devise innovative solutions to real-world challenges

2. Objectives (Curricular Goals & Competencies)

- **CG-1:** Develops skills and capacities of computational thinking, namely, decomposition, pattern recognition, data representation, generalisation, abstraction, and algorithms to solve problems where such techniques of computational thinking are effective.
- **CG-2:** Develops spatial and visual reasoning.
- **CG-3:** Gain foundational knowledge of AI, its types, and domains.
- **CG-4:** Understand key ethical terms such as bias and fairness in relation to AI.
- **CG-5:** Demonstrates proficiency to use Computer & other devices, computer applications for learning and practical purposes such as data analysis, preparation of visual representations and communication of ideas

3. Learning Outcomes

Computational Thinking (CT) Learning Outcomes

ABSTRACT THINKING

Students will be able to interpret and solve multi-step problems with layered and abstract clues, using:

- Advanced viewpoints and cross-sections of 3D objects
- Combined transformation of shapes (multiple flips, rotations, reflections, cuts/folds)
- Changes in orientation, position, order, and direction (clockwise, anticlockwise, diagonal)
- Identifying hidden, overlapping, or implied parts in complex visual patterns
- Symmetry across multiple axes and composite mirror/water image reasoning
- Visual reasoning involving scale, proportion, and spatial relationships

PATTERN RECOGNITION

Students will be able to identify, extend, and justify complex patterns involving multiple simultaneous changes, formed using:

- Numbers with mixed operations and logical rules
- Shapes/images with changing attributes (size, position, count, orientation)
- Letters and symbols with positional or alphabetical logic
- Patterns involving alternation, skipping, grouping, or cyclic behaviour
- Mixed patterns combining numbers, shapes, and letters with dependency rules

DECOMPOSITION

Students will be able to break down higher-order problems involving interdependent clues and constraints, using information from:

- Numerical clues involving place value, operations, factors, multiples, and comparisons
- Properties of 2D and 3D shapes (faces, edges, vertices, diagonals, angles
- Multi-step transfers or exchanges (money, quantities, digits, objects) with conditions
- Tables, grids, or charts requiring cross-referencing of multiple data points
- Conditional rules for counting, grouping, sorting, or eliminating possibilities
- Visual representations that encode numerical or logical values

ALGORITHMIC THINKING

Students will be able to follow, analyse, and apply multi-layered rules and procedures to solve complex problems involving:

- Number sequences formed using combined operations and logical conditions
- Movement on grids involving direction, distance, turns, and path constraints
- Stepwise changes where values increase/decrease based on rules
- Multi-step instructions involving swaps, shifts, transfers, and rearrangements
- Ordering people, objects, or events using multiple attributes or clues
- Logical flow of steps, identifying necessary vs redundant information

Artificial Intelligence (AI) Learning Outcomes

Learners will be able to:

- Summarise the basic ideas and concepts of AI and its application
- Describe key differences between machine intelligence and human intelligence
- Explain the difference between automation and AI using practical, real-world cases.
- Differentiate the three fundamental AI methodologies, namely supervised, unsupervised, and reinforcement learning
- Develop the skill of organizing and representing data and its various forms, including text, numbers, images, and sounds

- Recognize simple patterns in data and make decisions based on observations
- Demonstrate an understanding of ethics and digital responsibility in the use of AI, including digital footprints, privacy, and responsible technology behaviour.
- Practice essential internet safety protocols, such as creating secure passwords, maintaining safe online behaviour, and applying basic privacy measures while using digital and AI tools.
- Apply conceptual knowledge of AI to everyday activities by recognising human-centred design and ethical principles in how AI works and interacts with people

4. Mapped with NEP and NCF 2023

The Grade 6 curriculum is directly derived from the Aims of School Education outlined in the National Curriculum Framework for School Education (NCF-SE) 2023. It fulfills the NEP 2020 mandate to integrate Machine Learning and Computational Thinking into the school journey to foster creativity and interdisciplinary exploration.

5. Time Allocation

The Middle Stage (Classes 6–8) requires 100 hours annually. For Grade 6, this time is specifically divided as follows:

- **Advanced CT Skills:** 40 hours
- **Introductory AI Concepts:** 20 hours
- **Interdisciplinary Projects:** 40 hours (20 hours each for two projects)

6. Approach / Pedagogy

The pedagogical approach for Grade 6 is activity-based and inquiry-driven:

- **Experiential Learning:** Students engage with complex puzzles, riddles, and hands-on real-world problems
- **Collaborative Work:** The curriculum emphasizes group discussions, debates, and collaborative projects to solve multidisciplinary challenges
- **Project-Based Learning:** Students use AI tools and data analysis to create solutions for community or fictional city issues

7. Assessment

Assessment shifts from rote memorization to continuous, formative, and competency-based evaluation. Methods include:

- **Performance-Based Tools:** Project presentations, assignments, and reflective journals
- **Practical Evaluation:** Written tests with CT puzzles, practical examinations, and interactive activities
- **Qualitative Feedback:** Teachers use clear rubrics and Observation Journals to ensure consistency in tracking student development

How to Use This Book?

PART-1 Computational Thinking

Part 1 of this book is designed as a companion to the Mathematics textbook and is intended to be used alongside regular classroom teaching. Since it follows the same chapter sequence, the Mathematics teacher can seamlessly integrate it into daily instruction. As concepts are introduced in class, the corresponding questions from this book can be used to deepen understanding and encourage application.

Before beginning a chapter, the teacher is encouraged to read and identify the underlying concepts required for each question and plan how to align them with classroom teaching. As these concepts are taught, the teacher can introduce the related 'thinking questions' to students. It is important to note that the questions in this book are thinking-based and designed to promote analysis, reasoning, and problem-solving.

Teachers should adopt a facilitative approach, guiding students through prompts and discussions rather than directly providing solutions. Students should be given time to think and attempt independently, followed by classroom discussions where different approaches are shared and explored.

Some chapters also include activities that build intuition and engagement. These should be conducted before attempting the questions, as they help students approach the problems with better understanding.

PART-2 Artificial Intelligence

Part 2 of the handbook provides a structured introduction to Artificial Intelligence (AI) as a technology that enables machines to learn from data, recognise patterns, and make decisions. The concepts of AI are presented using simple explanations and real-life examples from areas such as healthcare, education, transport, and communication.

Each chapter includes:

- Foundational understanding of AI concepts
- Real-life examples and applications of AI
- Introduction to key AI domains such as Data Science, Computer Vision, and Natural Language Processing
- Activities and data-based tasks
- Reflection on ethical use of AI

The AI content progresses from introduction to application, including introductory predictive techniques such as regression, classification, and clustering. The book emphasises ethical and responsible use of AI, including introduction to bias, fairness, privacy, and safe use of technology, enabling informed and thoughtful engagement with AI systems.

Teachers should approach the book with the mindset that the process of thinking is more important than arriving at the correct answer. Creating a safe and encouraging environment where students feel comfortable making mistakes, exploring multiple strategies, and expressing their reasoning is essential. The goal is to nurture confident, independent thinkers rather than focus solely on correctness.

PART 1
COMPUTATIONAL THINKING

Chapter 1: Patterns in Mathematics

1. **The following series follows a fixed pattern:**
   2, 3, 3, 4, 4, 4, 5, 5, 5, 5, 6, …
   If the pattern continues, determine how many times the number 9 appears in the NEXT 20 terms.

   a) 3 b) 4 c) 7 d) 8

   Answer: a

   Solution:

   The series is made up of consecutive natural numbers, starting from 2.

   Each number follows this fixed rule:

   A number n appears exactly $(n-1)$ times

   For example:

   Number 2 appears (2 - 1) 1 time.

   Number 3 appears (3 - 1) 2 times.

   From the given series, **one 6 has already appeared**.

   So, in the next 20 terms:

   - **6** appears **4 more times**
   - **7** appears **6 times**
   - **8** appears **7 times**

   Total terms before 9 appears:

   4 + 6 + 7 = 17

   Out of the next 20 terms, **17 terms are not 9**, leaving:

   20 − 17 = 3

   So, **9 appears 3 times** in the next 20 terms.

   The sequence is:

   2, 3, 3, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9,.....

   20 Terms

   Hence, the correct answer is **option a**.

---

2. **The following number series is based on a pattern. One term is incorrect. Identify the incorrect term.**
   2, 3, 6, 11, 18, 25, 38, 51, 66, 83

   a) 11 b) 25 c) 51 d) 66

   Answer: b

   Solution:

   When analysing a number series, the **first step** is to check the **difference between consecutive terms**, as many series are formed using a pattern of differences.

   Step 1: Find the differences

   - 3 − 2 = 1
   - 6 − 3 = 3
   - 11 − 6 = 5
   - 18 − 11 = 7
   - 25 − 18 = 7
   - 38 − 25 = 13
   - 51 − 38 = 13

- 66 − 51 = 15
- 83 − 66 = 17

Step 2: Identify the pattern
The differences are expected to follow **consecutive odd numbers**:
1, 3, 5, 7, 9, 11, 13, 15, 17, …

Step 3: Verify the terms
Check the 4th and the 5th term, after the difference of 7, the next difference should be **9**, which gives:
18 + 9 = 27
However, **25** is given instead.

Conclusion
Since **25** does not fit the pattern, it is the **wrong term** in the series.
The correct sequence is: 2, 3, 6, 11, 18, **27**, 38, 51, 66, 83
Option b is the correct answer.

---

3. What will come in place of "?" in the given series?

1@3, #5#, 7@9, #11#, 13@15, ?, 19@21

a) @17@ b) #15# c) 16#18 d) #17#

Answer: d

Solution:

Each term is actually a group of three consecutive numbers (1-2-3, 4-5-6, and so on). However, only odd numbers can be seen and even numbers in each group are replaced by symbols:

- The even numbers from the odd-positioned terms are replaced by "@"
- The even numbers from the even-positioned terms are replaced by "#"

We have to find the 6th term of the series (even-positioned term).

As it is an even-positioned term, the symbol that replaces the even numbers in that term is "#".

As the previous term was 13@15 (which is 13-14-15), the next term will have 16-17-18.

When the even numbers in this term are replaced by "#", we get: #17#.

Therefore, the 6th term of the series is: #17#, which is option d.

Hence, option d is the correct answer.

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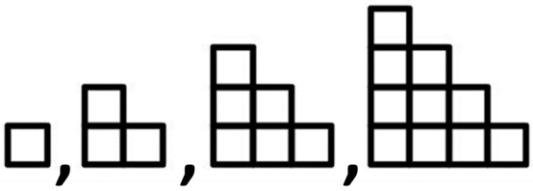
4. The first four terms of a block series are shown below.
If the pattern continues in the same manner, which term of the series will be the first to contain more than 20 blocks?



a) 5th term b) 6th term c) 7th term d) 8th term

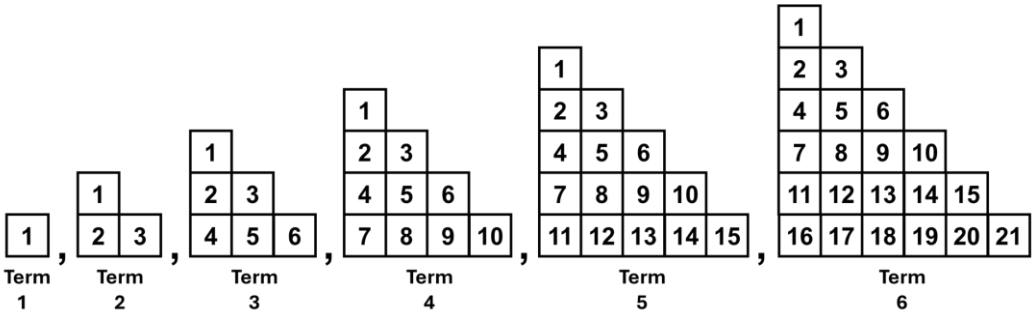
Answer: b

Solution:

In each next term, a new row is added at the bottom, with one extra block than the row above it (continuing the same step pattern).

So, the 5th term will have an extra row at the bottom, and that row contains one more block (4 + 1 = 5) than the row above it. Hence, the 5th term will have a total of 15 blocks.

Similarly, the 6th term will have one extra row compared to the 5th term, and that row contains one more block (5 + 1 = 6) than the row above it. Hence, the 6th term will have a total of 21 blocks, which is the first term to have more than 20 blocks.
Hence, the correct answer is **option b**.



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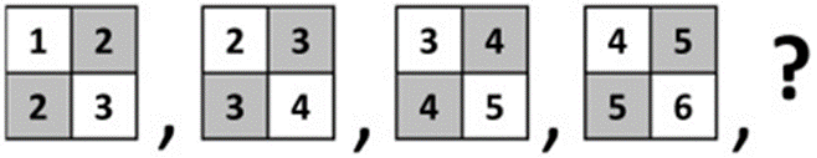
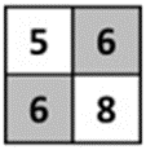
5. What will come in place of "?" in the given series?



a) 
b) 
c) 
d) 

Answer: d

Solution:

First, observe how the numbers change **from one term to the next**.
Each term is a **2 × 2 grid** containing four numbers.
When we compare consecutive terms, we see that **each number in the grid increases by 1** as we move to the next term.
For example:

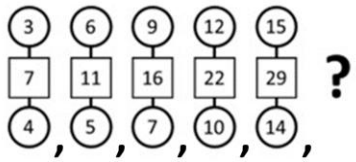
- Top-left number: 1 - 2 - 3 - 4
- Top-right number: 2 - 3 - 4 - 5
- Bottom-left number: 2 - 3 - 4 - 5
- Bottom-right number: 3 - 4 - 5 - 6

Since this same pattern continues, the next term will have **all four numbers increased by 1** compared to the previous term.
So, the next grid will be:

- Top-left: 5
- Top-right: 6
- Bottom-left: 6
- Bottom-right: 7

This matches **option d**.
Thus, option d is the correct answer.

6. What will come in place of "?" in the given series?



a) 

b) 

c) 

d) 

Answer: c

Solution:

First, observe the pattern in each position separately: top **circle, middle square, and bottom circle**.

Top circles:

The numbers increase by **3** each time:

3, 6, 9, 12, 15, **18**

Bottom circles:

The differences increase by 1 each time:

4 to 5 (+1), 5 to 7 (+2), 7 to 10 (+3), 10 to 14 (+4)

So, the next increase is **+5**:

14 + 5 = **19**

Middle squares: Each middle number is the **sum of the numbers in the top and bottom circles:**

3 + 4 = 7, 6 + 5 = 11, 9 + 7 = 16, 12 + 10 = 22, 15 + 14 = 29

So, the next middle number is:

18 + 19 = **37**

Thus, the missing figure contains **18 (top), 37 (middle), and 19 (bottom)**.

Hence, the correct answer is **option c**.

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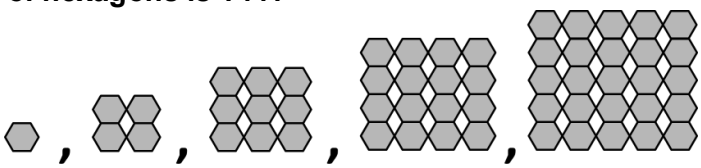
7. The first five terms of a series formed using grey hexagons and white diamonds are given below. If the same pattern continues, how many diamonds will be present in the term where the number of hexagons is 144?



a) 100 b) 135 c) 121 d) 169

Answer: c

Solution:

From the pattern, we observe:

Term 1: 1 hexagon, 0 diamonds

Term 2: 4 hexagons, 1 diamond

Term 3: 9 hexagons, 4 diamonds

Term 4: 16 hexagons, 9 diamonds

Term 5: 25 hexagons, 16 diamonds

Here, the hexagons follow the pattern 1, 4, 9, 16, 25 and so on, while the diamonds follow the pattern 0, 1, 4, 9, 16 and so on. (where all are square numbers)

We notice that, in each term:

Number of hexagons = n^2
Number of diamonds = $(n - 1)^2$
Now, we have to find the number of diamonds in a term that has 144 hexagons.
144 hexagons = 12^2
So, the number of diamonds = $(12 - 1)^2 = 11^2 = 121$
So, there will be **121 diamonds** when there are 144 hexagons.
Hence, the correct answer is **option c**.

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8. Given below are two sets of numbers, P and Q. Which number from Set P can be interchanged with a number from Set Q such that both new sets follow a particular series or pattern?
Set P: (18, 22, 24, 27, 30)
Set Q: (21, 24, 27, 31, 36)

a) 18 b) 27 c) 22 d) 30

Answer: c
Solution:
How to Approach Pattern Questions

- Look at the numbers and check if **most of them already follow a clear pattern**
- Identify the **most natural pattern**, such as:
  - Adding the same number each time
  - Increasing differences
  - Multiples, skips, or repeated operations
- Find the **number that breaks this pattern**
- Change or interchange **only that number**
- Verify the pattern again to ensure **all numbers now follow the same rule**

Step 1: Examine Set P
Set P: 18, 22, 24, 27, 30
At first glance, the differences are not consistent.
However, the last three numbers: 24, 27, 30 (clearly increase by 3).
This suggests that **Set P may be intended to follow a +3 pattern.**
If that is the case, the sequence would look like:
18, 21, 24, 27, 30
Comparing this with the given set, we see that **22 does not fit this pattern.**
So, **22 is a possible incorrect term** in Set P and would need to be replaced by **21** to make the pattern consistent.

Step 2: Check if the required replacement exists in Set Q
Set Q: 21, 24, 27, 31, 36
Since **21 is already present in Set Q**, an interchange is possible.
Now, before finalising, we must check whether **replacing 21 with 22** in Set Q creates a valid pattern there.

Step 3: Examine Set Q after the interchange
After replacing 21 with 22, Set Q becomes:
22, 24, 27, 31, 36
The differences are now:
+2, +3, +4, +5
This forms a **clear and consistent increasing-difference pattern**.

Step 4: Final Verification
After interchanging **22 and 21**:

- **Set P: 18, 21, 24, 27, 30** (constant increase of 3)

- **Set Q: 22, 24, 27, 31, 36** (differences increasing by 1)

Both sets now follow **simple and logical patterns**.
Thus, the number 22 from Set P is interchanged with the number 21 from Set Q.
Hence, option c is the correct answer.

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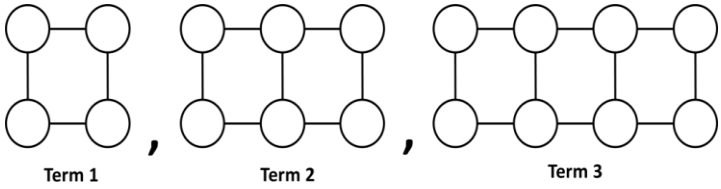
9. The first three terms of a series of circles are shown below. If the pattern continues in the same manner, how many circles will be there in term 91?



a) 184 b) 180 c) 194 d) 204

Answer: a

Solution:

In the first term, there are 4 circles arranged in 2 columns, with 2 circles in each column. In the second term, one more column of circles is added, making a total of 3 columns.
Similarly, in term 3, the number of columns is 4.
Term 1 has 2 columns (1 + 1 = 2)
Term 2 has 3 columns (2 + 1 = 3)
Term 3 has 4 columns (3 + 1 = 4)
Hence, we can say that, the number of columns of circles in each term is 1 more than the position of that term.
Based on the same rule, the number of columns in term 91 will be 91 + 1 = 92.
As each column contains two circles (one above and one below), the total number of circles in term 91 is 92 x 2 = 184.
Hence, there will be 184 circles in term 91.
The correct answer is option a.

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10. A pyramid has to be formed by combining cubes. Every level will have two fewer cubes than the level below it. If a pyramid is formed using at most 30 cubes, what is the maximum number of levels it can have?

a) 3 b) 4 c) 5 d) 6

Answer: c

Solution:

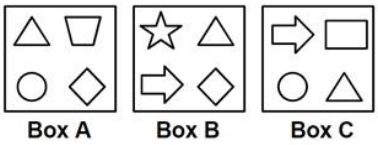
To get the maximum number of levels, the top level must have the smallest possible number of cubes, and the number of cubes should increase as we move to the lower levels.

Therefore, the number of cubes in the levels will be 1, 3, 5, 7, and 9 from top to bottom.

Total cubes in these 5 levels will be 25. After that, to add a level, we will need 11 cubes, which we don't have.
Now, if we take 2 as the least number of cubes in the top level and keep adding as we go down the levels, the number of cubes in the levels will be 2, 4, 6, 8, and 10 from top to bottom. Thus, in both arrangements, the pyramid will have 5 levels.

Hence, option c is the correct answer.

You must shoot exactly one item from each box, to eliminate it from its box. When an item is shot, the same item in the adjacent box is also eliminated. What is the MAXIMUM number of items that can be eliminated, after all 3 shots?



(a) 4 (b) 5 (c) 6 (d) 7

Answer: d

Solution:

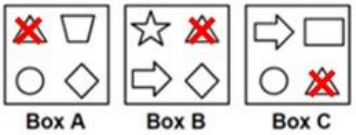
When we consider boxes A and B, we can see that two different shapes (rhombus and triangle) are common between them.

So, if the triangle is shot in box A, the same shape will be eliminated from box B, leading to two eliminations.

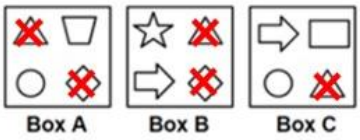
But, if you observe carefully, the triangle is the only shape that is common across all three boxes.

This means that if you shoot the triangle from box B, the triangles from the boxes on either side (A and C) will also be eliminated, making three eliminations in one go.

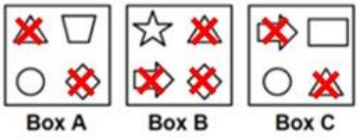
So, to maximise the number of items eliminated, it is ideal to shoot the triangle from box B.



Then, the rhombus from box A will be shot and the same shape will be eliminated from box B.



Finally, the arrow from box C will be shot and the same shape will be eliminated from box B.

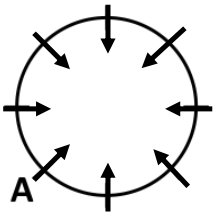


Hence, the maximum items that can be eliminated = 7 (3 triangles, 2 rhombuses, and 2 arrows). Option d is correct.

Chapter 2: Lines and Angles

1. **Eight friends (A, B, C, D, E, F, G, H) are sitting at equidistant positions around a circular table, each facing towards the centre, as shown below.**
   - **A is facing North-East**
   - **B and D are facing perpendicular directions**
   - **B is to the immediate left of A; while C is exactly between E and F**
   - **B and F are facing opposite directions**

   If G is sitting exactly between B and D, what is the angle between the directions that A and C are facing?

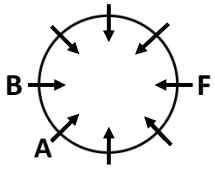


a) 45 degrees b) 90 degrees c) 135 degrees d) 180 degrees

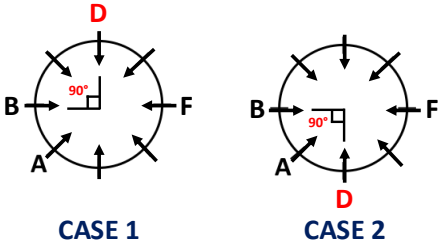
Answer: b

Solution:

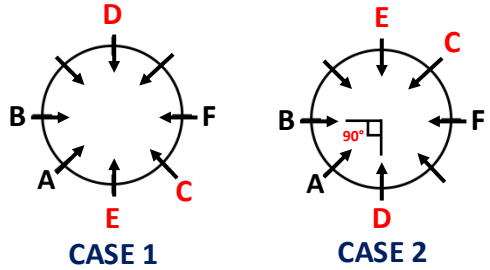
B is to the immediate left of A. Also, B and F are facing opposite directions.



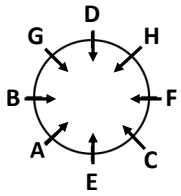
B and D are facing perpendicular directions. Two possible arrangements are formed:



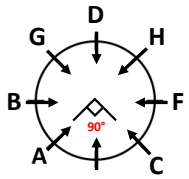
C is exactly between E and F.



However, as G is sitting exactly between B and D, case 2 is invalid.
As per case 1, the final arrangement can be seen:



Now, we have to find the angle between the directions of A and C.
As the angle around a circle is 360°, and there are 8 equidistant positions, the angle between two adjacent people = 360/8 = 45°.
Hence, the angle between A and C will be 90°, as highlighted below.



The correct answer is option b.

---

2. Avi and Sam attend dance sessions in the afternoon.

- **Avi's session starts when the angle between the hour hand and the minute hand of the clock is 60 degrees**
- **Sam's session starts at 1:55 PM**

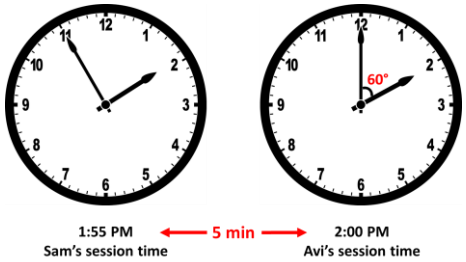
What is the least possible difference between the starting times of both sessions?

a) 2 minutes b) 5 minutes c) 10 minutes d) 15 minutes

Answer: b

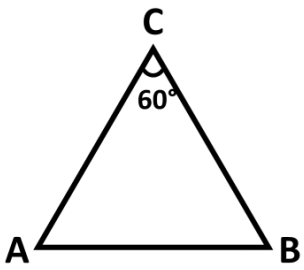
Solution:

Given that Avi's session started when the angle between the hour hand and the minute hand of the clock is 60 degrees.
We know that the complete angle around a clock is 360 degrees.
So, 60 minutes = 360 degrees
Hence, 10 minutes = 60 degrees
So, 60 degrees exist between the hands of a clock, only when they are 10 minutes apart.
This means that when Avi's session started, the hands of the clock were positioned so that they were 10 minutes apart.
Sam's session starts at 1:55 PM and we need to find Avi's session time.
To minimize the difference between the starting times of both the sessions, we have to consider a time that gives 60-degree angle between the hands and it must be as close to 1:55 as possible.
The time that gives 60-degree angle immediately after 1:55 PM is 2:00 PM (One hand at 12 and another hand at 2, which make 60 degrees)
Hence, the least possible difference between the starting times of both sessions is:
2:00 PM - 1:55 PM = 5 minutes.



Hence, option b is correct.

3. **An equilateral triangle (all the angles are equal) is given below. At minimum, by how many degrees should the given triangle be rotated anticlockwise so that it looks exactly like the original triangle?**

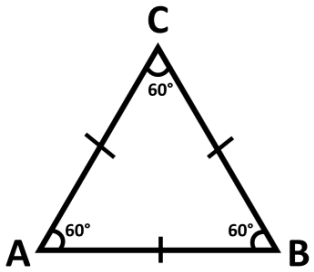


a) 30 degrees b) 60 degrees c) 120 degrees d) 90 degrees

Answer: c

Solution:

Given that all three angles are 60° (equal angles), and all three sides of the triangle are equal (equilateral triangle)



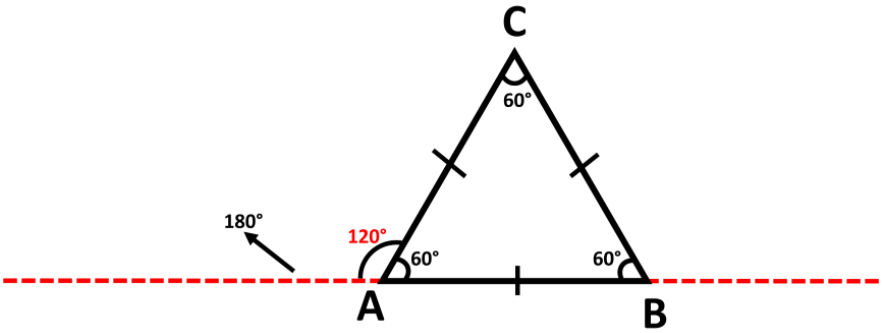
Now, we need to rotate the triangle in anti-clockwise direction, in such a way that side AC lies horizontally (just like the current side AB)

We know that the angle made by a straight line is 180°.

Also, angle CAB is 60°.

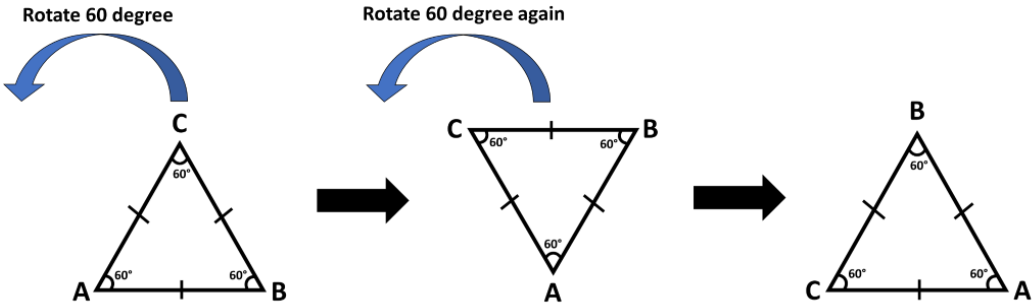
To make the next side lie on the same straight line again, the triangle must rotate through the remaining angle:

180° − 60° = 120°



Therefore, the triangle must be rotated **120° in the anticlockwise direction** to look exactly the same again.

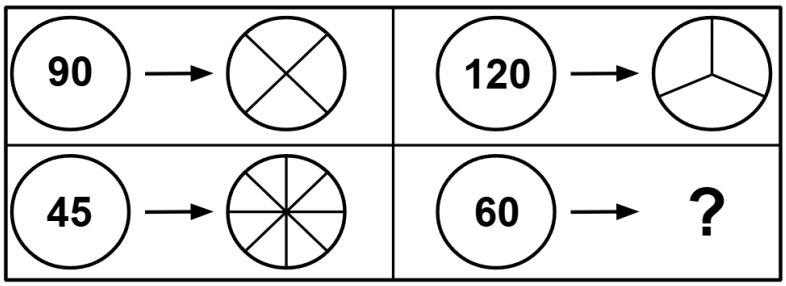
As shown, rotating it by 60° does not give the same position (the triangle looks inverted), but rotating it by **120°** brings the triangle back to an identical appearance.

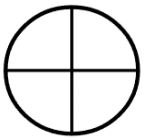
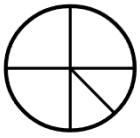
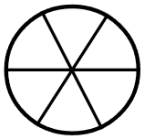
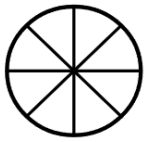


Hence, option c is correct.

---

4. What will come in place of "?"



a)  b)  c)  d) 

Answer: c

Solution:

The number inside the circle decides how many equal parts the circle is divided into.

A full circle is **360 degrees**.

So, we divide **360** by the number given inside the circle to find the number of parts.

- 360 ÷ 90 = 4 parts
- 360 ÷ 120 = 3 parts
- 360 ÷ 45 = 8 parts

Now for **60**:

360 ÷ 60 = **6**

So, the circle should be divided into **6 equal parts**.

Hence, option c is the correct answer.

---

5. A and B visit a park in the evening.

- **When A visited the park, the minute hand pointed at 12, and the other hand was 150° clockwise from it**
- **When B visited the park, the hour hand pointed at 5, and the other hand was 210° clockwise from it**

Based on the given information, which of the following statements is true?

a) A visited the park before B
b) B visited the park before A
c) A and B visited exactly at the same time
d) None of the above

Answer: c

Solution:

On a clock:

- A full circle = **360°**

- There are **12 numbers**, so the angle between two adjacent numbers is **360° ÷ 12 = 30°**

When A visited the park:

- The **minute hand** was pointing at 12
- The **other hand** (hour hand) was 150° clockwise from the minute hand

To find how many numbers apart this is:

$$150° \div 30° = 5$$

So, the hour hand is 5 numbers ahead of 12, i.e., at 5.
The time when A visited the park was 5:00.

When B visited the park:

- The **hour hand** was pointing at **5**
- The **other hand** (minute hand) was **210° clockwise** from it.

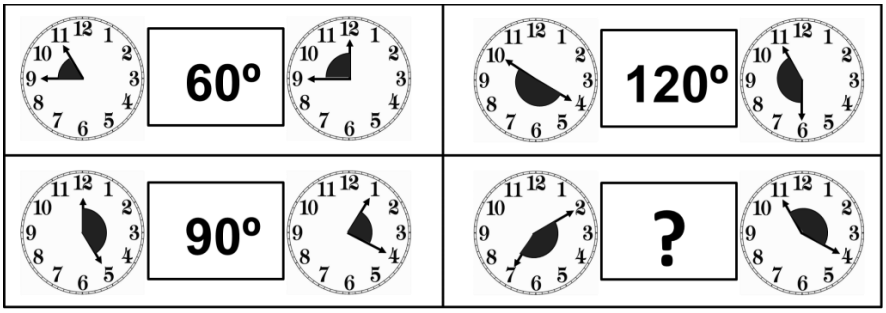
To find how many numbers apart this is:

$$210° \div 30° = 7$$

Moving **7 numbers clockwise from 5** lands on **12**.
The time when B visited the park was also **5:00**.
As both of them visited in the evening, the time was 5:00 pm and it can be definitely implied that A and B visited exactly at the same time. Therefore, the correct answer is option c.

---

6. What will come in place of "?"



a) 40° b) 60° c) 90° d) 30°

Answer: b

Solution:

A clock is a circle of **360°** and has **12 numbers**, so the gap between two numbers is **30°**.
In each set, we look at **both clocks** and find the **common angle covered** by the hands.

- **First set: 60°**
  The common part between the two clocks covers **2 number gaps** (9 to 11),
  2 × 30° = 60°
  So, the centre shows **60°**.
- **Second set: 120°**
  The common part covers **4 number gaps** (6 to 10),
  4 × 30° = 120°
  So, the centre shows **120°**.
- **Third set: 90°**
  The common part covers **3 number gaps** (1 to 4),
  3 × 30° = 90°
  So, the centre shows **90°**.

- **Question set:**
  The common part between the two clocks covers **2 number gaps** (2 to 4),
  2 × 30° = 60°

Thus, the missing value is 60°. Hence, option b is the correct answer.

---

7. How many times in a day, on a 12 - hour format clock, do the minute and hour hands form a straight line (i.e., an angle of 180°)?

a) 11 b) 12 c) 22 d) 24

Answer: c

Solution:

In a clock, the **minute hand moves faster than the hour hand**. Because of this difference in speed, the minute hand repeatedly moves ahead of the hour hand and at certain moments the two hands become **exactly opposite to each other**, forming a **straight line (180°)**.

Let us examine the clock **hour by hour from 12:00 a.m. to 12:00 p.m.**

These 12 hours can be divided into **12 intervals**:

- 12:00 – 1:00
- 1:00 – 2:00
- 2:00 – 3:00
- …
- 11:00 – 12:00

In **most of these hourly intervals**, the hands form a **straight line exactly once**.

However, there is a **special situation around 6 o'clock**.

At **6:00**, the hour hand is at **6** and the minute hand is at **12**, so the two hands are already **exactly opposite each other**, forming a **straight line**.

Now notice what happens when we count hour by hour:

- When considering the interval **5:00 to 6:00**, we count the straight line that occurs at **6:00**
- When considering the interval **6:00 to 7:00**, we again count the same straight line at **6:00**

So, the **same occurrence at 6:00 gets counted twice**, even though it happens **only once in reality**.

Therefore, from the **12 possible hourly cases**, we must **subtract 1** to remove this double counting.

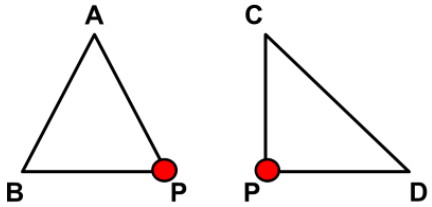
Thus, in **12 hours**, the hands form a straight line: 12 – 1 = 11 times

Since a **day has 24 hours**, this happens **twice in a day**: 11 x 2 = 22

Hence, the hands of a clock are in a straight line **22 times in a day**. Option c is the correct answer.

---

8. In the given figure, Triangle 2 is a right-angled triangle. Both triangles are arranged such that the red circles completely overlap, meaning both the triangles meet at point P. The triangles cannot be rotated or flipped. If an angle of 30° is formed between Triangle 1 and Triangle 2 at point P, find the value of ∠APD?



Triangle 1 **Triangle 2**

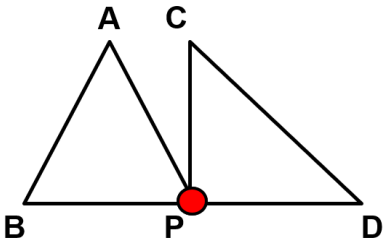
a) 110° b) 120° c) 130° d) 150°

Answer: b

Solution:

Let's solve it step by step:

When triangles 1 and 2 are arranged such that the red circles overlap each other, the arrangement looks like this:



It is mentioned that an angle of 30° is formed between Triangle 1 and Triangle 2 at point P.

In the image, we can see the acute angle ∠APC, with vertex as P.

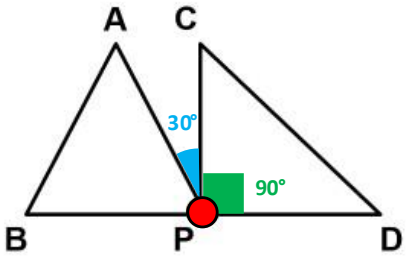
Thus, we can say that ∠APC = 30°.

As mentioned in question, Triangle 2 is a right-angled triangle

Thus, we can say that ∠CPD = 90°.

∠APD = ∠APC + ∠CPD

We can see that ∠APD = 30° + 90° = 120°.



Therefore, the correct answer is option b.

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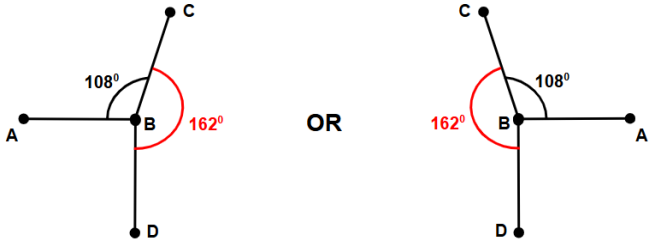
9. Sam draws three line segments AB, BC, and BD (with a common point B) on a sheet of paper ∠ABC = 108° and ∠CBD = 162°, and these angles lie on either side of the line segment BC. Later, he draws a pair of parallel line segments EF and GH, both perpendicularly intersecting BD. How many pairs of parallel line segments appear on the sheet, finally?

a) 1 b) 2 c) 3 d) 4

Answer: c

Solution:

It is given that ∠ABC = 108° and ∠CBD = 162°, and these angles lie on either side of BC.



So,

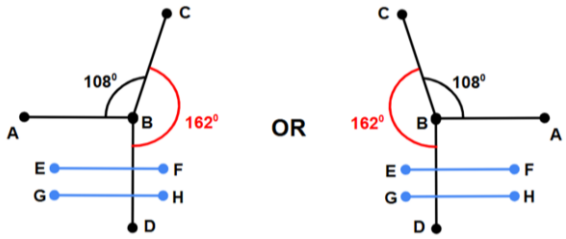
∠ABD = 360° − (108° + 162°)

∠ABD = 360° − 270°

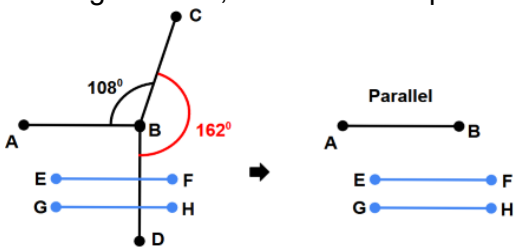
∠ABD = 90°

This means AB is perpendicular to BD.

It is also given that EF and GH are drawn perpendicular to BD.



Whatever the case, as AB is perpendicular to BD and both EF & GH are also perpendicular to the same line segment BD, all of them are parallel to each other.



Thus, the pairs of parallel line segments are:

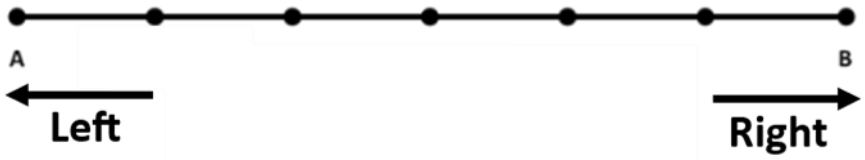
1) AB - EF
2) AB - GH
3) EF - GH

Hence, there are three such pairs of parallel line segments. Thus, option c is the correct answer.

---

10. A line segment AB is shown below. Five points: C, D, E, F, and G lie on the line segment AB such that

- All the points (including A and B) are at equal intervals
- The length of segment CB is equal to the length of segment GD
- Point E is immediately to the right of point C
- Point F cannot be next to E or D
Which segment among the following options is the longest?



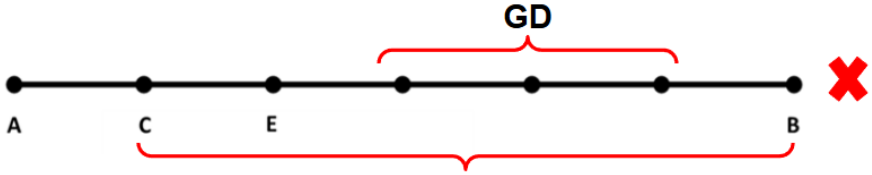
a) GC b) FE c) GE d) FD

Answer: d

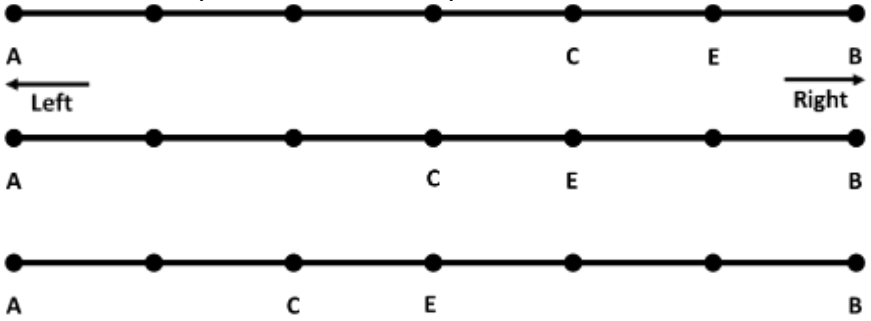
Solution:

We cannot place C immediately next to B, as E is on the immediate right to C.

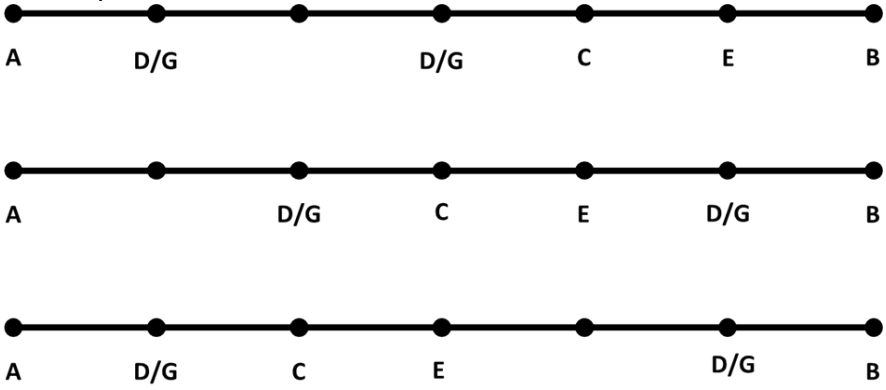
Also, we cannot place C immediately next to A, as the length of segment CB is equal to the length of segment GD, and it is not possible to have both points G and D between C and B.



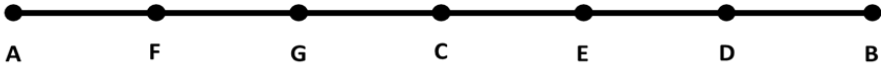
There are three possibilities for the positions of C and E:



And the placement for G and D can be as follows:



As F cannot be next to E or D, the first and third cases are eliminated.
Hence, the final arrangement is:



Clearly, among the given options, FD is the longest line segment.
Thus, option d is the correct answer.

The Thinking Spot

There are four ropes: A, B, C, and D. Each rope has a different length and a different colour chosen from Blue, Red, Green, and Yellow. Rope B is longer than only the Green rope. The Blue rope is longer than B but shorter than C. Rope A is not Blue. If the Yellow rope is the longest, which rope is Red?

(a) A (b) B (c) C (d) D

Answer: b

Solution:
Ropes A, B, C, and D have different length and colour.
Rope B is longer than only the green rope.

Rope:	_____ > _____ > **B** > _____
Colour:	**Green**

The blue rope is longer than B but shorter than C.

Rope:	**C** > _____ > **B** > _____
Colour:	**Blue** **Green**

A is not blue.

Rope:	**C** > **D** > **B** > **A**
Colour:	**Blue** **Green**

As per the question, the longest rope is yellow in colour.
This means that C is yellow.
Therefore, B is the red rope.

Rope:	**C** > **D** > **B** > **A**
Colour:	**Yellow** **Blue** **Red** **Green**

Hence, the correct answer is option b.

Chapter 3: Number Play

1. **Sachin plays a game using a standard die numbered 1 to 6. At each roll, he scores points equal to the number shown. He may roll the die any number of times.**
   The game ends when the number 6 appears three times (the three 6's need not be consecutive).
   If the total score at the end of the game is 29, what is the minimum number of rolls Sachin could have made?

   a) 4 b) 5 c) 6 d) 7

   Answer: c

   Solution:

   It is given that the game ends when Sachin gets **6 on three turns**.

   So, he must have scored **6 three times**, which gives:

   3 × 6 = **18 points**

   Since his total score is **29 points**, the remaining score must be:

   29 − 18 = **11 points**

   To minimise the number of turns, we should assume the **highest possible score in each remaining turn**.

   If the remaining 11 points were scored as **6 + 5**, the sequence of rolls would be:
   6, 5, 6, 6, 6 (five turns)

   However, this is **not possible**, because once Sachin gets **three 6s**, the game ends immediately. He would not get another chance to roll the die.

   So, the remaining **11 points must be scored without using another 6**.

   Since 6 cannot be used, let us consider the other possibilities to score 11.

   - 5 + 5 + 1 = 11 points
   - 5 + 4 + 2 = 11 points
   - 4 + 4 + 3 = 11 points

   However, in any case Sachin has to roll the dice at least 3 more times after 3 sixes.

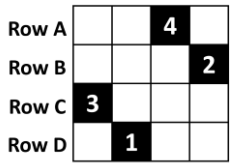
   Therefore, Sachin must have rolled the die **at least six times**, scoring:
   1, 5, 5, 6, 6, 6 or **3, 4, 4, 6, 6, 6** or **2, 4, 5, 6, 6, 6** (in any order) to obtain a total of **29 points**.

   Hence, **option c** is the correct answer.

---

2. **In the given grid, each white square contains 1, 2, 3, or 4 hidden coins.**
   Each black square shows the maximum number of coins present in any of its adjacent white squares.
   If every row has the same total number of coins, what is the MAXIMUM possible number of white squares that contain exactly one coin?

   Note: *Two squares are adjacent only if they share a common side. Squares that share a common corner alone, are NOT considered as adjacent*



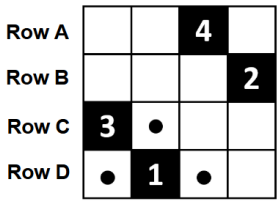
   a) 5 b) 6 c) 7 d) 8

   Answer: c

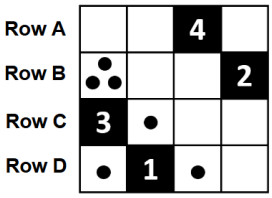
Solution:

Let's solve this in a logical way.

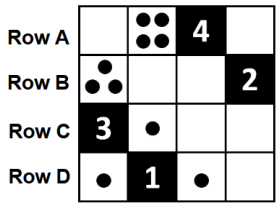
It is mentioned that the number on the black square represents the highest number of coins that its adjacent square has. So, all the squares adjacent to 1 must have only one coin.



Now, the only option left for the black square with 3 is to have 3 coins in the square above it.



Similarly, the black square having 4 must have 4 coins in any of its adjacent squares, but they cannot be adjacent to the black square having 2. So, 4 has only one possibility.



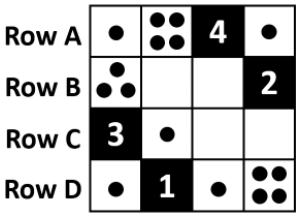
We know that every row has the same number of coins.

Observe Row A.

As it already has 4 coins in a square, the total number of coins in a row is definitely 6 or more than 6. (as the other 2 squares of row 1 will have at least one coin each: 4 + 1 + 1 = 6).

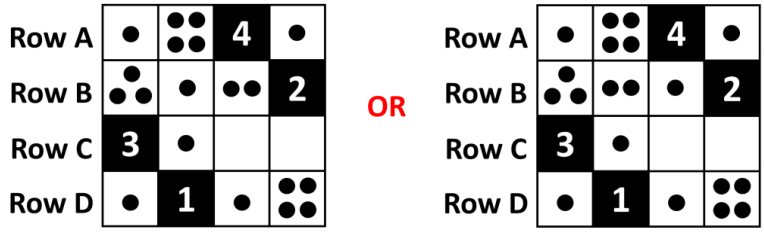
However, if the total number of coins in a row is more than 6, then the last empty square of row D must have more than 4 coins in it to get the total (1 + 1 + 5), which is invalid. (a square can have only 1 to 4 coins)

Therefore, the total number of coins in each row is definitely 6. Thus, rows A and D can be filled as:



Let's move to Row B:

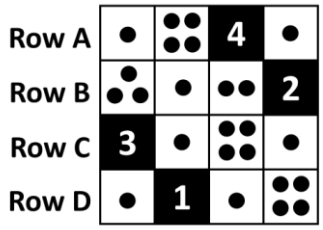
It has 3 coins already and we need to fill 3 more coins in two squares. The only possible combination of 3 here is 1 + 2 (in any order of the squares)



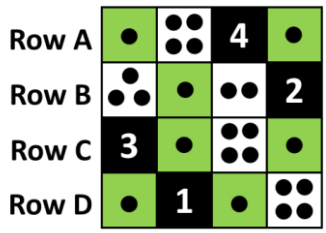
Similarly, row C has 1 coin already and we need to add 5 more coins in this row.

Now think, 5 coins can be made as a combination of 2 + 3 (or) 4 + 1.

But, as we are trying to detect the highest possible number of squares that can have only one coin in them, the combination that we choose must be 1 + 4.



Therefore, the number of squares that can have only one coin in them are 7.
Option c is correct.



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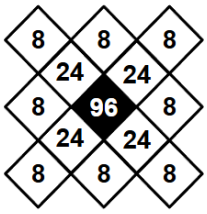
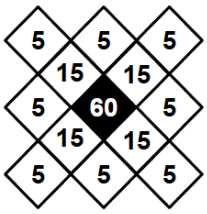
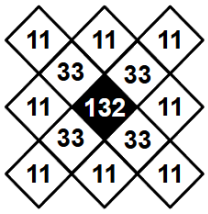
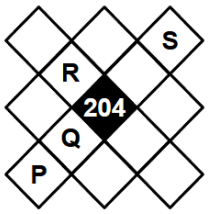
3. If each of the given terms follows the same theme, what will be the value of P + Q + R + S?









a) 134 b) 136 c) 119 d) 142

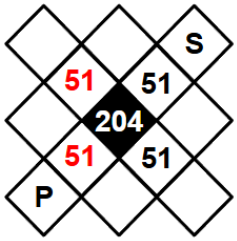
Answer: b

Solution:

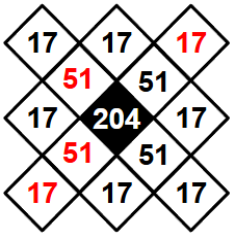
The following theme can be seen in each term:
In every term, the number in the black cell is split into 4 equal portions, as there are four white cells adjoining it (the ones connected directly along its sides), where each portion is written in each cell. *(for example, in the first term, 96 ÷ 4 = 24)*

Similarly, the numbers adjacent to the black cell (the ones connected to the black cell along its edges) are split into three equal portions as each of them has three adjacent white cells. Each portion is written in each outer cell. *(for example, in the first term, 24 ÷ 3 = 8)*

Based on the same theme, in the question term, we have 204 in the black cell.
As 204 ÷ 4 = 51, we must have 51 in each of its adjacent cells. Q = R = 51



Now, each 51 is split into three equal portions.
As 51 ÷ 3 = 17, all the outer numbers will be 17. P = S = 17



P + Q + R + S = 17 + 51 + 51 + 17 = 136
Option b is the correct answer.

---

4. An arrow between any two squares, always points towards the square having a larger number. A and B are two DIFFERENT numbers. If the largest 5-digit number is formed using all five squares, what will be the difference between the final number and 10000?

a) 44332 b) 54545 c) 54432 d) 44432

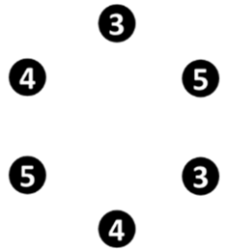
Answer: d

Solution:

Let's look at B first.
B has an arrow pointing towards it from 2. So, B must be greater than 2.
Also, B has an arrow pointing away from it towards 4. So, B must be less than 4.
Thus, B must be 3.

Now, let's look at A.
A has an arrow pointing towards it from 2. So, A must be greater than 2.
Also, A has an arrow pointing away from it towards 5. So, A must be less than 5.
The only possible numbers are 3 and 4.
But we already know that B is 3.
So, A must be 4.
Thus, the values of all five squares are: 5, 4, 2, 3, and 4.
The largest 5-digit number formed using all five squares is: 54432.
Now, we have to determine the difference between this number and 10000.
54432 - 10000 = 44432.
Hence, option d is the correct answer.

5. How many different triangles can be formed by connecting the black dots in the image below, where the sum of the numbers at their corners is 12?



a) 7 b) 6 c) 8 d) 5

Answer: c

Solution:

We need three numbers whose sum is 12.

The given image has only 3 unique numbers: 3, 4, and 5.

Let's assume that all three corner numbers of a triangle are equal.

As 12/3 = 4, we need three 4s to connect a triangle. But, the above image has only two 4s.

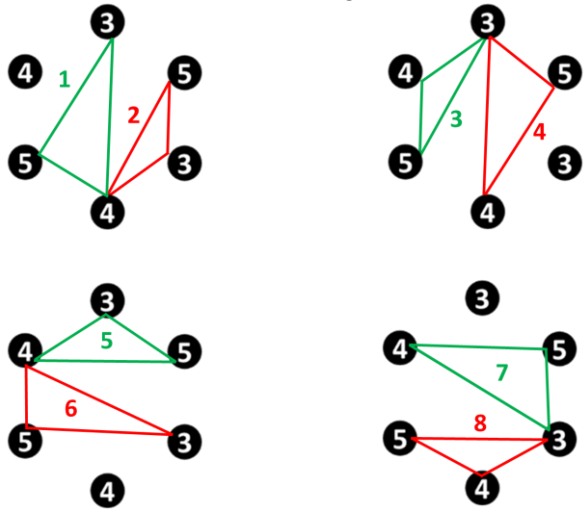
So, we have to try combinations of different numbers from the above image.

If the triangle includes 3 and 4 as its corner numbers, then 3 + 4 = 7. We need a 5 at the third corner to make a sum of 12. (3 + 4 + 5 = 12)

Similarly, if the triangle has 3 and 5 at its corners, then 3 + 5 = 8. We need a 4 to make a sum of 12. The same is true if 4 and 5 are the corners of a triangle. (as 4 + 5 = 9, we need a 3 to make a sum of 12)

So, the only possible combination is 3, 4, and 5.

Since there are two 3's, two 4's, and two 5's placed in different positions, we can form 8 different triangles as shown below in the image.



Hence, the answer is option c.

---

6. Amat and Ankit each picked three numbers from the set {1, 2, 3, 4, 5, 6}.
- 3 different numbers picked by Amat add up to give the highest possible sum
- 3 different numbers picked by Ankit add up to the second highest possible sum
Which pair of numbers were picked by both Amat and Ankit?

a) 3 and 4 b) 4 and 5 c) 5 and 6 d) 2 and 5

Answer: c

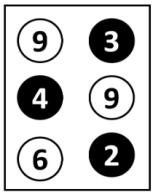
Solution:

To attain the highest possible sum, select the three largest numbers from the set, which are 6, 5, and 4.

This combination results in a sum of 6 + 5 + 4 = 15.
Now, to find the 2nd-highest possible sum, we must get a total just less than 15.
To keep the sum as large as possible, we should retain the two largest numbers, 6 and 5.
If we remove either 6 or 5, the total would decrease too much.
Since 6 + 5 + 4 gives 15 (the highest), we replace 4 with the next largest remaining number, which is 3.
This gives 6 + 5 + 3 = 14.
No other combination gives a sum greater than 14 but less than 15.
Thus, Amat picked {6, 5, 4} and Ankit picked {6, 5, 3}.
So, the pair of numbers picked by both Amat and Ankit is 5 and 6.
Hence, option c is correct.

---

7. A box contains six numbered circles coloured black and white.
A 6-digit number must be formed using all six circles, and the colours must alternate throughout the number. The first circle may be either black or white.
Among all such numbers that can be formed, take the second smallest number and the second largest number. What is the difference between these two numbers?



Box

a) 683233 b) 684324 c) 685314 d) 583297

Answer: b

Solution:

Step 1: Identify the digits

- **White digits:** 9, 9, 6
- **Black digits:** 4, 3, 2

All six digits must be used, and colours must appear **alternately**.

Second Greatest Number

To form the greatest number, the first digit should be the largest possible.

- Largest white = 9
- Largest black = 4

Since 9 > 4, the number starts with **White**.

Pattern: W – B – W – B – W – B
Greatest number formed: **949362**
To get the second greatest, keep the higher place values the same and make the smallest possible change.
Changing white digits affects higher places, so interchange the last two black digits.
Second greatest number: 949263

Second Smallest Number

To form the smallest number, the first digit should be the smallest possible.

- Smallest black = 2
- Smallest white = 6

Since 2 < 6, the number starts with Black.

Pattern: B – W – B – W – B – W
Smallest number formed: 263949

To get the **second smallest**, interchange the **last two black digits**. (since the last two white digits are 9, there wouldn't be any change in the number's value if we interchange them)
Second smallest number: **264939**
Final Step
949263 − 264939 = 684324
Hence, option b is the correct answer.

---

8. I am a 5-digit number made up of both even and odd digits. I read the same backwards and forwards (palindrome). The greatest difference between at least two of my digits is 9. What is the smallest possible sum of my digits?

a) 9 b) 10 c) 11 d) 13

Answer: c
Solution:
The number is a **5-digit palindrome**, so it has the form **ABCBA**.
It must:

- Contain **both even and odd digits**
- Have the **greatest difference between at least two of my digits equal to 9**

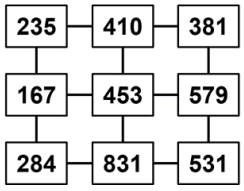
A difference of 9 is possible only if **0 and 9** are both present, so the number must include these digits.
To keep the **sum of digits as small as possible**:

- Use **9 only once** (since repeating 9 would increase the sum)
- Place **0** in the repeated positions **B and B**, because repeated digits affect the sum more

The first digit **A cannot be 0**, so the smallest possible value for **A** is **1**.
Thus, the smallest possible number is **10901**.
Digit sum:
1 + 0 + 9 + 0 + 1 = 11
All conditions are satisfied, so the **smallest possible sum of digits is 11**.
Therefore, option c is correct.

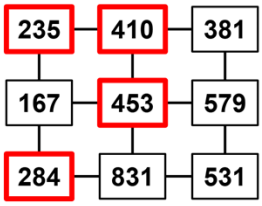
---

9. Count the number of blocks that are connected to at least one block containing a smaller number and one block containing a larger number than the number in it.



a) 2 b) 3 c) 4 d) 5

Answer: c
Solution:
As shown below, there are 4 numbers which are connected to at least one smaller and one larger number than itself.



Therefore, option c is the correct answer.

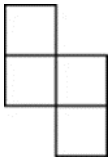
10. A 3 × 3 grid of digits is given below. Avi, Sam, Riya, and Maya each select a different digit from the grid such that:

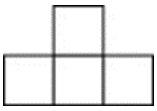
- **The sum of the digits chosen by Avi and Sam is equal to the digit chosen by Maya**
- **The digit chosen by Riya is the largest among the four chosen digits**

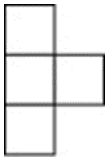
Which of the following options shows a possible set of cells chosen by all four friends?

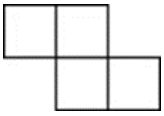
Note: *You cannot rotate the question or option images*

2	5	8
7	4	6
0	9	3

a) 

b) 

c) 

d) 

Answer: d

Solution:

Riya picks the largest digit among all four friends. So, from the four selected digits, the remaining three must satisfy: Avi's digit + Sam's digit = Maya's digit

We should look for an option where, when the highest digit is allotted to Riya, the next highest digit (Maya's choice) is the sum of the remaining two digits.

Option a: There are two possible placements as shown below:

2	5	8
7	4	6
0	9	3

Case A

2	5	8
7	4	6
0	9	3

Case B

Case A: If 9 is taken by Riya, the next highest digit 7 is NOT the sum of 2 and 4.
Case B: If 6 is taken by Riya, the next highest digit 5 is NOT the sum of 3 and 4.

Option b: There are two possible placements as shown below:

2	5	8
7	4	6
0	9	3

Case A

2	5	8
7	4	6
0	9	3

Case B

Case A: If 7 is taken by Riya, the next highest digit 6 is NOT the sum of 4 and 5.
Case B: If 9 is taken by Riya, the next highest digit 4 is NOT the sum of 0 and 3.

Option c: There are two possible placements as shown below:

2	5	8
7	4	6
0	9	3

Case A

2	5	8
7	4	6
0	9	3

Case B

Case A: If 7 is taken by Riya, the next highest digit 4 is NOT the sum of 0 and 2.
Case B: If 9 is taken by Riya, the next highest digit 6 is NOT the sum of 4 and 5.

Option d: There are two possible placements as shown below:

2	5	8
7	4	6
0	9	3

Case A

2	5	8
7	4	6
0	9	3

Case B

Case A: If 6 is taken by Riya, the next highest digit 5 is NOT the sum of 2 and 4.
Case B: If 9 is taken by Riya, the next highest digit 7 is THE SUM OF 3 and 4.

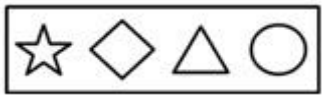
On checking the options, only option d satisfies both conditions. Hence, option d is correct.

The Thinking Spot

Four friends A, B, C, and D each selected a different shape from the shapes shown below, such that:

- **A selected a shape that is neither beside B's shape nor D's shape**
- **C and D did not select the triangle**

Who among them chose the circle?

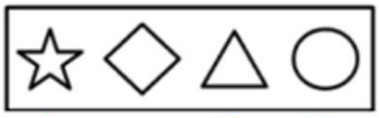


(a) A (b) B (c) C (d) D

Answer: d

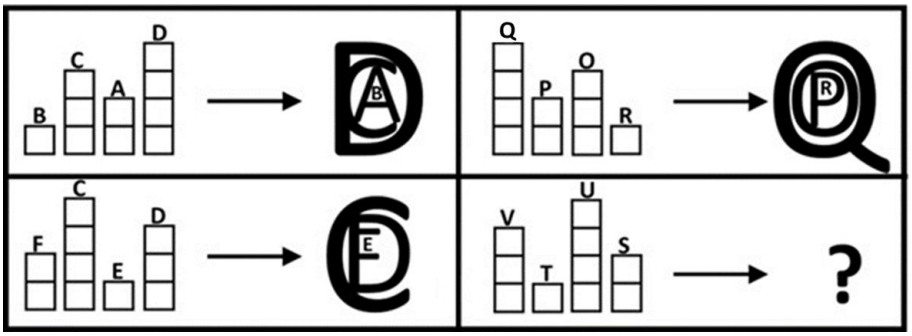
Solution:

A selected a shape which is neither beside B's shape nor D's shape.
A selected a shape which is next to only C's shape
So, A can select a shape only at the extreme ends, because he can have only 1 shape (C's shape) next to his shape.
Hence, A can either choose the star or circle.
If A's shape is a circle, then automatically, C's shape is the triangle.
However, it is already given that C and D did not select the triangle.
Thus, A must have selected the star and C must have chosen the rhombus.
Hence, B's shape is triangle (as D did not select the triangle) and D's shape would be the circle. Thus, the correct answer is option d.



Chapter 4: Data Handling and Presentation

1. What will come in place of "?"



a) 

b) 

c) 

d) 

Answer: d

Solution:

Each group of blocks has letters positioned on top of them. When the blocks are considered in descending order of their height, the letters follow the same order of size after the arrow.

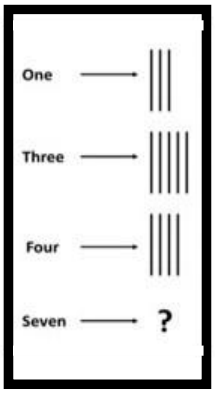
On the right side of the arrow, the letters are positioned in a proper order of their size, where the letter on the tallest block becomes the bigger outermost letter of the image (and the remaining letters follow the same order inward)

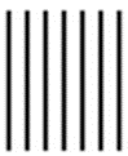
In the 4th term, arranging the blocks in descending order results in the letter arrangement (in decreasing size) U-V-S-T. So, the figure after the arrow must show U as the outermost letter, V inside it, then S, and finally T placed further inside, which matches Option d.

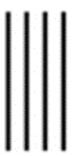
Therefore, option d is the correct answer.

---

2. What will come in place of "?"



a) 

b) 

c) 

d) 

Answer: c

Solution:

In each pair, the number of lines on the right is equal to the number of letters in the word on the left.
For example, the word “ONE” has 3 letters. So, it is represented by 3 lines.
Following the same logic, “SEVEN” has 5 letters. So, it should be represented by 5 lines.
Among the given options, option c shows 5 lines. Therefore, option c is the correct answer.

---

3. Sales of 4 milk stores are given below, in the form of a pictograph. If each symbol in the pictograph represents ‘x’ litres, where x is a whole number and the sales made by any store is less than 100 litres, what is the MAXIMUM possible quantity of milk sold (in litres) by all the stores in total?

Store	Quantity of Milk sold = x litres
A	
B	
C	
D	

a) 255 L b) 272 L c) 306 L d) 283 L

Answer: b

Solution:

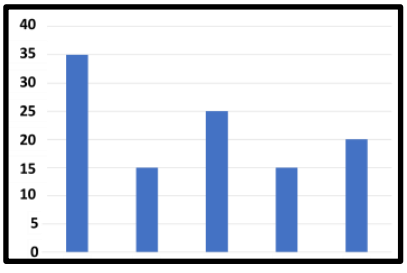
From the given pictograph, we have sales made by each store as:
A: 3x
B: 4.5x
C: 6x
D: 3.5x
As the sales made by any store is less than 100 litres, and the highest sales shown in the pictograph is 6x (Store C), the largest possible value of 6x must also be less than 100.
The highest multiple of 6 that is less than 100 is 96 (as x is a whole number, 6x is also a whole number).
The maximum value of x can be 96/6 = 16
Hence, the maximum possible quantity of milk sold by all stores is 3x + 4.5x + 6x + 3.5x
= 17x
= 17 × 16 = 272 litres
Option b is the correct answer.

---

4. The weights (in kg) of five friends, A, B, C, D, and E, are represented in the graph below (not necessarily in the same order).

- **E is lighter than C**
- **Both B and D are lighter than E, and the difference between the weights of B and E is the same as the difference between the weights of D and E**
- **The difference between the weights of A and any other friend is 10 kg or less**

What is the difference between the weights of B and C?



a) 10 kg b) 5 kg c) 20 kg d) 15 kg

Answer: c

Solution:

From the bar graph, the five weights are:

15, 15, 20, 25, 35

It is given that B and D are lighter than E and the difference between B and E is the same as the difference between D and E.

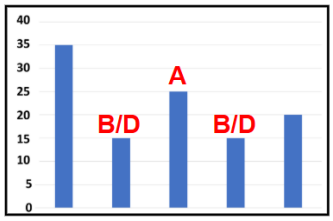
This means that both B and D are of the same weight, and are less than E.

Hence, we can assign the bars of 15 kg to B and D, as only 15 kg are repeated.

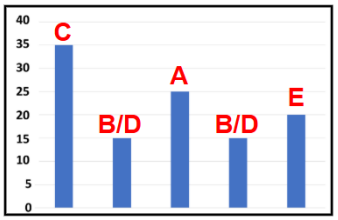
Also, it is given that the difference between the weights of A and any other friend is 10 or less than 10 kg. A can either be 20 kg, 25 kg or 35 kg only.

35 - 20 gives a difference of 15 kg, which is more than 10 kg difference.

So, A cannot be either 35 kg or 20 kg. Therefore, A can only be 25 kg.



Now, as E is lighter than C, we get the following graph:



Therefore, the difference between the weights of B and C is 35 - 15 = 20 kg.

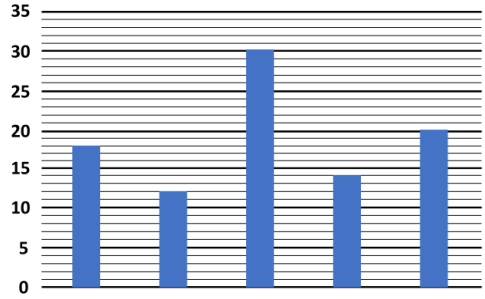
Option c is the correct answer.

---

5. The bar graph shows the number of marbles collected by Monica, Rachel, Ross, Chandler, and Joey.

- **Rachel has collected more marbles than Joey and less than that of Chandler**
- **Monica has collected as much as Rachel and Ross collected together**

How many marbles did Chandler collect?



a) 18 b) 14 c) 20 d) Cannot be determined

Answer: c

Solution:

From given graph, we have the count of marbles as: 18, 12, 30, 14, 20.

From the second instruction we know, Monica has collected as much as Rachel and Ross collected together.

We get only one pair that adds up to the other number in the graph i.e., 18 + 12 = 30.

So, Monica has collected 30 marbles.

Which means marbles collected by Ross and Rachel are 18 and 12.

From the first instruction we know, Rachel has collected more marbles than Joey and less than that of Chandler.

So, Rachel must have a value such that one remaining number is smaller than Joey and one is greater than Chandler.

Among the remaining numbers 14 and 20, this is only possible if Rachel = 18, because 14 is less than 18 and 20 is greater than 18.

So, Joey = 14 and Chandler = 20. Therefore, Chandler collected 20 marbles.

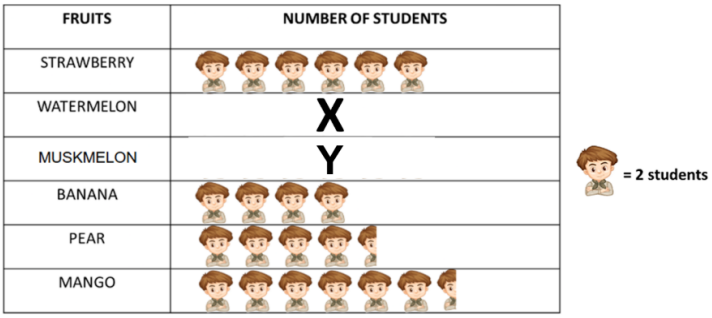
Hence, option c is the correct answer.

---

6. The pictograph represents students' fruit preferences. Let X denote the number of students who like Watermelon and Y denote those who like Muskmelon.

- **X is half the total number of students who like Strawberry and Banana**
- **Y equals the total number of students who like Pear and Mango**

Which fruit has a number of students equal to the difference between X and Y?



a) Strawberry b) Banana c) Pear d) Mango

Answer: a

Solution:

Each symbol in the pictograph represents **2 students**.

Step 1: Find the number of students for each fruit

- **Strawberry**:
  6 symbols: 6 × 2 = 12 students
- **Banana**:
  4 symbols: 4 × 2 = 8 students
- **Pear**:
  4 full symbols and 1/2 symbol
  4 × 2 = 8 students
  1/2 symbol = 1 student
  Total = 9 students
- **Mango**:
  6 full symbols and 1/2 symbol
  6 × 2 = 12 students
  1/2 symbol = 1 student
  Total = 13 students

Step 2: Find X (Watermelon)
X = (Strawberry + Banana) ÷ 2
X = (12 + 8) ÷ 2
X = 20 ÷ 2
X = 10 (represented by 5 symbols, as each symbol = 2 students)

Step 3: Find Y (Muskmelon)
Y = Pear + Mango
Y = 9 + 13
Y = 22 (represented by 11 symbols, as each symbol = 2 students)

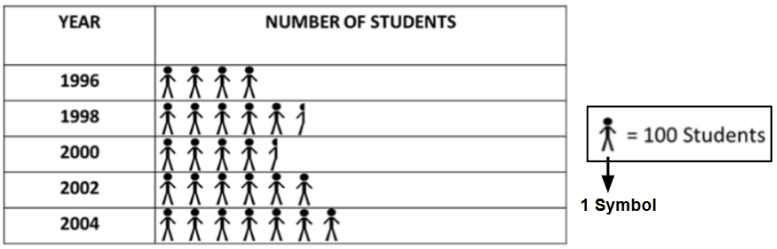
Step 4: Find the difference between X and Y
Y − X = 22 − 10 = 12

Step 5: Match the difference with a fruit
12 students like **Strawberry**.
Hence, option a is the correct answer.

---

7. A pictograph with some missing data is shown below. Extra symbols need to be added (but none can be removed or shifted) to complete the pictograph, such that:
- **The number of students increases by 300 for every gap of 4 years**
- **The number of students in each year is a multiple of 100**

What is the MINIMUM number of symbols that must be added to satisfy all the above conditions?



a) 8.5 b) 8 c) 9 d) 7.5

Answer: c

Solution:
Given:
- 1996 = 400
- 1998 = 550
- 2000 = 450
- 2002 = 600
- 2004 = 700

Each 4-year gap must be 300, and all final numbers must be multiples of 100. Only addition is allowed.

1996 is already a multiple of 100.
So, no new symbol is required here.

To make the difference between year 1996 and 2000 as 300,
We need to have the number of students in the year 2000 as 700. (since 400 + 300 = 700)
As we already have 450 in the year 2000, we need 250 more students. — (1)
So, 2000 will have 700 students.
- 1996 = 400
- 1998 = 550
- 2000 = 450 + **250**
- 2002 = 600
- 2004 = 700

1998 has 550 students. Here, as the number of students must be a multiple of 100, **we need 50 more students — (2)**
So, 1998 will have 550 + 50 = 600 students.

- 1996 = 400
- 1998 = 550 + **50**
- 2000 = 450 + **250**
- 2002 = 600
- 2004 = 700

To have an increase of 300 from year 1998 to 2002, we need 600 + 300 = 900 students in 2002.
As 2002 already has 600 students, we need 900 - 600 = **300 more students in 2002**
1998 becomes 600, and 2002 becomes 900.

- 1996 = 400
- 1998 = 550 + **50**
- 2000 = 450 + **250**
- 2002 = 600 + **300**
- 2004 = 700

Finally, to make an increase of 300 from year 2000 to 2004, we need to have 300 more students in 2004 (since both have 700 students each)

- 1996 = 400
- 1998 = 550 + **50**
- 2000 = 450 + **250**
- 2002 = 600 + **300**
- 2004 = 700 + **300**

Students to be added:
50 + 250 + 300 + 300 = 900
Since 1 symbol = 100 students, 900 ÷ 100 = 9 symbols
Minimum symbols added = 9.
Hence, option c is the correct answer.

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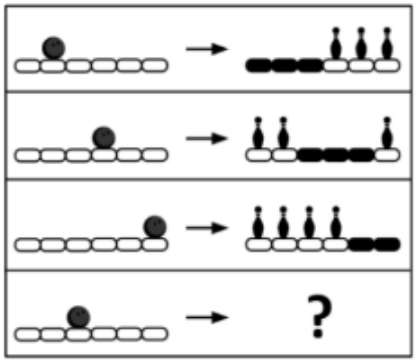
8. What will come in place of "?"



a) 
b) 
c) 
d) 

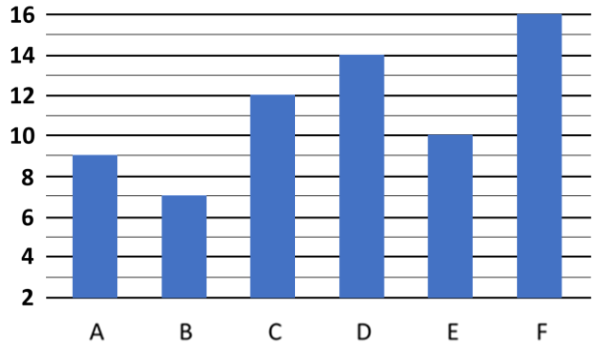
Answer: d

Solution:

Here, the tile with the ball and its immediate neighbours (left and right) turn black; and every other tile gets a bottle.
In the question term, the ball is on the 3rd tile, so tiles 2, 3, and 4 must be black and the rest must have bottles. The diagram matching this pattern is option d, which is the correct answer.

9. **The bar graph shows the quiz scores of six students A, B, C, D, E, and F. The students are grouped as follows:**
   - **Group 1: Students whose scores are composite numbers**
   - **Group 2: Students whose score forms a perfect square when added to any other student's score**
   - **Group 3: Students whose score is greater than the average score of all six students**

   How many students belong to exactly two of these groups?



a) 2 b) 3 c) 4 d) 5

Answer: b

Solution:

From the bar graph, the scores are:

9, 7, 12, 14, 10, 16

Group 1: Composite numbers

Composite numbers among the scores are: 9, 10, 12, 14, and 16

So, the students in group 1 are: A, C, D, E, and F.

Group 2: Scores that can form a perfect square when added to another score

- 9 + 7 = 16 (perfect square)
- 9 + 16 = 25 (perfect square)

The scores in this group are: 9, 7, and 16

So, the students in group 2 are: A, B, and F.

Group 3: Scores greater than the average

Average score = (9 + 7 + 12 + 14 + 10 + 16) ÷ 6

Average = 68 ÷ 6 ≈ 11.33

Scores greater than the average are: 12, 14, and 16

So, the students in group 3 are: C, D, and F.

Group membership count

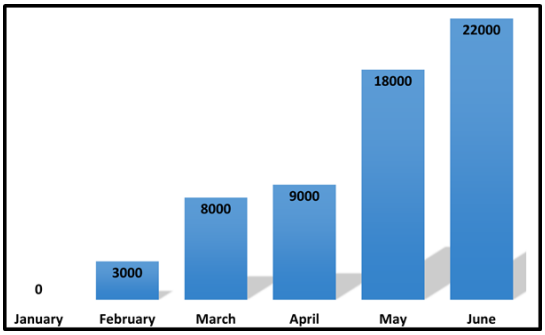
- **9 (A)** - Group 1 and Group 2 (2 groups)
- **7 (B)** - Group 2 only (1 group)
- **12 (C)** - Group 1 and Group 3 (2 groups)
- **14 (D)** - Group 1 and Group 3 (2 groups)
- **10 (E)** - Group 1 only (1 group)
- **16 (F)** - Group 1, Group 2, and Group 3 (3 groups)

A, C, and D belong to **exactly two groups**. **Hence, 3 students belong to exactly two groups. Option b is the correct answer.**

10. Raj saved some amount of money every month from January to June.

- **He saved a total of Rs. 30,000 in the first three months and Rs. 30,000 again in the last three months as well**
- **He did not save any money in February**
- **The maximum total saved in any two consecutive months is Rs. 40,000**
- **While drawing the chart, Raj arranged the savings in increasing order without matching them with the month names written below**

What was the actual amount saved in June?



a) Rs. 22000
b) Rs. 9000
c) Rs. 3000
d) Cannot be determined

Answer: d

Solution:

1. In the first 3 months, and the next 3 months, he saved Rs. 30,000 each time.

Which gives,

January + February + March = 30,000

April + May + June = 30,000

2. In February he didn't save any money.

January + March = 30,000

Only two amounts adding up to 30,000 are 8000 and 22,000

3. The highest amount he saved altogether in two sequential months is 40,000.

The only amounts that add up to 40,000 are **18,000** and **22,000**. Since **22,000** is in the first quarter, its adjacent month must have **18,000**.

January cannot have 22,000 because February's savings are 0.

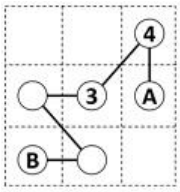
Therefore, Raj saved **22,000** in March and **18,000** in April.

From 2 and 3, we get, March = Rs. 22,000, April = Rs. 18,000, and January = Rs. 8000.

Hence, June can be either Rs. 3000 or Rs. 9000.

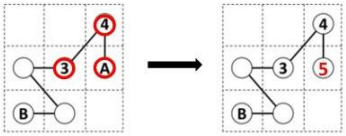
Therefore, option d is correct.

The circles in the grid below can only contain numbers from 1 to 6.
- Every pair of connected circles contains consecutive numbers
- No two circles belonging to the same row or column can have the same number
- A number can be placed in more than one circle
What is the difference between A and B?

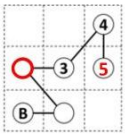


(a) 1 (b) 2 (c) 3 (d) 4

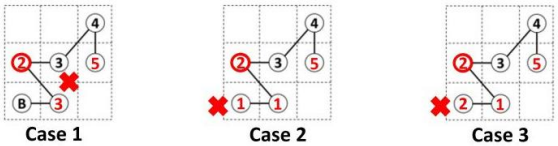
Answer: a
Solution:
Given that the pairs of connected circles must have consecutive numbers, with no row or column having the same number, twice.
A can be either 3 or 5, as it is connected to 4.
However, as 3 is already present in the same row, A will be 5.



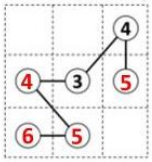
Now, this empty circle can either have 2 or 4 in it, as it is connected to 3.



But, if it has 2, its next connected circle should either have 3 or 1.
However, the grid cannot be filled further, as the question condition cannot be satisfied in any case, as shown.



Hence, the grid can be filled completely, only if we proceed with 4.
As shown below, A = 5 and B = 6, **and the difference between A and B is 1.**
Hence, option a is the correct answer.



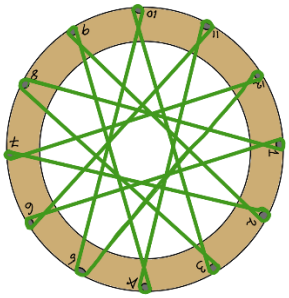
Chapter 5: Prime Time

Activity Time

Factors, Multiples, HCF and LCM

Introduction

Imagine using numbers and their relationships to create beautiful artworks. In this activity, we will take a circle with 12 equally spaced points. By connecting these points using a fixed rule, we will create beautiful shapes such as regular polygons and stars.



This activity helps students understand:

- Factors and multiples of a number

Activity	Time	Description
Launch	5 min	Teacher demonstrate the activity Supporting Links: Activity Video Link: https://youtu.be/L_PqVp8Ro2g?si=XRF5cFMvsXzSMYIA&t=382
Trail by Students	15 min	Students Tryout the activity with each other. Student Worksheet: https://docs.google.com/document/d/1TGjoEGiumTgstdyNznQy8pUJ10izCgaAJg1hGtMwTRY/edit?usp=sharing
Discussions and Explorations	15 min	Attempting the worksheets and the discussion based on the activity

CT Components

Algorithmic Thinking:

In this activity, students will follow a rule - Starting from a number on a circle with **12** equally spaced points, add a step number (say **n**) to it and keep doing it until you reach back to the starting point. This becomes the algorithm for every circle.

Pattern Recognition:

Once the different shapes have been formed for the circle with different step numbers, students will try to recognise the different shapes that are formed. They will then try to see a pattern between the shape formed, and the step numbers and points on the circle.

Generalisation:

After recognising the pattern of the shapes formed on the circle with different step numbers, students will generalise the shapes formed for any circle with **m** equidistant points and **n** step numbers.

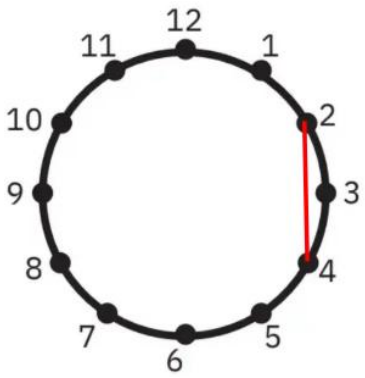
Activity

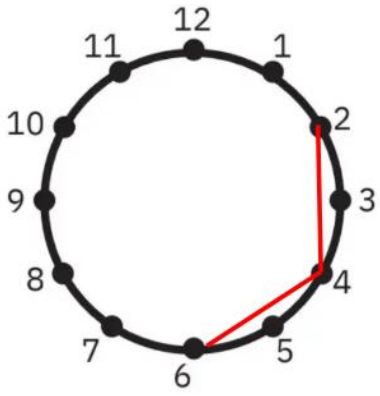
You are given a circle with 12 equidistant points.

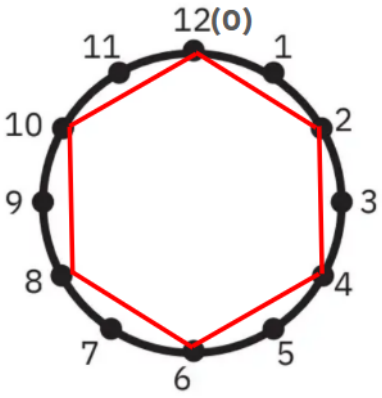
You have to connect these points using a rule.

Rule:

1. Starting from 2, add 2 to it and connect it with the next number, i.e. 4.
2. Add 2 to 4, then connect it to the next.
3. Keep adding 2 until you reach the starting point.







1. How many steps did it take to reach the starting point? What shape do you get?

a) Three b) Four c) Five d) Six

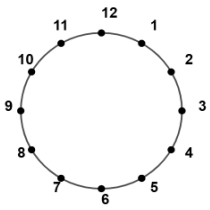
Answer: d

Solution:

We can see that the 6 steps formed equal chords on the circle, thus giving us a regular hexagon. Also, if we add 2 to the last point again, we will just retrace the steps we took in the first sequence.

Competencies: Algorithmic Thinking

Now starting from any point, add 3 to it and join to the next point. Keep adding 3 until you reach the starting point.



2. How many steps would be needed to reach the starting point?

a) Two b) Three c) Four d) Five

Answer: c

Solution:

Starting from 3 and adding 3 at every step, we proceed like this

$3 \rightarrow 6 \rightarrow 9 \rightarrow 12 \rightarrow 3$

After 4 steps, we return to 3.

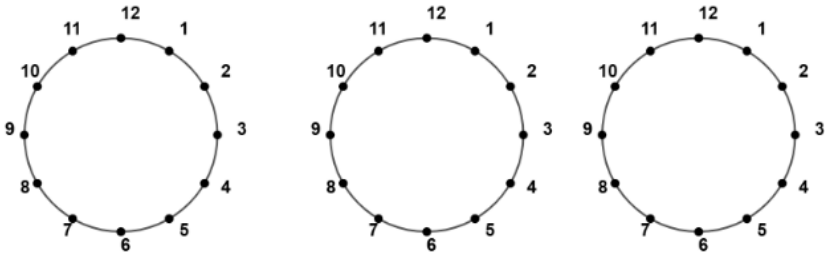
Shape: Since the 4 steps formed equal chords on the circle, we get a square.

Note: If we add 3 to 3 again, we will just retrace the steps that we made in the first sequence.

<u>Repeat the same process by</u>

a) Starting from 4 and adding 4
b) Starting from 5 and adding 5
c) Starting from 6 and adding 6

Until you reach the starting point.



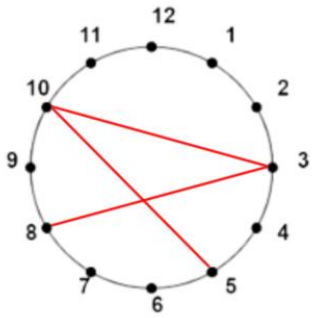
<u>What shapes do you get? Record your answers in the table below.</u>

Number added	No. of steps till the starting point	Shape formed
2	6	Hexagon
3	4	Square
4		
5		
6		

Note: When the starting point is 5, adding 5 to it gives 10. Now, adding 5 to 10 gives 15, which is not on the circle. But since the numbers lie on a circle, we can keep going around it. So 15 will go to 3 (12 + 3 = 15). Now add 5 to 3, and we get 8. Keep going in the same manner and we will get this sequence of steps:

5→ 10→3→8→1→6→11→4→9→2→7→12→5

So, after 12 steps, we will reach 5 again.



Do you notice any **patterns** in the **numbers we are adding, the number of points on the circle, and the shape being formed in the circle**?

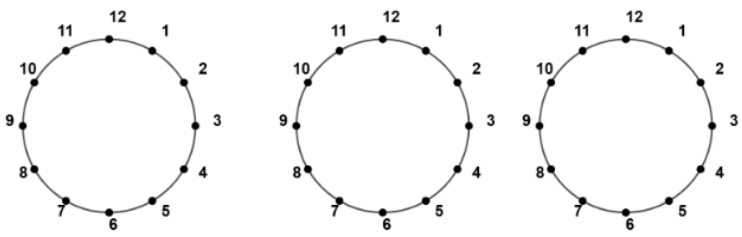
Why did you get polygons on adding 2, 3 and 4, while a star on adding 5? Is there any relationship between these numbers and 12, the number of points on the circle?

Competencies: Algorithmic Thinking, Pattern Recognition

Explanation: The numbers 2, 3, and 4 are factors of 12, while 5 is not. To reach 12 - 2, 3, and 4 take 6,4 and 3 steps respectively and reach the starting point. But when we start from 5, we have to keep on going until we reach a number that is a common multiple of both 5 and 12, so that the starting point is the same as the ending point. So 5 takes 12 steps, adding to 60, which is a common multiple of both 5 and 12 and in the process, it covers all points, giving us a 12-pointed star.

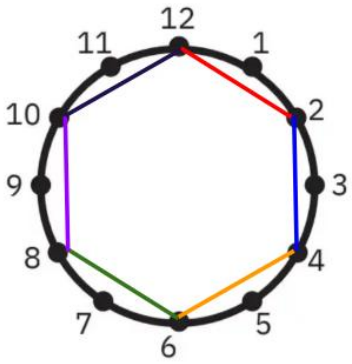
Explorations

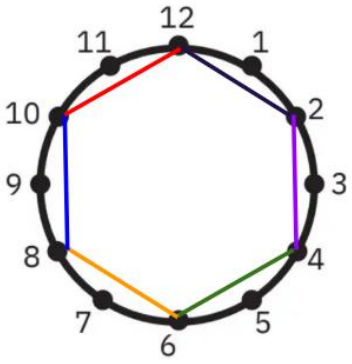
1. **What shapes will you get when you add 7, 8, 9, 10 and 11 until you reach the starting point? Try to find out the relationship between the numbers and the number of points on a circle.**



Competencies: Algorithmic Thinking, Pattern Recognition, Generalisation

Explanation - We will observe that 7, 8, 9, 10, and 11 will have the same shape as in the cases of 5, 4, 3, 2, and 1, respectively. And if you look at these numbers on the circle, they are the reflections of each other. In case 2, if I mark my lines in order in different colours and then repeat the procedure for 10, we will be able to see that the hexagons obtained are reflections of each other.





In the first image, we start from 2, the blue string connects to 4. Then 4 connects to 6 through a yellow string, and so on.

In the second image, we start from 10, add 10 to get 20, which will go to 8 (12 + 8), so the first string is blue from 10 → 8. Then 8 plus 10 is 18, which goes to 6 using a yellow string and so on.

So, the numbers that are reflections will have the same shapes.

We can also generalise - If there are m points on a circle, and we know the shapes formed by step number n, then m-n will also have the same shape.

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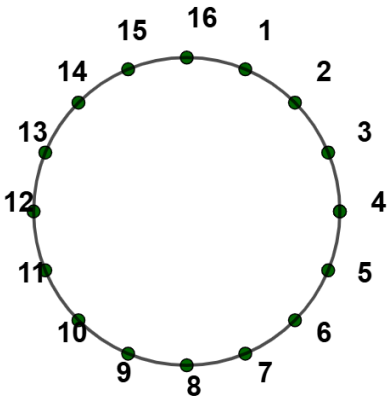
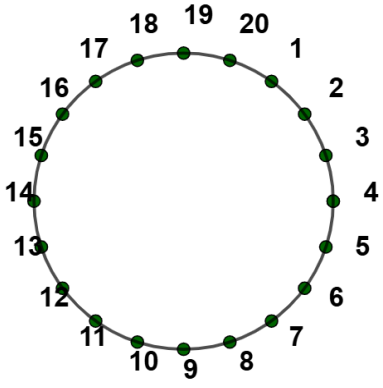
2. Two circles, one with 16 points and the other with 20 points, are given. Which of the two will give a square when added to which number?





a) The 16-point circle, on adding 4
b) The 16-point circle, on adding 12
c) The 20-point circle, on adding 5
d) The 20-point circle, on adding 15

Competencies: Pattern Recognition, Decomposition

Explanation: All 4 options are correct.

For 16 point circle, to get a square, we need to take 4 steps. So, 16 divided by 4 is 4, hence adding 4 gives us a square. Also, 16-4 = 12 also gives a square.

We can similarly find for 20 point circle.

For further exploration on the teachers' part: Try to explore the same exercise with a 20-point circle and different step numbers. Try to see what happens when step numbers are not proper factors, but have a common factor with the number of points on the circle.

Questions

1. **Find the ODD one out.**

a) 

b) 

c) 

d) 

Answer: b

Solution:

In each term, the numbers written in white blocks are multiplied to give their product, which is written in the black shaded block.

The only option which does not follow this logic is option b. Thus, option b is the correct answer.

---

2. **If "X" is a number formed by the addition of two or more DIFFERENT single-digit prime numbers, which of the following options CANNOT be a value of the number "X"?**

a) 8 b) 10 c) 11 d) 15

Answer: c

Solution:

The single-digit prime numbers are:

2, 3, 5, and 7.

The number X must be formed by adding two or more different prime numbers from this list.

Let us check each option one by one:

Option a: 8 can be the sum: 3 + 5 = 8.

Option b: 10 can be the sum: 3 + 7 = 10

Option c: 11 cannot be the sum of any two or more single digit prime numbers, as 3 + 7 results in 10 (1 less than 11) and 5 + 7 results in 12 (1 more than 11). So, 11 cannot be the sum in any possible way.

Option d: 15 can be the sum: 3 + 5 + 7 = 15. Hence, the correct answer is option c.

---

3. **The sum of three consecutive natural numbers is equal to Y. Which of the following numbers will Y always be divisible by?**

a) 3 b) 2 c) 4 d) Cannot be determined

Answer: a

Solution:

Since the numbers are **three consecutive natural numbers**, the result must hold true for any such set. Check a few examples:

- 1 + 2 + 3 = 6, divisible by 3 (also by 2, but not by 4)
- 2 + 3 + 4 = 9, divisible by 3 (not by 2, or by 4)
- 6 + 7 + 8 = 21, divisible by 3 (not by 2, or by 4)

So, divisibility by 2 and 4 is **not consistent**, but divisibility by **3 appears every time**. This happens because among any three consecutive numbers, **one number is always a multiple of 3**. The other two numbers are 1 more and 1 less than that multiple, and together they also add up to a multiple of 3. Therefore, the sum of any three consecutive natural numbers is **always divisible by 3**. Hence, **option a** is the correct answer.

---

4. **A two-digit number is 1 more than a multiple of 3. How many different possible values can it have?**

a) 29 b) 30 c) 31 d) 32

Answer: b

Solution:

A two-digit number which is one more than a multiple of 3 can be shown as 3x + 1.

The largest two-digit multiple of 3 is 99, and adding 1 to it would result in 100, which is a 3-digit number, which breaks the condition.

So, the maximum value 3x + 1 can be is 97:

3x + 1 = 97

3x = 97 - 1

3x = 96

x = 32.

Also, let's check the least value x can have:

For x = 1:

3x + 1 = 3(1) + 1 = 4 (since it is a single digit, x cannot be 1)

For x = 2:

3x + 1 = 3(2) + 1 =7 (since it is a single digit, x cannot be 2)

Now, the values which x can have for 3x+1 to be a two-digit number could be anywhere from 3 to 32.

1 to 32 gives 32 values for x and as x cannot be 1 or 2, excluding two values, we get 32 - 2 = 30.

Hence, x has 30 values, and the correct answer is option b.

---

5. The product of a number 'PQ' and 7 is 'RSQ', where P, Q, R, and S are distinct digits. Which of the following CANNOT be the possible value of 'RSQ'?

$$\begin{array}{r} PQ \\ \times \quad 7 \\ \hline RSQ \\ \hline \end{array}$$

a) 210 b) 315 c) 420 d) 105

Answer: d

Solution:

As per the question, when you multiply a number by 7, the last digit of the product is the same as the last digit of the original number (the problem says both end with Q).

Let's check each of the options, one by one:

210 ends with 0. So, Q = 0. If the product is 210 then the original two-digit number must be 30. That gives digits 3, 0, 2, and 1, which are all different. Thus, possible.

315 ends with 5. So, Q = 5. If the product is 315 the original two-digit number must be 45. That yields digits 4, 5, 3, and 1, which are all different. Thus, possible.

420 ends with 0. So, Q = 0. Product 420 comes from 60: digits 6,0,4, and 2, which are all different. Thus, possible.

105 ends with 5. So, Q = 5. Product 105 would come from 15, that means the original two-digit number starts with 1 and the product's hundreds digit is also 1. So, the hundreds digit (R) and the original tens digit (P) would both be 1 - they're not distinct, which breaks the problem condition.

105 cannot be the product because it forces two digits to be the same.

Hence, the correct answer is option d.

---

6. Nausheen thinks of 5 consecutive numbers. 3 of these numbers are prime and 3 of these are even numbers. What is the sum of these numbers?

a) 10 b) 15 c) 20 d) Cannot be determined

Answer: c

Solution:

In the question, it is mentioned that Nausheen thinks of three prime numbers and 3 even numbers.

So, there are 3 + 3 = 6 numbers.

But, Nausheen actually thinks of only 5 consecutive numbers and not 6.
So, one of the numbers that he thinks will be an even number, as well as a prime number.
We know that the **only even prime number is 2**.
So, to have 3 prime numbers, the sequence must include 2.
Also, in the set of any 5 consecutive numbers, there can be 3 even numbers only if the sequence starts with an even number. So, the set starts with 2. (as it cannot start with 1, which is odd)
Therefore, the numbers are:
2, 3, 4, 5, 6
Check:
Even numbers: 2, 4, 6 (3)
Prime numbers: 2, 3, 5 (3)
Sum = 2 + 3 + 4 + 5 + 6 = 20
Hence, the correct answer is option c.

---

7. In a certain language, if 3 is coded as 'free', 5 is coded as 'dive', 10 is coded as 'hen', then what could be the possible code for the PRIME FACTOR of 169, in the same language?

a) heighten b) throwing c) routine d) titan

Answer: c

Solution:

Observe the given codes carefully:

- 3: free
- 5: dive
- 10: hen

Notice that each code word rhymes with the number name:

- 3: three - free
- 5: five - dive
- 10: ten - hen

So, the pattern is:
The code is a word that rhymes with the number.
Now, find the prime factor of 169.
169 = 13 × 13
So, the prime factor is 13.
The number name is thirteen.
Among the options, the word that rhymes with thirteen is **routine**.
Hence, the correct answer is option c.

---

8. If "X" is a number formed by the multiplication of 2 single-digit prime numbers, which of the following options is ALWAYS TRUE about the number "X"?

a) The number "X" cannot be even
b) The number "X" is a 2-digit number
c) The number "X" is a multiple of 4
d) The number "X" is less than 50

Answer: d

Solution:

Option a: 2 x 3 = 6. Hence, option a is not always true.
Option b: 2 x 3 = 6 is a single digit number. Hence, option b is not always true.
Option c: 3 x 5 = 15 which is not a multiple of 4. Hence, option c is not always true.
Option d: If we take the two largest single digit prime numbers (5 and 7) and multiply them, we get 35 which is less than 50. Hence, option d is always TRUE.
Thus, the correct answer is option d.

9. In the letter grid below, the spelling of which prime number is immediately followed by the spelling of its succeeding number in the number series?

ONEFIIVESIXTWOTHREENINETENELEVNTWELVEONEFOURSIXSEVEN

a) 3 b) 5 c) 11 d) 2

Answer: d

Solution:

Step 1: Identify the prime numbers in the grid:

ONEFIIVESIXTWOTHREENINETENELEVNTWELVEONEFOURSIXSEVEN

Step 2: Among the prime numbers found, identify the number which is immediately followed by its succeeding number (next number of the original number series).

As shown, only TWO is the prime number, which is immediately followed by the spelling of its succeeding number (THREE) in the number series.

ONEFIIVESIXTWOTHREENINETENELEVNTWELVEONEFOURSIXSEVEN

Hence, option d is the correct answer.

---

10. Alex, Jim, and Sam were born on prime-numbered dates in the same month and year. Sam was born on a Friday, and the month started on a Sunday.
- The difference between the dates of Alex's and Jim's birthdays is 20
- Jim was born 10 days after Sam
On which day of the week was Alex born?

a) Thursday b) Wednesday c) Tuesday d) Saturday

Answer: c

Solution:

The **prime-numbered dates** in a month are:
2, 3, 5, 7, 11, 13, 17, 19, 23, 29 (and 31, if applicable).
The month started on a **Sunday**. Therefore, the **first Friday** falls **5 days later**:
Sunday + 5 days = Friday
So, the date of the first Friday is:
1 + 5 = **6**
Adding 7 to get the remaining Fridays, the **Friday dates** are:
6, 13, 20, 27
Among these, only **13** is a prime number.
Hence, **Sam was born on the 13th** of the month.
Jim was born **10 days after Sam**, so Jim's birth date is:
13 + 10 = **23rd**
The difference between the birth dates of **Alex and Jim** is **20 days**. So, Alex's birth date is:
23 − 20 = **3rd**
All these dates are **prime numbers**. So, all conditions are satisfied.
Since the month started on Sunday:

- 2nd falls on **Monday**
- 3rd falls on **Tuesday**

Therefore, **Alex was born on a Tuesday**. Hence, **option c** is the correct answer.

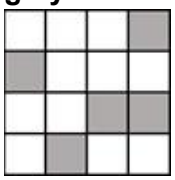
The Thinking Spot

The image given below contains ONLY white and grey squares. You can change the colour of a square by clicking on it.

- If you click a white square, the colour of that square and all squares that share a common corner (but do not share a common side) with it will change

- If you click a grey square, its colour and the colour of the squares that share a common side with it will change

What is the minimum number of squares that must be clicked to make the number of grey and white squares equal?



(a) 1 (b) 2 (c) 3 (d) 4

Answer: a

Solution:

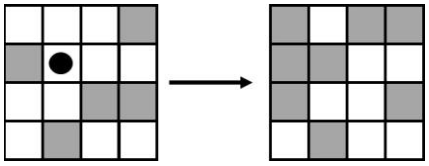
Let's approach the question logically to achieve an equal number of grey and white squares in a grid with a total of 16 squares. Currently, there are 11 white squares and 5 grey squares.

To balance the count, we aim for 8 squares of each colour. Since we have more white squares, we need to increase the number of grey squares by 3.

By observing the grid, we need to identify a white square to click, as clicking it will not only change its colour but also the colours of squares that share a common corner (without sharing a common side) with it.

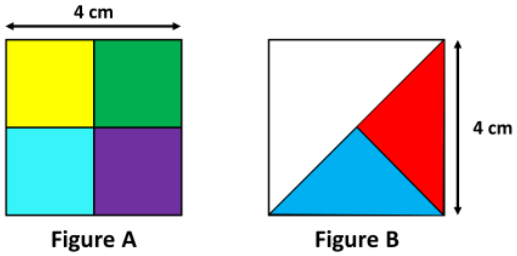
To achieve the desired change of only 3 white squares to grey, we look for a white square that shares a common corner with two other white squares and one grey square. In the grid, such a square is identified and marked. By clicking this square, we can achieve an equal number of white and grey squares.

Therefore, strategically clicking the one highlighted white square will help us reach the goal of having 8 grey and 8 white squares in the grid.
Hence, the correct answer is option a.

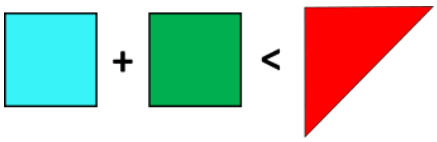


Chapter 6: Perimeter and Area

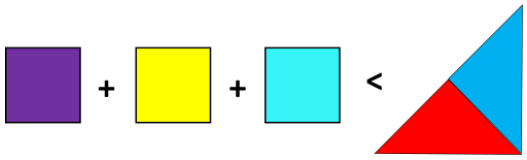
1. **Figures A and B represent squares which are divided into different parts, as shown in the image below. Which of the following options correctly represents the relation between the division?**



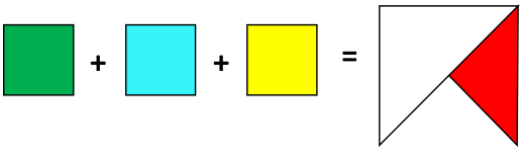
a)



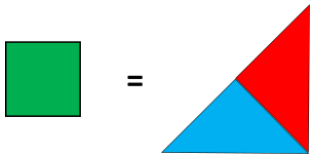
b)



c)



d)



Answer: c

Solution:

Given that the side of each square = 4 cm
Therefore, Area of the square = 4 × 4 = 16 sq. cm
Area of one small square = 16/4 = 4 sq. cm
Red and Blue triangles = Half of the area of square
Thus, Red and Blue triangles = 1/2 of 16 = 8 sq. cm
Area of any smaller coloured triangle = 1/2 of 8 = 4 sq. cm
Area of bigger white triangle = 1/2 × 4 × 4 = 8 sq. cm

Option a:
Squares: 4 + 4 = 8
Triangle: 4
According to option a, 8 < 4.
8 is not less than 4. So, option a is incorrect.

Option b:
Squares: 4 + 4 + 4 = 12
Triangles: 8
12 < 8
According to option b, 12 < 8.
12 is not less than 8. So, option b is incorrect.

Option c:
Squares: 4 + 4 + 4 = 12
Triangles: 8 + 4 = 12
12 = 12
Areas match perfectly. So, option c is correct.

Option d:
Square: 4
Triangles: 8
$4 \neq 8$
According to option d, $4 = 8$.
So, option d is incorrect.
Therefore, the correct answer is option c.

---

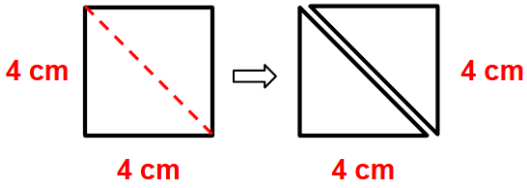
2. The perimeter of a square X is 16 cm. The square is cut along its diagonal to form two identical triangles.
Which of these statements is DEFINITELY FALSE based on the above information?

a) Two sides of the triangle meet each other perpendicularly
b) The length of at least one side of each triangle is 4 cm
c) The combined area of the triangles is 16 cm^2
d) The combined perimeter of the triangles is 16 cm

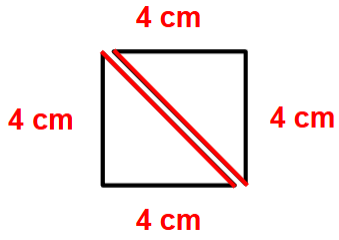
Answer: d

Solution:

Perimeter of a square = 16 cm = 4 x Side length.
So, side length = 16 cm / 4 = 4 cm.

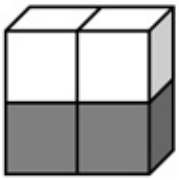


When the square is cut into two triangles, then the two triangles formed are right angled triangles.
So, two sides of the triangle meet each other perpendicularly.
Option a is true.
Also, the length of at least one side of each triangle is 4 cm as shown in the image above.
Option b is true.
As the side of the square = 4cm, the area of the square = 4 x 4 = 16 cm^2.
The combined area of both the triangles is also 16 cm^2.
Option c is true.
Now, the combined perimeter of the triangles will be more than 16 cm as now we have 1 new side in each triangle, as shown below:



Therefore, option d is false.
The correct answer is option d.

3. **A larger block is formed using 4 small cubes (2 grey cubes and 2 white cubes), as shown below. How many faces of the larger block have equal grey and white areas?**



a) 4 b) 5 c) 3 d) 2

Answer: a

Solution:

Given: A large block is made of 4 small cubes - 2 grey (bottom) and 2 white (top).
Let's analyse each face:

Front View (as shown in the image):
•Top = 2 white cubes
•Bottom = 2 grey cubes
Equal grey and white - Yes!

Back View
•Since all cubes are the same front-to-back, the back will look exactly like the front.
Equal grey and white - Yes!

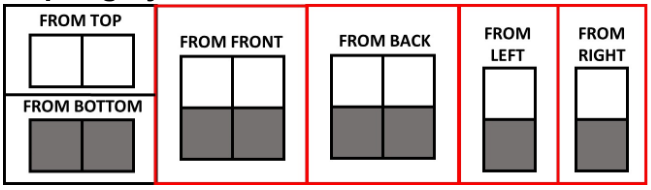
Left Side View
•On the left face, we'll see the left half of the structure.
•That will be: 1 white cube on top, 1 grey cube on bottom
Equal grey and white - Yes!

Right Side View
•Same logic - we see the right half
•1 white on top, 1 grey on bottom
Equal grey and white - Yes!

Top View
•Topmost cubes are both white
Only white visible - Not equal

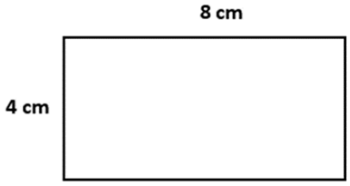
Bottom View
•Bottommost cubes are both grey
Only grey visible - Not equal

Final Answer:
•**Equal grey and white faces: Front, Back, Left, Right = 4 faces**



Hence, the correct answer is option a.

4. **How many times should the given paper sheet be folded in half so that the perimeter of the new shape is 16 cm?**

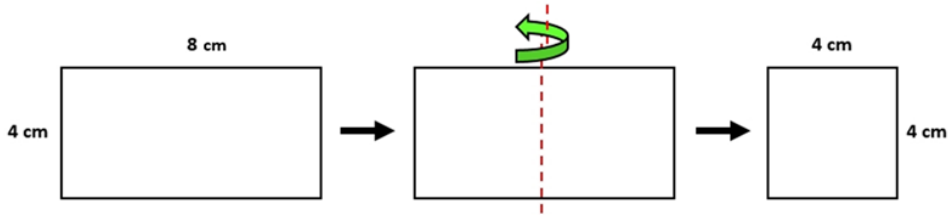


a) 0 b) 1 c) 2 d) 3

Answer: b

Solution:

Only one fold is required, as shown in the image below.

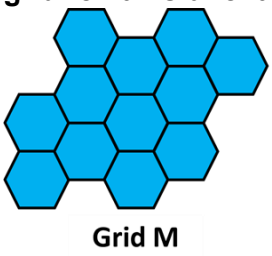


Perimeter = 4 + 4 + 4 + 4 = 16 cm

Hence, the correct answer is option b.

---

5. **Grid M is made using regular hexagons (like Shape A), as shown. Additional copies of Shape A may be attached only along the outer sides of Grid M, and each added shape must share at least one full side with the existing grid. The shapes must be added such that the total perimeter of the grid remains unchanged. What is the MAXIMUM number of Shape A pieces that can be added?**


Grid M

Shape A

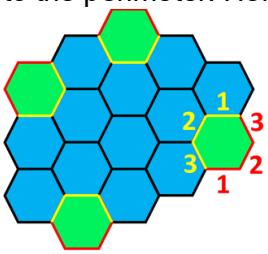
a) 2 b) 3 c) 4 d) 6

Answer: c

Solution:

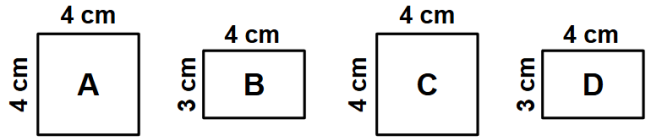
If Shape A is to be added to Grid M so that its perimeter remains the same, then it should satisfy the condition that, when a shape is added, some sides may disappear where the new shapes touch, and some new sides may appear. The number of sides removed must be the same as the number of sides added. We see that this is possible in 4 places as shown in the image below.

The lines in yellow show the sides removed from the perimeter while the lines in red show the lines added to the perimeter. Hence, the correct answer is option c.

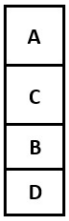


Grid M

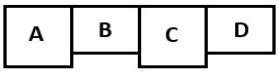
6. All the squares and rectangles given below are to be used to form an arrangement. The arrangement shown in which of these options will give the HIGHEST perimeter?



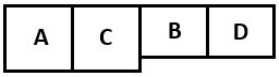
a)



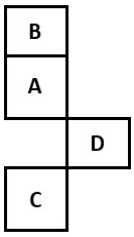
b)



c)



d)

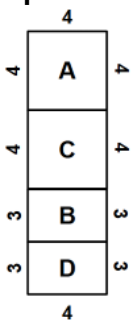


Answer: d

Solution:

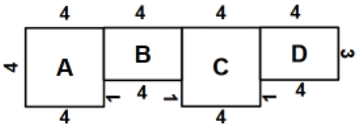
Perimeter is the measure of the outline of the figure. Let us analyse each option one by one:

Option a:



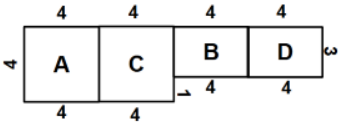
The perimeter is: 6 sides of 4 cm = 6 x 4 = 24 and 4 sides of 3 cm = 4 x 3 = 12.
Total = 24 + 12 = 36 cm.

Option b:



The perimeter is: 9 sides of 4 cm, 1 side of 3 cm and 3 sides of 1 cm.
Total = 36 + 3 + 3 = 42 cm.

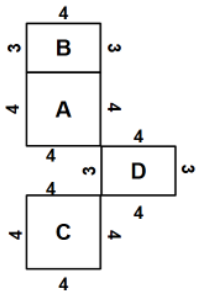
Option c:



The perimeter is: 9 sides of 4 cm, 1 side of 3 cm and 1 side of 1 cm.

Total = 36 + 3 + 1 = 40 cm.

Option d:

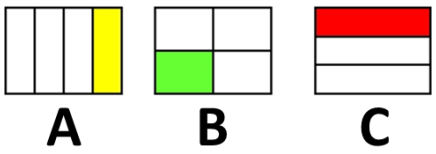


The perimeter is: 10 sides of 4 cm and 4 sides of 3 cm.
Total = 40 + 12 = 52 cm.
Since, option d has the largest perimeter, it is the correct answer.

LOGICAL APPROACH:
The above approach shows the systematic way of solving the problem by considering the actual dimensions of the given figures.
However, there is a logical approach too.
If you observe all the options carefully, only option d has all four sides of two figures included in the total perimeter (square C and rectangle D).
Whereas in other options, at least one side of every figure is not included in the perimeter.
Obviously, the highest perimeter will be seen in option d. Hence, option d is the correct answer.

---

7. If figures A, B, and C are all of the same dimensions, which of the following coloured blocks has the largest area?



a) Red
b) Yellow
c) Green
d) All of them have an equal area

Answer: a

Solution:
On observing the three figures, we see that figures A and B are divided into four equal parts. So, each part is one - fourth of the original area.
Figure C is divided into three equal parts, so each part is one - third of the original area. Since one - third is greater than one - fourth, the red block has the largest area.
Option a is the correct answer.

---

8. A square frame has a side length of 16 cm. Inside it, four square-shaped photographs of side 4 cm are to be placed such that:

- **Each photograph touches the CORNER of at least one other photograph**
- **No two photographs share a common side**
- **The photographs do not overlap**

What is the LARGEST square-shaped empty space that can be seen inside the frame, finally?

a) 9 cm^2
b) 16 cm^2
c) 64 cm^2
d) 192 cm^2

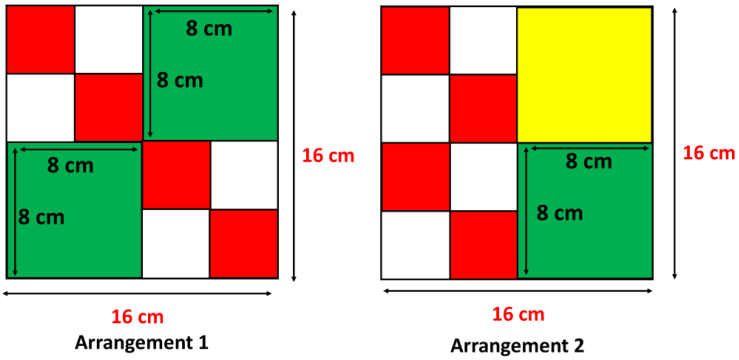
Answer: c

Solution:

As no two photographs share a common side but every photograph is connected to at least one corner of another photograph, there can be different possible arrangements as shown below:

Here, the red photographs are placed in such a way that they are connected to each other by corners.

In any case, the largest possible square region that remains empty is represented by the green and yellow squares of side 8 cm each.

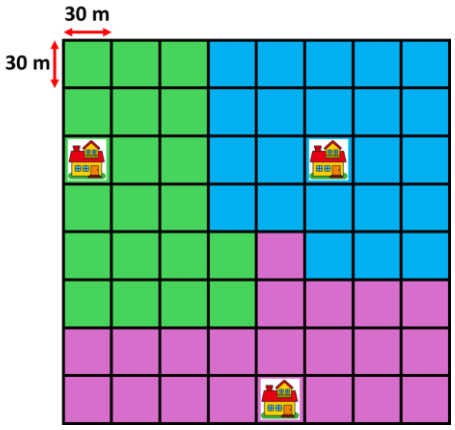


Hence, the area of the empty square region = 8 x 8 = 64 cm^2.

Option c is the correct answer.

---

9. The grid shows a piece of land divided among three houses using different colours (including the area occupied by each house). The land is then redistributed so that all three houses receive equal areas. Which of the following options is NOT the exact area of land gained or lost by any house after this redistribution?



a) 1200 sq. m. b) 1500 sq. m. c) 300 sq. m. d) 900 sq. m.

Answer: d

Solution:

We can see that each block is 30 m x 30 m.

So, the area of each block will be 900 sq. m.

Let's look at the greenhouse (covers the land in the green blocks)

It covers 20 blocks.

Thus, the area of land with the greenhouse is 20 x 900 = 18000 sq. m.

The Blue house covers 23 blocks.

Thus, the area of land with the blue house is 23 x 900 = 20700 sq. m.

The Purple house covers 21 blocks.

Thus, the area of land with the purple house is 21 x 900 = 18900 sq. m.
Now, the land must be divided equally.
We have 8 x 8 = 64 blocks, with each block having an area of 900 sq. m.
Thus, the total area of the land = 64 x 900 = 57600 sq. m.
This area is now divided into three equal parts: 57600 / 3 = 19200 sq. m.
Thus, each house will now have 19200 sq. m. land.

The greenhouse will gain 19200 – 18000 = 1200 sq. m.
The blue house will lose 20700 – 19200 = 1500 sq. m.
The purple house will gain 19200 – 18900 = 300 sq. m.

Thus, option d) 900 sq. m. is the correct answer.

---

10. Figures A, B, and C are three rectangles of equal dimensions. Figures A and B contain some shapes placed inside them. Using these shapes, completely fill figure C without leaving any gaps. Which set of options can be used to exactly fill figure C?
Note: *The shapes may be rotated but must not overlap. The dimensions of the shapes in the options are the same as the dimensions given in the question image*

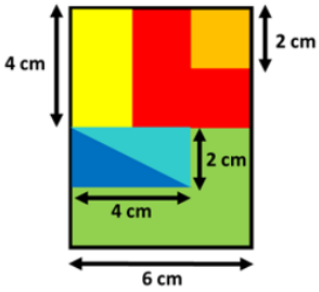


Figure A

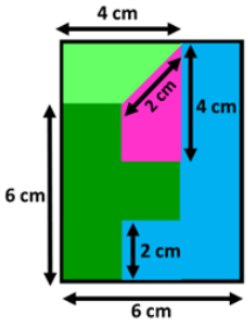
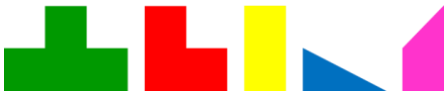


Figure B


Figure C

a) 

b) 

c) 

d) 

Answer: d
Solution:
As shown in the image below, when all the shapes from Option d are used, they fit perfectly into Figure C, without any gaps or overlaps. Option d is the correct answer.

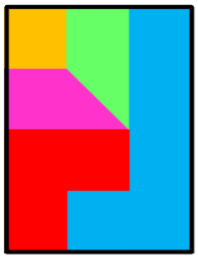


Figure C

The numbers given below are to be placed in the grid in such a way that the sum of two adjacent numbers in the grid should be greater than 9 but less than 17. What will come in place of A?
Numbers to be placed: 11, 3, 5, 2

14			A	8		12

(a) A = 5 (b) A = 3 (c) A = 2 (d) A = 11

Answer: a

Solution:

Let us approach the question logically and systematically.
The number after 14 can only be 2, resulting in 16, which is greater than 9 but less than 17.

14	2		A	8		12

The number before 12 can only be 3. When you add 3 to 12, you get 15, which is greater than 9 but less than 17. Placing any other number would result in a sum greater or equal to 17.

14	2		A	8	3	12

Numbers left with us: 11 and 5
Now, A can only be 5. If we replace A with 11, the sum becomes 8 + 11 = 19, which contradicts our condition that the sum should be less than 17.
Therefore, A must be 5.
Thus, option a is the correct answer.

14	2	11	5	8	3	12

Chapter 7: Fractions

1. **Aashay scored the following marks in 3 subjects:**
   Dance: 22/25
   Maths: 41/50
   Science: 93/100
   Arrange the three subjects in descending order of how well he performed in them.

   a) Maths-Science-Dance
   b) Science-Maths-Dance
   c) Science-Dance-Maths
   d) Maths-Dance-Science

   Answer: c

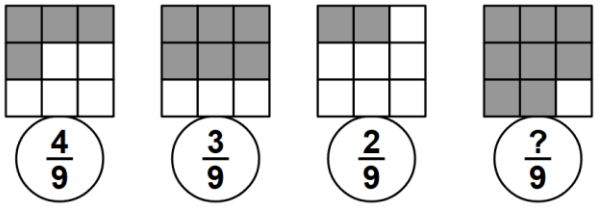
   Solution:

   In this question, you must convert all the marks to out of 100 so that comparison is easier.
   1. 22 out of 25 is the same as 88 out of 100.
   2. 41 out of 50 is the same as 82 out of 100.
   3. Science is 93 out of 100.

   So, the descending order of marks is **Science, Dance, and Maths.** Hence, option c is the correct answer.

---

2. **What will come in place of "?"**



   a) 1
   b) 8
   c) 9
   d) 5

   Answer: a

   Solution:

   In each term, the numerator consists of either the number of shaded or unshaded cells of the grid, whichever is smaller.
   For example, in the first term, there are 4 shaded cells and 5 unshaded cells.
   As 4 < 5, we have 4/9 as the fraction.
   In the next term, there are 6 shaded cells and 3 unshaded cells.
   As 3 < 6, we have 3/9 as the fraction.
   Now, the last term has 8 shaded cells and 1 unshaded cell.
   Hence, the numerator of the fraction must be 1.
   Option a is the correct answer.

---

3. **Arrange the given fractions in ascending order. Which option can be placed exactly in the middle of the new arrangement so that the order remains ascending?**

   10/15, 8/9, 17/18, 5/6

   a) 68/90
   b) 71/90
   c) 77/90
   d) 84/90

   Answer: c

   Solution:

   Converting into the common denominator of 90 (as the denominators of all the options are 90), we get the fractions given in the question as: 60/90, 80/90, 85/90, and 75/90.
   Their ascending order is: 60/90, 75/90, 80/90, 85/90.

So, any fraction that can be placed exactly in the middle of the row must have a value more than 75/90 and less than 80/90. (such that the arrangement is still in ascending order)
Therefore, option c - 77/90 is the correct answer.

---

4. Two numbers, 23/18 and 7/54 are taken. A binary operation is performed on them and the result obtained is 31/27. What operation might have been performed on the numbers taken?

a) Addition b) Subtraction c) Multiplication d) None of these

Answer: b

Solution:

The given fractions are 23/18 and 7/54.
Make the denominators the same:

$$\frac{23}{18} = \frac{69}{54}$$

So, the fractions are:

$$\frac{69}{54} \text{ and } \frac{7}{54}$$

The result given is $\frac{31}{27}$.
Convert it to the same denominator:

$$\frac{31}{27} = \frac{62}{54}$$

Now compare:

$$\frac{69}{54} > \frac{62}{54} > \frac{7}{54}$$

The result lies **between** the two given fractions.
This means **addition or multiplication is not possible** as in the above case addition and multiplication would increase the numerator and hence the results do not lie between the given two fractions.
So, we check subtraction:

$$\frac{69}{54} - \frac{7}{54} = \frac{62}{54} = \frac{31}{27}$$

This matches the given result.
Hence, the operation performed is subtraction.
Hence, the correct answer is option b.

---

5. In a class of 50 students, 20 are boys and the remaining are girls. Of the girls in the class, one third like singing and two-thirds like dancing. Some girls like both singing and dancing. If 5 girls like neither singing nor dancing, what fraction of the girls like both activities?

a) 1/3 b) 1/4 c) 1/5 d) 1/6

Answer: d

Solution:

If 20 are boys, then 50 - 20 = 30 girls are there in class.
One-third like singing, so 30/3 = 10 like singing.
Two-thirds like dancing, so (2 x 30)/3 = 20 like dancing.
If we simply add these, we get 10 + 20 = **30.**
But we are told that **5 girls like neither** singing nor dancing. That means only **25 girls** like at least one of the two activities.
So, **5 girls must be counted twice**, meaning they like **both** singing and dancing.
Therefore, **5 girls like both activities**.

Since there are 30 girls in total, the fraction is:
5 out of 30 = **1/6**
Hence, the correct answer is option d.

---

6. Tim has some sons, some daughters, and 27 grandchildren.
- **2/3 of his children are male and the rest are female**
- **Each of his sons has 2 sons and 1 daughter**
- **Each of his daughters has 2 daughters and 1 son**

How many daughters does Tim have?

a) 2 b) 3 c) 6 d) 9

Answer: b

Solution:

Total number of grandchildren = 27
Tim has both sons and daughters.
Each son has 2 sons and 1 daughter.
Each son has 3 children.
Each daughter has 2 daughters and 1 son.
So, each daughter has 3 children.
Thus, irrespective of being a son or daughter, every child of Tim has 3 children.
As there are 27 grandchildren altogether, Tim must have 27/3 = 9 children.
Among these 9, 2/3 are male and the rest are female.
9 x (2/3) = 6
So, there are 6 males, out of 9
The number of daughters = 9 - 6 = 3
Hence, option b is the correct answer.

---

7. Some numbers appear in a series as shown below:
1/2, 3/4, 1, 5/4, 3/2, 7/4...
Which of the following statements is definitely true regarding the above sequence?

a) The seventh term of the series would be 5/2

b) The difference between the sixth and eighth terms would be 3/4

c) The product of seventh and tenth terms is 20/4

d) The sum of the ninth and eleventh terms is 22/4

Answer: d

Solution:

It is a fraction sequence starting from 1/2 where every term increases by 1/4.
So, if we keep adding 1/4, we would get the next terms. Hence, the next terms are:
1/2, 3/4, 1, 5/4, 3/2, 7/4, 2, 9/4, 5/2, 11/4, 3, 13/4, 7/2, 15/4…
Let us analyse each option one by one:
Option a: As shown above in the sequence, the seventh term is 2 and not 5/2.
Hence, this statement is false.
Option b: The sixth term is 7/4 and eighth term is 9/4. There is a difference of 2/4.
Thus, option b is also false.
Option c: The seventh and tenth terms in the series are 2 and 11/4 respectively. The product of 2 and 11/4 is 22/4.
Hence, option c is also false.
Option d: The ninth term is 5/2 which can also be written as 10/4 and eleventh term is 3 which can also be written as 12/4. Hence, the sum of 10/4 and 12/4 is:

10/4 + 12/4 = 22/4
Since option d is definitely true, the correct answer is option d.

---

8. Aman and Samarth appear for an exam and each of them attempts all the questions.
Aman says: "1/3rd of my answers were wrong"
Samarth says: "5 of my answers were wrong"
If both of them together get 3/4th of the answers right, how many questions did Aman get right?

a) 20 b) 30 c) 10 d) 15

Answer: a

Solution:

Aman says that **1/3 of his answers were wrong**, which means **2/3 of his answers were correct**.
We test the options to see which one satisfies **all** the given conditions.

Check Option a: Aman got 20 questions right

If 20 is **2/3** of Aman's total questions, then it means that out of three parts, two parts = 20 questions.
Hence, three parts = 30 questions.
Total questions = 30
So, Aman:

- Right = 20
- Wrong = 10

Samarth says he got **5 questions wrong**, so:

- Total questions = 30
- Right = 25

Together:

- Total questions = 30 + 30 = 60
- Total correct answers = 20 + 25 = 45

Now,
45 ÷ 60 = **3/4**, which matches the given condition.
Option a satisfies all conditions.

Option b (30 right):

If 30 = 2/3, then two out of three parts = 30 questions.
So, total questions = 45 (2/3 of total questions = 30, total questions = 30 x 3/2)
Samarth got 5 wrong, 40 right
Together: 70 right out of 90, **not 3/4**

Option c (10 right):

If 10 = 2/3, then two out of three parts = 10 questions.
Total questions = 15 (2/3 of total questions = 10, total questions = 10 x 3/2)
Samarth: 10 right
Together: 20 out of 30, **not 3/4**

Option d (15 right):

If 15 = 2/3, then two out of three parts = 15 questions.
2/3 of total questions = 15, total questions = 15 x 3/2
Total questions = 22.5, **not possible**
Hence, option a is the correct answer.

---

9. Raju's age is 2/3 of his brother's age. Currently, if one of them is 30 years old, which of these options DOES NOT represent the possible age of Raju's brother?

a) 45 years b) 30 years c) 27 years d) None of these

Answer: c

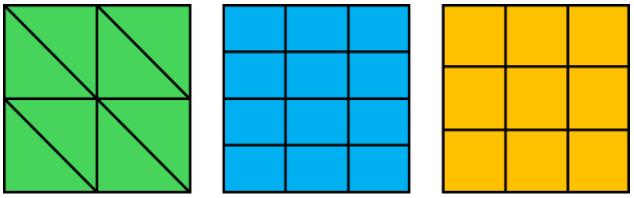
Solution:
Raju's age is 2/3 of his brother's age.
Raju's age = (2/3) of his brother's age.
If Raju's brother is 3k years old, then Raju will be (2/3) x 3k = 2k years old.

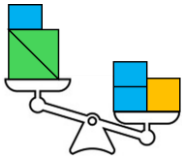
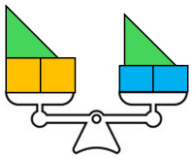
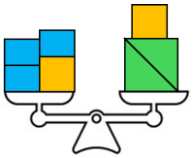
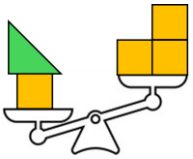
- Raju's age = 2k
- Brother's age = 3k

It is given that **one of them is 30 years old**.
Case 1: Raju is 30 years old
2k = 30. So, k = 15
Brother's age = 3k = 45 years
Case 2: Brother is 30 years old
3k = 30. So, k = 10
Raju's age = 2k = 20 years
So, the possible ages of Raju's brother are **45 years** and **30 years**.
Since, **27 years** does not appear in any valid case, it is **not possible**.
Therefore, option c is the correct answer.

---

10. The figure shows three square bricks of the same weight, each divided into equal pieces. Which option correctly represents the relationship among these pieces?



a)  b)  c)  d) 

Answer: c
Solution:
All three bricks have the **same total weight**.

- Green brick is divided into **8 equal pieces**: each green piece = **1/8**
- Blue brick is divided into **12 equal pieces**: each blue piece = **1/12**
- Yellow brick is divided into **9 equal pieces**: each yellow piece = **1/9**

Now check each option:
Option a
Left: 2 green + 1 blue = 1/8 + 1/8 + 1/12 = 1/3
Right: 2 blue + 1 yellow = 1/12 + 1/12 + 1/9 = 5/18
Since **1/3 > 5/18**, the balance shown is incorrect.

Option b
Both sides have one green piece, so remove it.
Left: 2 yellow = 2/9
Right: 2 blue = 1/6
Since **2/9 > 1/6**, the balance is incorrect.

Option c
Both sides have one yellow piece, so remove it.
Left: 3 blue = 3 × 1/12 = 1/4

Right: 2 green = 2 × 1/8 = 1/4
Both sides are equal, so the balance is correct.

Option d
After removing one yellow piece from both sides:
1 green = 1/8
Remaining yellow pieces = 2 × 1/9 = 2/9
Since **1/8 < 2/9**, the balance is incorrect.
Option c correctly represents the relationship among the pieces.
Hence, the correct answer is option c.

The Thinking Spot

A always lies on Tuesdays, Wednesdays, and Saturdays but tells the truth on all other days. B always lies on Tuesdays, Fridays, and Sundays but tells the truth on all other days.
Today, A tells C, "Yesterday, I was lying."
Today, B also tells C, "Yesterday, I was lying."
If A told the truth to C and B lied to C, which day is today?
(a) Sunday (b) Wednesday (c) Thursday (d) Saturday

Answer: a

Solution:
Analysing the situation, A truthfully informs C that yesterday A was lying, allowing for the possibilities of yesterday being Tuesday, Wednesday, or Saturday.

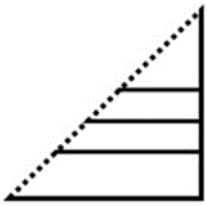
In contrast, B lies to C by claiming that yesterday B was lying, indicating that B was actually telling the truth. This opens up the possibilities for yesterday being Monday, Wednesday, Thursday, or Saturday.

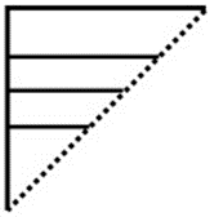
Considering both statements, the only days that align with both A and B are Wednesday and Saturday. Consequently, today could be either Thursday or Sunday. B is lying today and he lies on Sunday and not on Thursday.

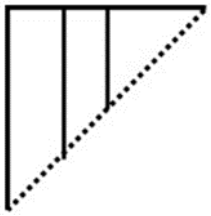
Therefore, the correct answer is Sunday.
Hence, the correct answer is option a.

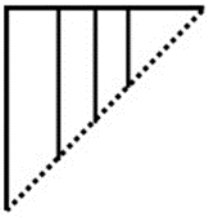
Chapter 8: Playing with Constructions

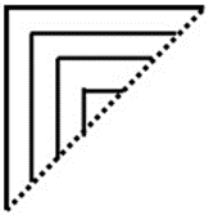
1. **An image made of squares is cut diagonally into two halves, and one half is shown below. Which option should be joined with the question image so that the resulting image forms exactly 4 squares?**
   Note: *You cannot rotate any of the images*



a) 

b) 

c) 

d) 

Answer: c

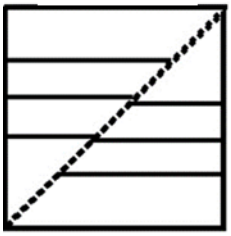
Solution:

The approach to solving this question involves forming a square with four equal sides. In the question image, there are four horizontal lines and one vertical line, with the vertical line connecting all the horizontal lines. This setup provides two sides for each of the four squares (one vertical and one horizontal). We need to add the remaining sides to complete each square.

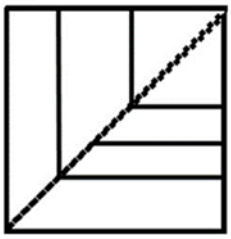
- **Option a:** It contains three horizontal lines that do not connect to form any squares, so this option is incorrect.
- **Option b:** When combined with the question image, it forms three squares instead of four, so this option is incorrect.
- **Option c:** It forms four squares when combined with the question image, so this option is correct.
- **Option d:** It does not form any squares when combined with the question image, so this option is incorrect.

Thus, the correct answer is **option c**.

Option a

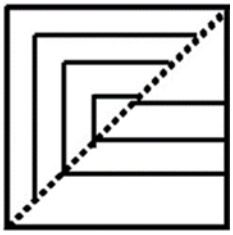


Option b

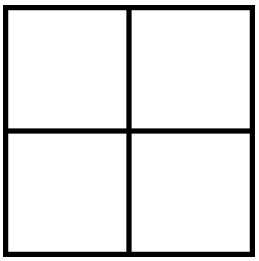


Option c

Option d



2. **Given below is an arrangement of squares. What is the minimum number of straight lines required so that the total number of square shapes that appear in the final image (including the existing ones) is more than 5?**

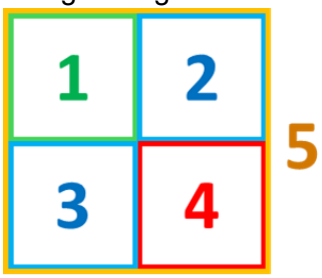


a) 2 b) 3 c) 4 d) 5

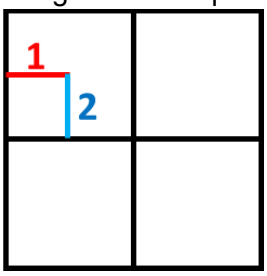
Answer: a

Solution:

The given figure has 5 squares.



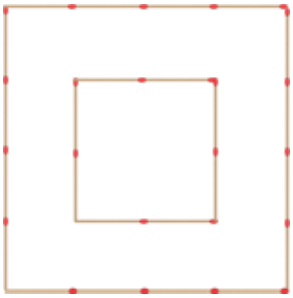
We need to add a minimum number of lines such that the new figure will have at least 6 squares.
Adding only one line will not give us a new square.
We get a new square if we add two lines as shown below.



Thus, at minimum, we must add two lines such that the resultant figure has more than 5 squares.
Thus, option a is the correct answer.

---

3. **The following arrangement is made up of matchsticks of the same dimensions. How many additional matchsticks are needed to divide the area between the outlines of the larger outer square and the smaller inner square into three parts, each having the same area as the smaller inner square?**



a) 4 b) 3 c) 2 d) 5

Answer: b

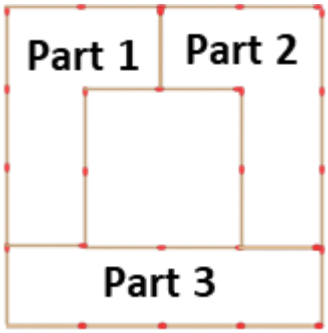
Solution:

Let the length of each matchstick be 1 unit. Therefore, the area of each smaller square is 1 x 1 units = 1 unit

Area of Part 1: (3 x 1) + (1 x 1) = 4 units

Area of Part 2: (3 x 1) + (1 x 1) = 4 units

Area of Part 3: 4 x 1 = 4 units

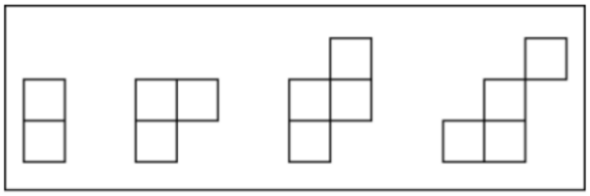


Hence, the correct answer is option b.

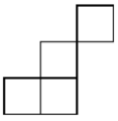
---

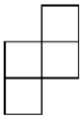
4. **Form a 3 × 3 square using exactly 3 shapes from the set given below. Which shape will NOT be used?**

Note: *You cannot rotate or overlap the shapes*



a) 

b) 

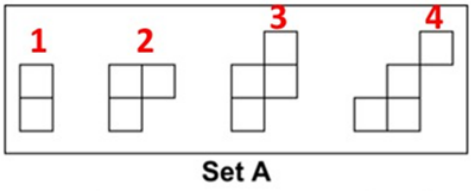
c) 

d) 

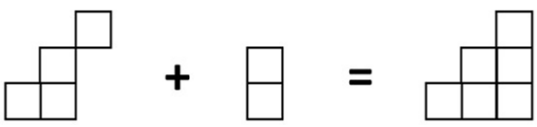
Answer: c

Solution:

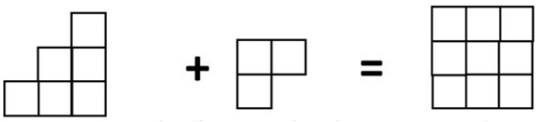
The approach to solve a question like this is to first look for the shape that has the maximum number of blocks where the other shapes can fit to form a 3 × 3 square. Now, let us first number all the shapes in Set A.



Now, by selecting the 4th shape from Set A, we get a total of three columns. Next, we need to fit in the other shapes. Let us analyse. To complete column 3, we need two blocks, so we take the first shape from Set A.

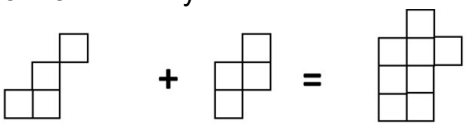


Placing **shape 2** in the resultant figure completes it and forms a **3 × 3 square**.



Shape 3 is not used in forming the above 3 × 3 grid. Now, let us check whether shape 3 can be used with any of the other shapes to make a 3 × 3 square.

If we try to combine shape 3 with shape 4, it will never fit inside a 3 × 3 grid. This is because both shapes have a stepped structure, and when they are placed together (without rotating or overlapping), the total height increases and goes beyond 3 rows. As a result, the arrangement becomes taller than the allowed 3 × 3 boundary.



Similarly, when we try merging shape 3 with any of the remaining shapes from Set A, the combined layout again crosses the 3-row limit or creates empty gaps that cannot be filled by the third shape. So, no combination containing shape 3 can fit perfectly inside a 3 × 3 square.

Hence, shape 3 can never be used to form the required 3 × 3 grid. Hence, option c is the right answer.

---

5. Six pieces are given. Using all of them, form two separate 3 × 3 square grids, each containing both letters and shapes. In both completed grids, which shape will be adjacent to a letter?

Note: *Two cells are considered adjacent only if they share a common side. Cells that share a common corner alone are not adjacent. Rotation of the pieces is not allowed*

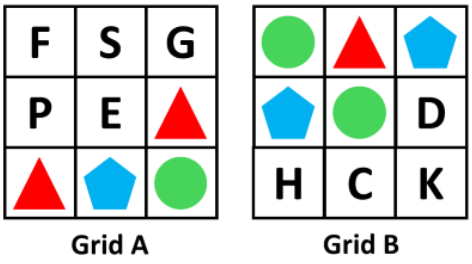
a) Red Triangle b) Green Circle c) Blue Pentagon d) Both options b and c

Answer: c

Solution:

Each square grid must have some letters and shapes.

The only possible arrangement of the blocks that satisfies this condition is given below:



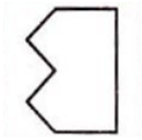
In Grid A, the cells containing the red triangles and the blue pentagon are adjacent to the letter cells.

In Grid B, the cells containing the blue pentagons and the green circle are adjacent to the letter cells.

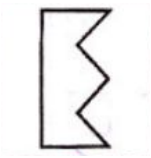
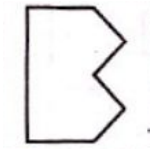
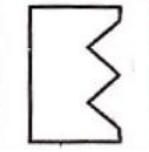
Thus, the blue pentagon cell will be adjacent to a letter cell in both the square grids.

Thus, option c is the correct answer.

6. **Which of these options, when combined with the question image, will form a rectangle or a square? Note:** *The images cannot overlap each other*



Question Image

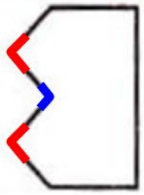
a)  b)  c)  d) 

Answer: a

Solution:

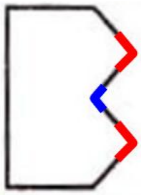
The key to solving such questions is to look for visual cues.

In the question image we see edges point outwards and one edge pointing inwards.

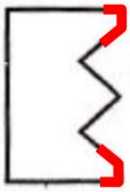


So, we need a shape which has two edges pointing inwards and one edge in the middle pointing outwards.

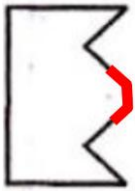
In option b, there are two edges pointing outwards and one edge pointing inwards, hence this shape will not complete the question image properly.



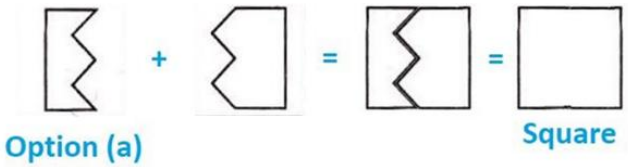
In option c, two edges point inward and one edge in the middle points outward. However, the straight lines at the top-right and bottom-right corners would not fit with the question image, as the question image does not have straight lines at the corners.



In option d, the outward edge in the middle does not have a sharp tip, which would leave an empty space in the middle of the rectangle.



Only option a can be combined with the part in the question image to form a square.



Hence, the correct answer is option a.

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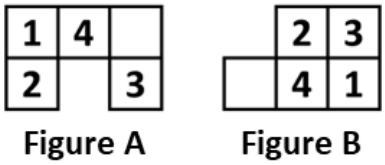
7. When Figure A is placed over Figure B to form a square grid, which same digits will be positioned exactly on top of each other?



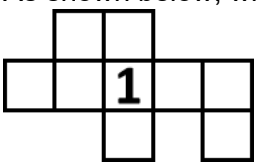
a) 1 b) 2 c) 3 d) 4

Answer: c

Solution:

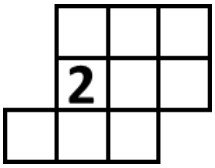
Option a:

As shown below, when the blocks with number **1** overlap, the following shape is formed.



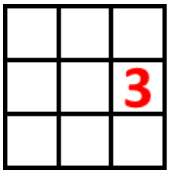
Option b:

As shown below, when the blocks with number **2** overlap, the following shape is formed.



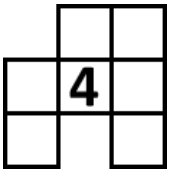
Option c:

As shown below, when the blocks with number **3** overlap, a **square** is formed.



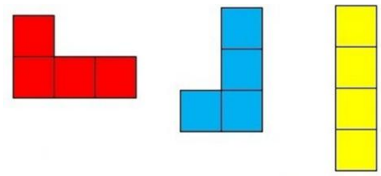
Option d:

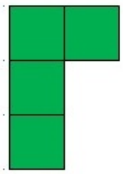
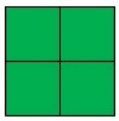
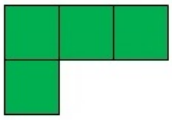
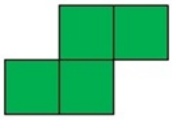
As shown below, when the blocks with number **4** overlap, the following shape is formed.



Since a **square** is formed only when the blocks with number **3** overlap, the correct answer is **option c**.

8. **Four pieces together form a square. Only three of these pieces are shown. Which option represents the fourth piece that, when joined with the given three pieces, will complete the square?**
Note: *The pieces must not overlap each other and rotation is not allowed*



a) 
b) 
c) 
d) 

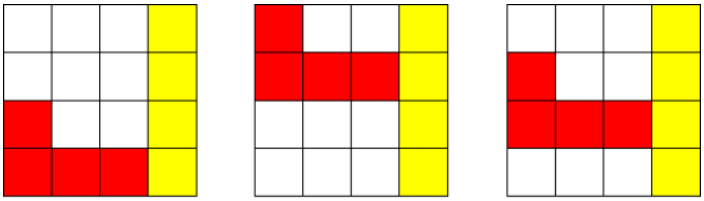
Answer: b

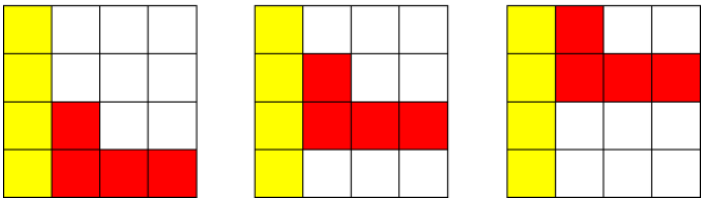
Solution:

A square must have equal height and width.

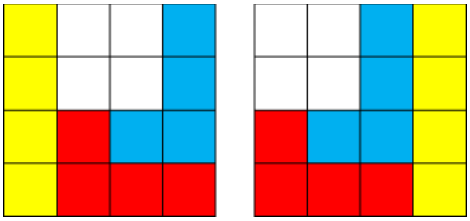
The yellow piece already has 4 blocks in one column. If the red piece is placed in the same column, that column will have more than 4 blocks, making the figure taller than its width.

As shown below, six arrangements of the yellow and red blocks are possible.

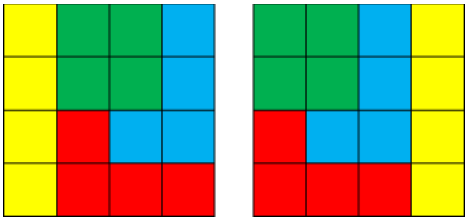




There are only two arrangements in which blue piece can be placed as shown below:



In both the arrangements the place remaining for the green piece is a 2 x 2 square which is present in option b. Filling that, we get the final arrangements as shown below:



Hence, the correct answer is option b.

9. Two identical paper sheets are joined together at one of their sides to form a square. Which of the following CAN DEFINITELY NOT be the shape of each of the paper sheets?

a) Triangle b) Square c) Rectangle d) None of these

Answer: b

Solution:

The question asks which two identical paper sheets when joined together at one of their sides does not form a square, let us analyse each option one by one:

Option a: Joining two triangles will give a square as shown below:

Option b: Joining two squares at any side will always result in a rectangle.
Hence, a square can never be formed.

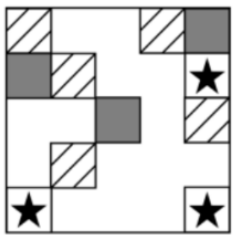
Option c: Joining two rectangles will give a square as shown below:

Since joining two squares can never result in a square, the paper sheets can definitely not be squares.
Hence, the correct answer is **option b.**

---

10. A 5 × 5 grid is formed using three different pattern blocks, as shown in the image. Some blocks are missing from the grid. No two adjacent blocks in the grid can have the same pattern. Complete the grid and tell which pattern block is PRESENT the MOST.

Note: *Blocks that share common sides are considered to be adjacent. Blocks that share a common corner alone, are NOT adjacent*



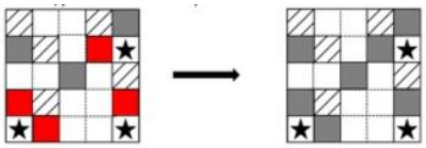
a) Pattern 3 b) Pattern 2 c) Pattern 1 d) Both options b and c

Answer: c

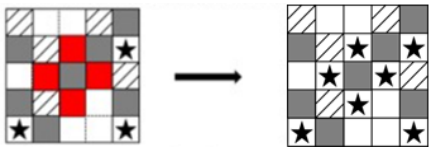
Solution:

We have to form the 5 × 5 grid using three different pattern blocks as shown below.

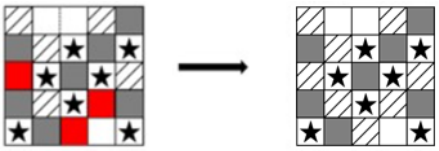
We have to complete the given grid such that:
No two adjacent blocks have the same pattern.
The red-shaded blocks can only contain pattern 1, because their adjacent blocks already contain patterns 2 and 3.
Therefore, pattern 1 must be placed in the red-shaded blocks.



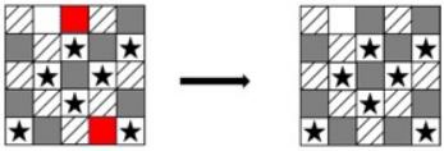
Now, let's analyse the grid to place pattern 2.
The red-shaded blocks can hold pattern 2, because their adjacent blocks already contain patterns 1 and 3.
Therefore, pattern 2 must be placed in the red-shaded block.



Now, let's analyse the grid to place pattern 3.
The red-shaded blocks can contain pattern 3, because their adjacent blocks already have patterns 1 and 2.
Therefore, pattern 3 must be placed in the red-shaded blocks.

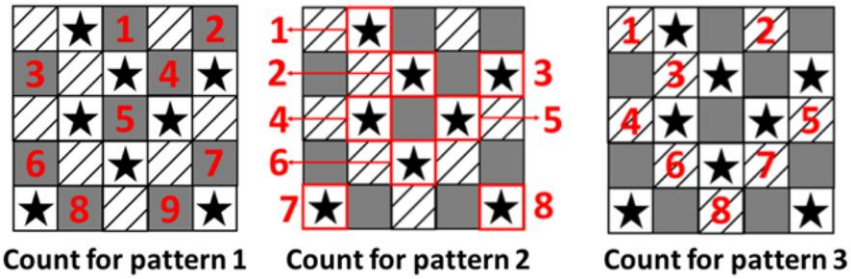


In the grid below, the red-shaded blocks are adjacent to pattern 2 and pattern 3.
Therefore, pattern 1 must be placed in the red-shaded blocks.

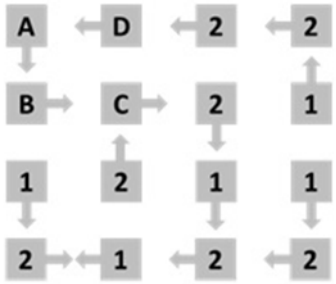


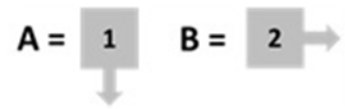
The red-shaded block shown below is adjacent to pattern 1 and pattern 3.
Therefore, pattern 2 must be placed in the red-shaded blocks.

As shown below, Pattern 1 is present 9 times.
Patterns 2 and 3 are present 8 times each.
Thus, Pattern 1 is present the most number of times.
Hence, option c is the correct answer.

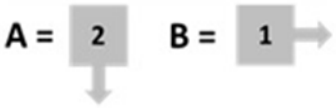


Place numbers inside every cell so that each cell indicates how many different numbers its arrow(s) point to. What will come in place of A and B?

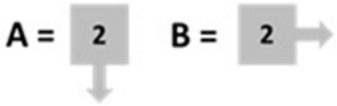




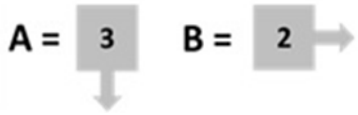
(a)



(b)



(c)



(d)

Answer: c

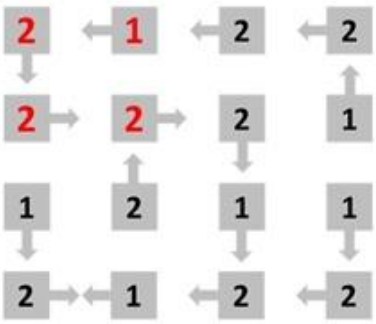
Solution:

In the given grid, we can determine the values of the cells by following the arrows. Since C's arrow points to the numbers 1 and 2, C must have the value 2.

Similarly, B's arrow points to the numbers 1 and 2. So, B must also have the value 2. Now since we know that B = 2, we can see that A's arrow also points to the numbers 1 and 2. So, A must also have the value 2.

Therefore, the values of the cells are: A = 2, B = 2

Thus, option c is the correct answer.



Chapter 9: Symmetry

1. **Image A is placed exactly on top of Image B (exactly overlapping it). How many shapes with vertical symmetry overlap letters that also have vertical symmetry?**
Note: *Rotation of the images is not allowed*

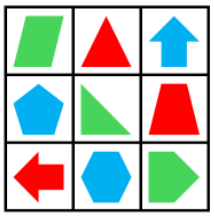


Image A

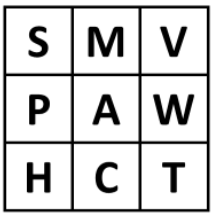


Image B

a) 1 b) 2 c) 3 d) 4

Answer: c

Solution:

Among the shapes of Image A, five shapes have vertical symmetry.

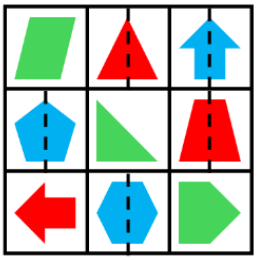


Image A

Among the letters, six letters have vertical symmetry.

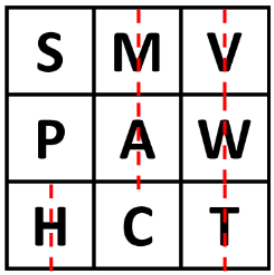


Image B

Image A is placed over Image B.

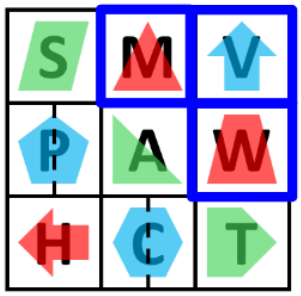
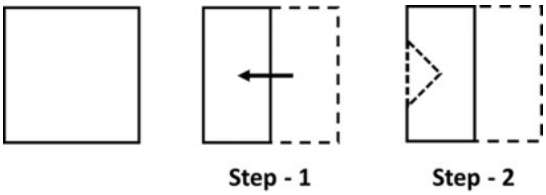
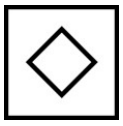
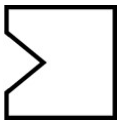


Image A + Image B

3 such shapes having vertical symmetry overlap three letters having vertical symmetry.
Hence, option c is the correct answer.

2. **A square sheet of paper is folded in half, as shown in Step 1. A triangular piece is then cut from the folded sheet, as shown in Step 2. Which option shows the final shape obtained when the paper is unfolded?**



a)  b)  c)  d) 

Answer: c

Solution:

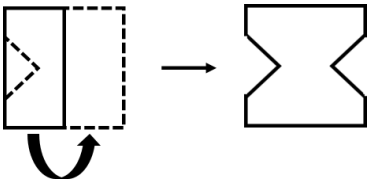
A triangle is cut from the folded edge, as shown in Step 2 of the diagram.
Since the paper is folded, the cut passes through two layers (on the outer edges of the sheet). This means:

- The cut shape appears twice when the paper is unfolded
- The two shapes appear as mirror images on opposite sides of the centre line

Option c shows:

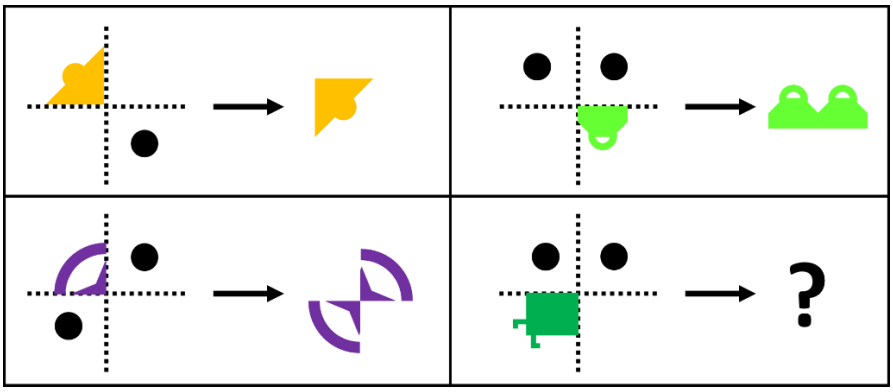
- Two identical triangular cuts on both sides
- A shape that is symmetric along the vertical axis

Options A, B, and D do not match the required symmetry or shape pattern.
Hence, the correct answer is **option c**.



---

3. **What will come in place of "?"**



a)  b)  c)  d) 

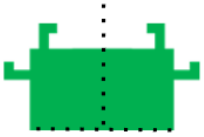
Answer: c

Solution:

In each pair, on the left, a symmetrical image is divided into four parts (where the dotted lines act as the lines of symmetry) and only one part is revealed among them.

On the right side, the corresponding symmetric part(s) of the image are revealed, and only those parts where the black dots are placed (on the left) become visible.

In the question term, since the dots are placed in the top-left and top-right sections, the corresponding symmetric images of the given green part will appear in those two sections.

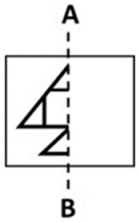


The orientation of the figure matches **option c**. Hence, the correct answer is option c.

---

4. A symmetrical transparent sheet of paper is folded in half along the dotted line AB. When the sheet is unfolded, what is the total number of triangles seen?

Note: *Line AB is not a part of the shape*



a) 3 b) 4 c) 5 d) 6

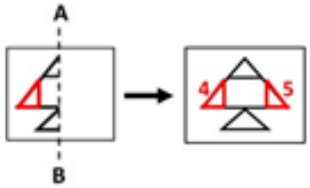
Answer: c

Solution:

Since the sheet is transparent and symmetrical, unfolding it will create a mirror reflection on the right side that matches the figures on the left side.

Therefore, the half-triangles on the left side form full triangles when the sheet is unfolded.

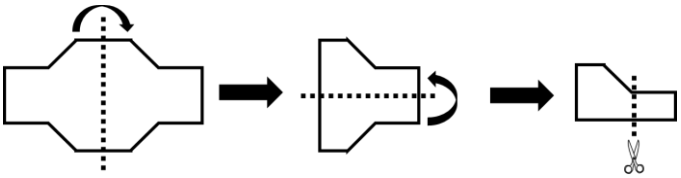
The full triangles on the left side will mirror onto the right side when the sheet is unfolded, resulting in an additional triangle on the right.



Hence, 5 triangles are formed when the sheet is unfolded.

Option c is correct.

5. **The given shape is first folded vertically, then horizontally, and then cut along the dotted line as shown below. After unfolding, if the resultant shape has equal sides (edges), how many lines of symmetry does the resultant shape have?**

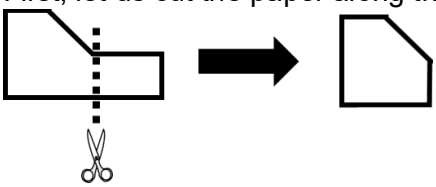


a) 10 b) 4 c) 6 d) 8

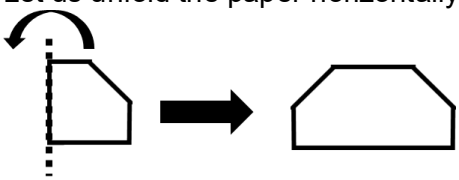
Answer: d

Solution:

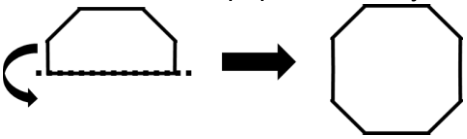
First, let us cut the paper along the dotted line.



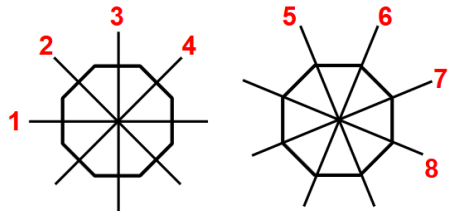
Let us unfold the paper horizontally:



Let us unfold the paper vertically:



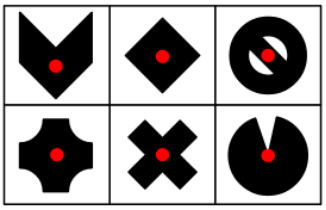
As shown below, the resultant shape has **8 lines of symmetry**. Hence, the correct answer is **option d**.



---

6. **The following grid is made of 6 small white squares. Each square has a black shape inside it. Count the number of squares which are adjacent to exactly two other squares, whose shapes have an angle of rotational symmetry of 90^0.**

Note: *The red circle in each shape acts as the centre of rotation. Two squares are said to be adjacent if they share the common sides. Squares that share common corner alone are not adjacent to each other*

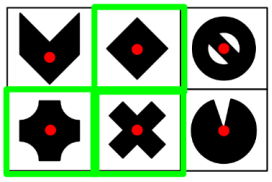


a) 1 b) 2 c) 3 d) More than 3

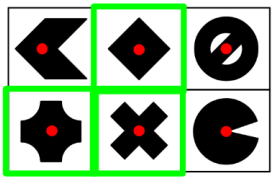
Answer: b

Solution:

The easier way is to first identify the shapes that have an angle of rotational symmetry of 90^0.
For this, analyse how each shape looks when it rotates by 90^0.



ORIGINAL SHAPES

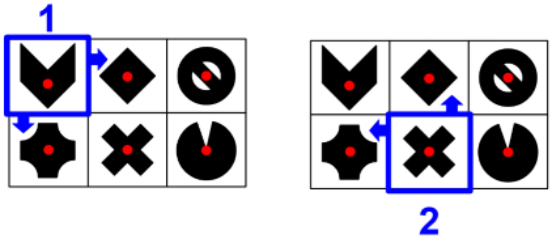


SHAPES AFTER 90^0 ROTATION

Exactly 3 shapes have a rotational symmetry with angle 90^0.

So, we have to count the number of squares which have EXACTLY two other adjacent squares, whose shapes have an angle of rotational symmetry of 90^0.

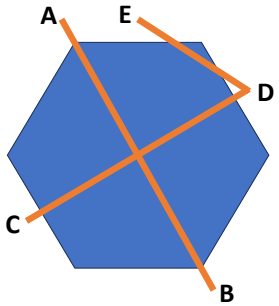
As shown below, there are two such squares.



Option b is correct.

---

7. Along which line should I cut the given paper sheet to get two identical Pentagons?

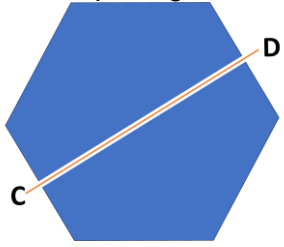


a) AB b) CD c) DE d) None of These

Answer: b

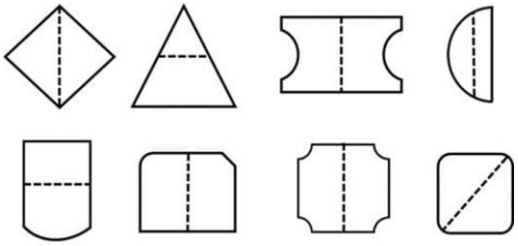
Solution:

As the given paper has 6 sides, if it is cut along line AB, then each piece will have 3 sides of the original sheet and a new side is formed as it is cut along the diagonal (3 + 1 = 4). In other words, the figure will be divided into identical quadrilaterals (not a pentagon).
As shown in the figure given below, when the given paper piece is cut along the line CD, we will get two identical pentagons.



Hence, option b is the answer.

8. **Eight shapes are shown below, each having a dotted line. Count the number of shapes in which the dotted line is a line of symmetry.**

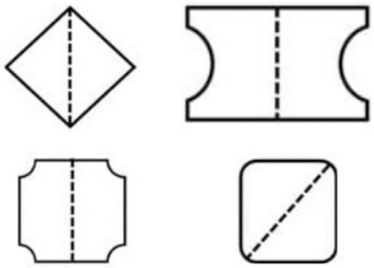


a) 3 b) 4 c) 5 d) 6

Answer: b

Solution:

As shown below, there are four shapes where the dotted lines are lines of symmetry:



Hence, the correct answer is option b.

---

9. **How many of the following letters have at least one line of symmetry?**

RISTLHPACE

a) 5 letters b) 6 letters c) 8 letters d) 10 letters

Answer: b

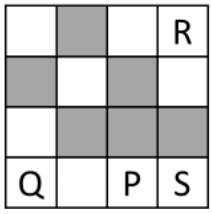
Solution:

The letters that have at least one line of symmetry are: I, T, H, A, C, and E.

Hence, option b is correct.

---

10. **In the given figure, exactly one square among the labelled squares – P, Q, R, and S must be shaded grey to make the complete grid symmetric, along any one of the directions. Which square must be shaded to satisfy the condition?**



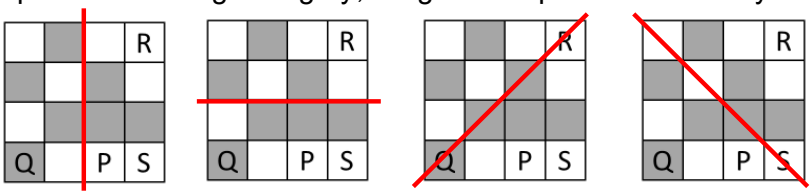
a) Q b) R c) S d) P

Answer: d

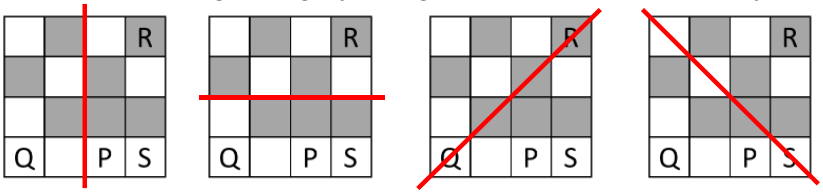
Solution:

Let us analyse each option one by one:

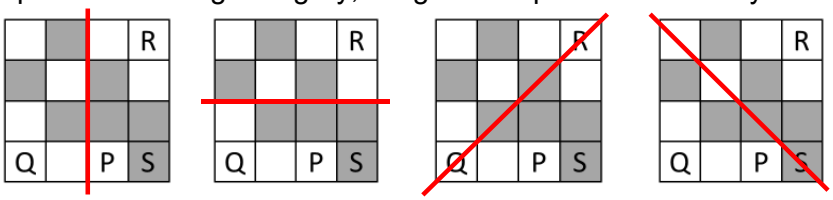
Option a: Shading Q in grey, we get a shape which is not symmetrical.



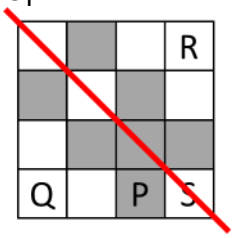
Option b: Shading R in grey, we get a shape which is not symmetrical.



Option c: Shading S in grey, we get a shape which is not symmetrical.



Option d: After shading square P, the shape becomes symmetrical along the following line of symmetry:



Hence, option d is correct.

The Thinking Spot

There are 3 jars out of which one of them has candies and the other two are empty jars. There is a message printed on the lid of each jar. Only one of these messages is true and the others are false.
The message on the 1st jar is: "The Candies are not in this jar" and the same message is written on the 2nd jar as well.
The message on the 3rd jar is: "The Candies are in the 2nd jar".
Which jar has candies in it?

(a) 1st
(b) 2nd
(c) 3rd
(d) Cannot be determined

Answer: a

Solution:
If the candies are in the 1st Jar, then the message on the 2nd Jar will be true and the messages on the other two Jars will be false.
If the candies are in the 2nd jar, then the message on both the 1st jar and the 3rd jar will be true.
If the candies are in the 3rd jar, then the message on both the 1st and the 2nd jar will be true.
Only if the 1st jar has the candies, the conditions in the question are satisfied.
Hence, the candies are in the 1st jar.
Thus, the correct answer is option a.

Chapter 10: The Other Side of Zero

1. **In the following series, which of these English alphabets would appear first alongside a negative number?**

   A165, B153, C141, D129, ...

   a) M b) N c) O d) P

   Answer: c

   Solution:

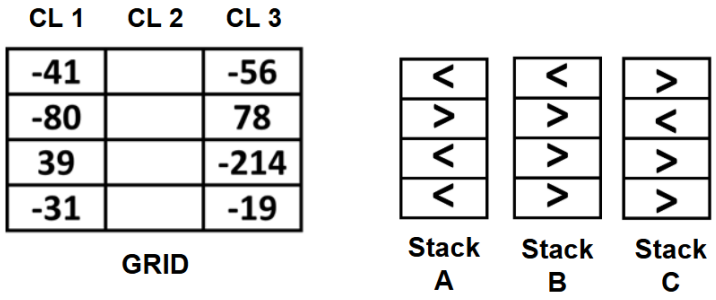
   In the given series, following things are happening:

   - Every term has a letter before the number, which starts from A and changes to the next letter alphabetically
   - Every term has a number after the letter, which decreases by 12 in every next term, starting from 165

   So, if we continue the series, we get: E117, F105, G93, H81, I69, J57, K45, L33, M21, N9, O -3, ...
   We observe that O is the first alphabet which is written alongside a negative number.
   Hence, the correct answer is option c.

---

2. **In the given grid, the empty cells in Column 2 must be filled using either ">" or "<". Three symbol stacks are provided, and each stack must be placed as given (without changing the order) into Column 2. Which two stacks, when placed in Column 2, result in the same number of correctly related integer pairs?**

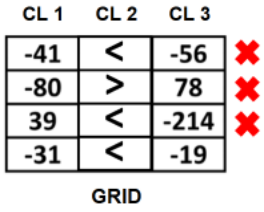


   a) Stacks A and B b) Stacks B and C c) Stacks A and C d) All stacks A, B and C

   Answer: a

   Solution:

   Let's assume what happens when each stack is placed on the grid.
   Stack A:
   When stack A is placed on the grid, we get exactly one pair of integers having a correct relationship between them.



   Stack B:
   When stack B is placed on the grid, we get exactly one pair of integers having a correct relationship between them.

CL 1	CL 2	CL 3	
-41	<	-56	✖
-80	>	78	✖
39	>	-214	
-31	>	-19	✖

GRID

Stack C:

When stack C is placed on the grid, we get exactly three pairs of integers having a correct relationship between them.

CL 1	CL 2	CL 3	
-41	>	-56	
-80	<	78	
39	>	-214	
-31	>	-19	✖

GRID

Therefore, stacks A and B result in the same number of correct pairs of integers.

Option a is the correct answer.

---

3. What will come in place of "?" in the given series?

-12, 2, -10, 4, -8, 6, -6, ?

a) 7 b) 8 c) -4 d) 9

Answer: b

Solution:

The given series consists of two interwoven sequences. The first sequence appears at the odd positions and starts from -12, while the second sequence appears at the even positions and starts from 2.

In both sequences, each term is obtained by adding 2 to the previous term.

The missing term is at the eighth position, which belongs to the second (even-position) sequence.

The previous term in this sequence is 6. So, adding 2 to 6 will give us 8.

Therefore, option b is the correct answer.

---

4. If C is a positive integer, which of these options will have the LARGEST value, where "+" means "-" and "-" means "+"?

a) C + 151 - 41 b) C - 80 + 357 c) C + 50 + 93 d) C + 200 - 68

Answer: a

Solution:

Given that "+" means "-" and "-" means "+".

So, the options would become:

A) C + 151 - 41 = C - 151 + 41

B) C - 80 + 357 = C + 80 - 357

C) C + 50 + 93 = C - 50 - 93

D) C + 200 - 68 = C - 200 + 68

Let us analyse each option one by one:

1. C - 151 + 41 = C - 110
2. C + 80 - 357 = C - 277
3. C - 50 - 93 = C - 143
4. C - 200 + 68 = C - 132

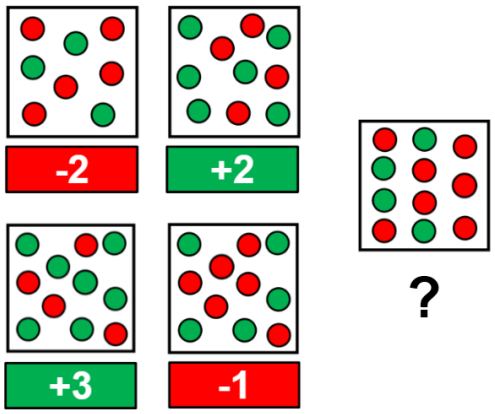
C is a positive number.

110, which is the smallest number among 110, 277, 143, and 132 is being subtracted from C.

Compared to other values, C - 110 will be the largest.
As C -110 is the largest, option a is the correct answer.

---

5. If each of the given terms follows the same theme, what will come in place of "?"



a) +3 b) -2 c) -3 d) -3

Answer: d

Solution:

In each term, the red circle represents a value of -1, while the green circle represents +1.
The number inside the box shows the total sum of the values represented by the circles.
Also, the colour of the box is the same as the colour of the highest number of circles in each term.
In the given term, there are 7 red circles and 4 green circles, resulting in a total value of -3.
The box will be red, as there are more red circles than green.
Therefore, the correct answer is option d.

---

6. In a shop, every customer receives a scorecard that starts with 0 points. If an item costing more than ₹500 is purchased, the amount exceeding ₹500 is added to the scorecard as points. If an item costing less than ₹500 is purchased, the amount by which it is less than ₹500 is subtracted from the scorecard as points. The data regarding the first five purchases of a customer is shown in the table below. Using the table, find the sum of A, B, C, D, and E.

Purchase Price	Score Card
B	A
200	C
600	40
420	D
E	-25

a) 1695 b) 1395 c) 1495 d) 1480

Answer: b

Solution:

The approach to find the unknown values is to logically compare the purchase prices of the previous or next purchase and check by what value the points on the scorecard changed, with respect to the current points.
Solving for C: Compare with the next purchase.
Value of scorecard initially was C, then it changed to 40 after an addition of 100 (since the purchase of 600 is 100 more than 500, we add 100 to the scorecard). So, the value of C is:
C + 100 = 40

C = 40 - 100
C = - 60
Solving for A: Compare with the next purchase.
Value of scorecard initially was A, then it changed to -60 after the subtraction of 300 (as the purchase of 200 is 300 less than 500, we have to subtract 300 from the scorecard). So, the value of A is:
A - 300 = - 60
A = - 60 + 300
A = 240
Solving for B: Check the increased value of the scorecard (from 0 to A)
At the start, we know that the value of the score card is 0.
Then, after buying a product of ₹B, it changed to 240.
So, B is ₹240 more than 500. Thus, the value of B is:
B = 500 + 240
B = 740
Solving for D: Compare with the previous purchase.
Value of scorecard initially was 40, then it changed to D after the subtraction of 80 (as the purchase of 420 is 80 less than 500, we subtract 80 from the scorecard). So, the value of D is:
D = 40 - 80
D = -40
Solving for E: Check the increased value of the scorecard (from D to -25)
Value of scorecard is -40 (D's value). Then, after buying a product of ₹E it changed to -25.
So, E is ₹15 more than 500. Thus, the value of E is:
E = 500 + 15
E = 515

Purchase Price	Score Card
740	240
200	- 60
600	40
420	- 40
515	-25

Thus, the sum of A, B, C, D, and E is:
240 + 740 + (-60) + (-40) + 515
= 1495 - 100
= 1395
Hence, the correct answer is option b.

---

7. Alex has a magic box that changes a number based on these rules:
- **If the input is greater than 400, subtract 100**
- **If the input is less than 201, add 100**
- **If the input is between 201 and 401, it becomes 0**

After this, the sign of the number is reversed (positive becomes negative and vice versa)
Which input will produce an output of -345?

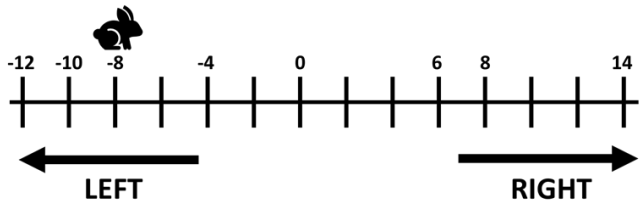
a) 445 b) 245 c) -445 d) 545

Answer: a
Solution:
The final result is -345, which means before the sign change it was +345.

However, to get 345 after the operation, the original number must have been one that, after adding or subtracting 100, becomes 345. (as any input between 201 and 401 becomes 0, it is definite that our input is not between 201 and 401).
Let's test both cases:
If 100 was deducted, the original input would be 445 (445 = 345 + 100), and if 100 was added, the original input would be 245 (245 = 345 - 100).
Since, 445 is greater than 400, it satisfies the first rule ("If a number is greater than 400, 100 is deducted").
Also, 245 would not satisfy the above condition, as it lies between 201 and 401 and would have become 0, if given as input.
Thus, the original number must have been +445.
After deduction, we get 345, and then the sign changes to negative, giving -345.
Hence, the required number is 445. Option a is correct.

---

8. A number line has equally spaced points with values following a pattern, where some values are hidden. A rabbit starts at -8 and jumps on the 9th point to the right. From its new position, it then jumps on the 7th point to the left. What is the sum of the values of all the points it lands on, including the starting point?

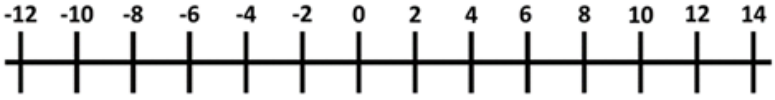


a) 0 b) 2 c) -2 d) -4

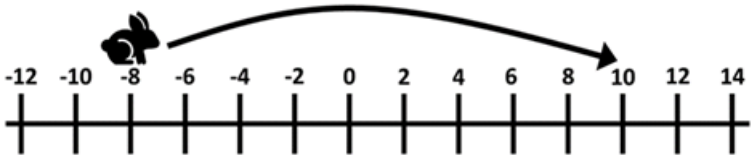
Answer: c

Solution:

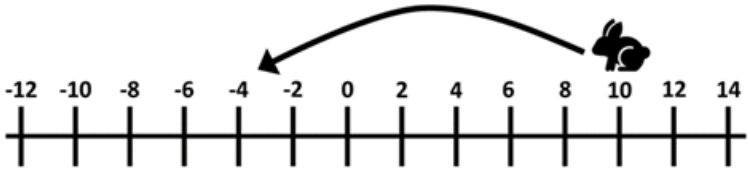
Let us first fill the empty places on the number line:



Step 1: Rabbit stands at -8 and jumps 9 positions to the right. It will come at 10, as shown below:

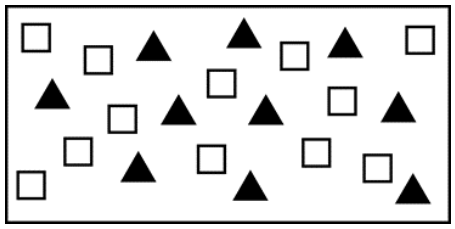


Step 2: Rabbit stands at 10 and jumps 7 positions to the left. It will come at -4, as shown below:



So, the numbers collected are -8, 10 and -4.
Hence, their sum is -8 + 10 + (-4) = -2.
Hence, option c is the correct answer.

9. In the box below, each square represents +10, and each triangle represents -15. How many more such squares or triangles should be added to the box, such that the sum of all the shapes of the box is 50?



a) 3 triangles b) 1 triangle c) 8 squares d) 5 squares

Answer: c

Solution:

Let's find the total value of the box with the given figures.

Each square represents +10, and there are 12 squares. So, their total value is 12 × 10 = +120.

Each triangle represents -15, and there are 10 triangles. So, their total value is 10 × (-15) = -150.

The total value of the box is 120 - 150 = -30.

Since we want the box value to become +50, we need to increase the total by 80 (because (-30) + 80 = 50).

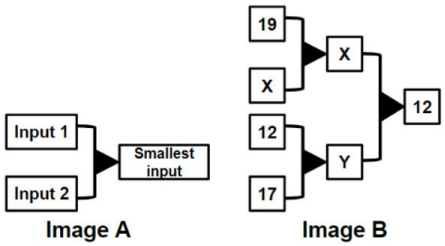
Each square adds +10. So, adding 8 more squares would make the total 50.

Hence, 8 additional squares are needed for the box value to become 50.

Thus, the correct answer is option c.

---

10. Below is a logic machine that takes two numerical inputs and selects the smaller number to continue, as shown in Image A. Using this same logic, what could be the possible value of 'X' in Image B?



a) 24 b) 20 c) 14 d) 11

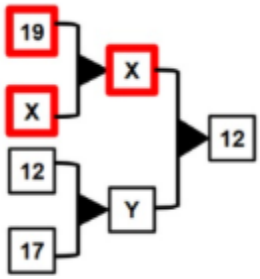
Answer: c

Solution:

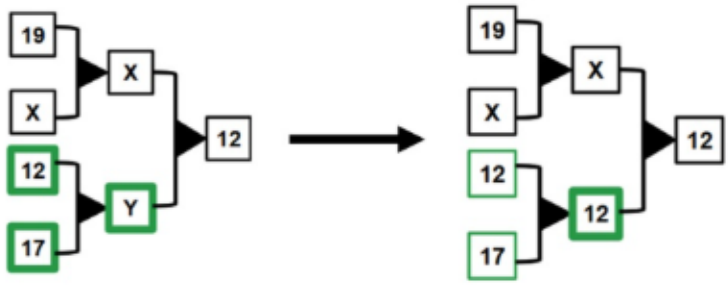
The logic machine selects the smaller number between two inputs.

In Image B, the top logic machine selected 'X' when 19 and 'X' are entered as inputs.

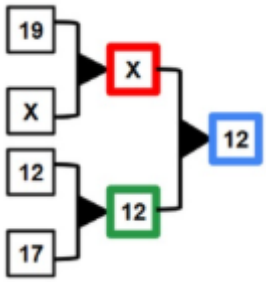
This means that 'X' is a number less than 19. -------- (1)



The logic machine at the bottom selected ‘Y’ when 12 and 17 are entered as inputs.
As the machine selects the smaller number, ‘Y’ is definitely 12.



Finally, when ‘X’ and ‘12’ are the inputs, the machine selected 12.
This means that 12 is the smaller number. Hence, ‘X’ is a number greater than 12. -------- (2)



From (1) and (2), we can say that ‘X’ is greater than 12 and less than 19.
Thus, 14 is a possible value of ‘X’.
So, option c is the correct answer.

The Thinking Spot

All 26 letters of the English alphabet are arranged in a circle in the order A to Z, with Z next to A. Six groups of 4 consecutive letters are selected from this arrangement and each group is assigned a unique number from 1 to 6. The table below shows a letter and the number of the group it belongs to. Which option shows letters that could belong to the same group?

G	S	K	A	J	F	D	N	P
3	6	4	1	3	2	2	4	5

(a) A-B-C-D (b) G-H-I-J (c) L-M-N-O (d) I-J-K-L

Answer: b

Solution:

To solve this question, you need to look for the first and last letters of any 4-letter group. If the value of end letters is same then they are part of the same group and if the value is not the same, then the letters are not the part of the same group.

For example, in option a, if all the 4 letters belong to the same group, then A and D should have the same number. But as per the grid the value of A is 1 and that of D is 2. Hence, these letters are not a part of the same group.

Only in option b, end letters G and J have the same value i.e. 3.

Hence, G-H-I-J are a part of the same group.

If G and J are part of the same group, then the next group would start with K and end with N. Therefore, options C and D are also not possible.

Thus, option b is the correct answer.

PART 2

ARTIFICIAL INTELLIGENCE

Chapter: 1 Introduction to AI and Everyday Examples

Exercise

A. Multiple Choice Questions.

1. What is labelled data?
   a) Data without any tags b) Data with predefined labels or tags
   c) Random data d) Incorrect data
2. Who introduced the Turing Test?
   a) John McCarthy b) Alan Turing
   c) Charles Babbage d) Isaac Newton
3. In supervised learning, data is:
   a) Unlabelled b) Random
   c) Labelled d) Deleted
4. Predicting exam marks based on the trained data uses:
   a) Supervised Learning b) Unsupervised Learning
   c) Reinforcement Learning d) All of the above
5. Which of the following is not AI?
   a) Voice assistant b) Face recognition
   c) Traditional traffic signal d) Smart chatbot

B. Fill in the blanks.

1. Intelligence includes the ability to learn and _____ problems.
2. AI is a technique to make intelligent_____.
3. Automation works on fixed _____ and preset instructions.
4. Unsupervised learning is mainly used for _____.
5. Machine Learning allows machines to learn from _____.

C. Short answer questions.

1. Define intelligence in your own words.
2. State two differences between automation and AI.
3. What is reinforcement learning?
4. Name the three types of Machine Learning.
5. Give two examples of AI used in daily life.

D. Think and apply.

Identify the Type of Machine Learning

Scenario	Type of Learning
Grouping customers based on shopping habits without labels	
Predicting house prices based on past labelled data	
A game AI improving after winning or losing	
Sorting emails into spam and not spam	

E. Classify the following as AI or Automation.

Example	AI or Automation?
Traffic light changing at fixed intervals	
Face recognition system	
Washing machine with preset timer	
Voice assistant answering questions	

Solutions

A. Multiple Choice Questions.

1. b) Data with predefined labels or tags
2. b) Alan Turing
3. c) Labelled
4. a) Supervised Learning
5. c) Traditional traffic signal

B. Fill in the blanks.

1. solve
2. machines
3. rules
4. clustering
5. data

C. Short answer questions.

1. Intelligence is the ability to learn, think, understand and solve problems.
2. Two differences between automation and AI:
   i. Automation follows fixed rules, AI learns from data
   ii. Automation gives same output, AI can change output
3. Reinforcement learning is a type of learning where machines learn using rewards and penalties.
4. Three types of Machine Learning:
   i. Supervised learning
   ii. Unsupervised learning
   iii. Reinforcement learning
5. Two AI examples:
   i. Voice assistants
   ii. Face recognition

D. Think and apply.

Scenario	Type of Learning
Grouping customers based on shopping habits without labels	Unsupervised Learning
Predicting house prices based on past labelled data	Supervised Learning
A game AI improving after winning or losing	Reinforcement Learning
Sorting emails into spam and not spam	Supervised Learning

E. Classify the following as AI or Automation.

Example	AI or Automation?
Traffic light changing at fixed intervals	Automation
Face recognition system	AI
Washing machine with preset timer	Automation
Voice assistant answering questions	AI

Chapter 2: Basic Data Concepts

Exercise

A. Multiple Choice Questions.

1. A teacher analyses last year's exam results to improve teaching methods. This is an example of:
   a) Guesswork b) Using data for decision-making
   c) Random selection d) Entertainment
2. A fitness app counts your daily steps and shows weekly progress. What type of data is mainly collected?
   a) Image data b) Text data
   c) Numerical data d) Sound data
3. A weather app predicts rain using satellite information. This shows that data helps in:
   a) Playing games b) Making future predictions
   c) Writing stories d) Sending messages
4. A security camera records activities at the school gate. What type of data is mainly collected?
   a) Text data b) Video data
   c) Image data d) Numerical data
5. Which of the following is an example of image data?
   a) Your name b) Your address
   c) Your age d) Your photograph

B. Fill in the blanks.

1. Data means raw_____ and figures.
2. Tables arrange data in rows and _____.
3. Text data is made up of letters, words, and _____.
4. Grouping similar kinds of data is called _____.
5. Saving data in secure systems is known as_____.

C. Short answer questions.

1. What is data?
2. State any two important aspects of data in daily life.
3. Name the four main types of data.
4. What is the difference between a table and a chart?
5. Define classification and labeling in organising data.

D. Think and apply.

1. A student measures the height of a plant every week. What type of data is being collected?
2. A teacher wants to compare the marks of students clearly. Should she use a table or a bar chart? Give one reason.
3. A shopping app suggests products based on your previous searches. How is data being used in this situation?
4. Your desktop has many mixed files with random names.

E. Classify the following as AI or Automation.

Example	Type of Data
Exam Marks	
A voice message	
School ID photo	
Your home address	
Number of students in the class	

Solutions

A. Multiple Choice Questions.

1. b) Using data for decision-making
2. c) Numerical data
3. b) Making future predictions
4. b) Video data
5. d) Your photograph

B. Fill in the blanks.

1. facts
2. columns
3. sentences
4. classification
5. storage

C. Short answer questions.

1. Data is raw information that can be processed to get useful information.
2. Two importance of data:
   i. Helps in decision making
   ii. Helps in business growth
3. Four types of data:
   i. Numerical
   ii. Text
   iii. Image
   iv. Sound
4. Table vs Chart
   Table → rows and columns
   Chart → graphical representation
5. Classification: grouping similar data
   Labelling: giving proper names to data

D. Think and apply.

1. Numerical data
2. Bar chart, Reason: easier comparison
3. Data used to give recommendations
4. Organising data into folders

E. Classify the following as AI or Automation.

Example	Type of Data
Exam Marks	Numerical
A voice message	Sound
School ID photo	Image
Your home address	Text
Number of students in the class	Numerical

Chapter 3: Simple Pattern Recognition and Decision Making

Exercise

A. Multiple Choice Questions.

1. A student notices that every morning, he wakes up, brushes his teeth and eats breakfast in the same order.
   What does this represent?
   a) A random action b) A pattern
   c) A single event d) A mistake
2. Making observations from data means:
   a) Changing the data b) Looking for patterns and key findings
   c) Making guesses d) Hiding results
3. Arranging data by its attributes to find similar groups is called:
   a) Machine learning b) Sorting and Filtering
   c) Entertainment d) Prediction
4. Drawing a conclusion means:
   a) Copying data b) Understanding and applying observations
   c) Creating confusion d) Repeating the same data
5. Decision-making means:
   a) Acting without thinking b) Choosing an action after thinking
   c) Ignoring facts d) Random guessing

B. Fill in the blanks.

1. A pattern is a repeated and predictable _____of elements.
2. Identifying patterns means looking for repeated_____ or similarities in data.
3. Making observations from data means looking for patterns, trends, and _____ findings.
4. Drawing a conclusion means understanding observations to answer a_____.
5. Decision making means choosing an action after thinking carefully about the_____ available.

C. Short answer questions.

1. Define a pattern and give one example from daily life.
2. Name any two methods used to recognise repeated actions or events and briefly explain one of them.
3. Why is predictability important when identifying patterns?
4. What is statistical analysis used for when studying large datasets?
5. Explain the difference between making an observation and drawing a conclusion with an example.

D. Think and apply.

1. A student measures the height of a plant every week. What type of data is being collected?
2. A student notices that the temperature is higher in the afternoon than in the morning for several days. What is the student doing?
3. A student notices that practising every day improves performance in a basketball game. What decision can the student make from this observation?
4. A class survey shows that more students like cricket than football. What can the teacher conclude from this data?

E. Identify the Method Used.

Situation	Method Used
Watching daily rainfall for a month	
Arranging students by height	
Using graphs to compare sales	
Studying trends over five years	
Using an algorithm to recognise faces	

Solutions

A. Multiple Choice Questions.

1. b) A pattern
2. b) Looking for patterns and key findings
3. b) Sorting and Filtering
4. b) Understanding and applying observations
5. b) Choosing an action after thinking

B. Fill in the blanks.

1. sequence
2. actions.
3. key
4. question
5. information.

C. Short answer questions.

1. A pattern is a repeated sequence. Example: 2,4,6,8
2. Two methods:
   i. Observation
   ii. Data visualization

   Observation: watching events repeatedly over time.
3. Predictability helps us know what will happen next.
4. Statistical analysis is used to understand large datasets.
5. Observation: Temperature higher in afternoon, Conclusion: Afternoons are warmer

D. Think and apply.

1. Numerical data
2. Identifying Pattern
3. Practice daily
4. Cricket most popular s

E. Identify the Method Used.

Situation	Method Used
Watching daily rainfall for a month	Time Series Analysis
Arranging students by height	Sorting and Filtering
Using graphs to compare sales	Data Visualization
Studying trends over five years	Time Series Analysis
Using an algorithm to recognise faces	Machine Learning

Chapter 4: Ethics and Digital Responsibility

Exercise

A. Multiple Choice Questions.

1. Copying text from a website without credit is:
   a) Hacking b) Plagiarism
   c) Spamming d) Phishing
2. You get a message: “Win a free phone! Share your password.” You should:
   a) Send it b) Inform your parents
   c) Post online d) Give fake info
3. A pop-up says: *Scan viruses, win $1000!* Safest action:
   a) Click b) Ignore
   c) Ask someone else d) Download scanner
4. Checking bank on public Wi-Fi. Best action:
   a) Check now b) Use secure network
   c) Ask someone else d) Install random app
5. Posting helpful tips online while thinking about who sees them is:
   a) Active footprint b) Passive footprint
   c) Hacker footprint d) Phishing footprint

B. Fill in the blanks.

1. Responsible use of technology means thinking before you _____online.
2. Never give out your _____ information to strangers online.
3. Ethics in technology help prevent _____, plagiarism, and hacking.
4. A phishing attempt is an illegal attempt to obtain_____ information.
5. Active digital footprints are created when you _____ online intentionally.

C. Short answer questions.

1. Define responsible digital citizenship and give one example from daily life.
2. Name two ways to protect your privacy online and explain one.
3. What is the difference between active and passive digital footprints?
4. Why is it important to use strong passwords and change them periodically?
5. Explain software piracy and one step to prevent it.

D. Think and apply.

1. A student posts a picture of a school project online. Which type of digital footprint is this?
2. Your friend receives an email asking for their bank details. What should they do?
3. A social media app recommends content based on your likes. How is your data being used?
4. You want to download a new game safely. What steps will you follow to avoid malware?
5. You see someone copying your school assignment without permission. Which ethical rule is being broken?

E. Identify the Term.

Description	Identify the term
The act of sending fake emails or messages with the intention of stealing personal information.	
The act of copying someone else's work, text, or project without giving due credit.	
The record of all your online activities, including posts, likes, and websites visited.	
These are the rules and morals that should be followed while using computers and the internet to avoid causing harm.	
A document that explains how a website or app collects, uses, and protects users' personal data.	

Solutions

A. Multiple Choice Questions.

1. b) Plagiarism
2. b) Inform your parents
3. b) Ignore
4. b) Use secure network
5. a) Active footprint

B. Fill in the blanks.

1. Click
2. Personal
3. Cybercrimes
4. Confidential
5. Post

C. Short answer questions.

1. Responsible digital citizenship means using internet safely and respectfully. Example: Not sharing personal information online.
2. Two ways:
    a. Use strong passwords
    b. Do not share personal info
3. Active footprint: intentional activity; Passive footprint: unintentional activity
4. Strong passwords prevent hacking and protect accounts.
5. Software piracy is illegal copying of software.
   Prevention: download from official websites.

D. Think and apply.

1. Active digital footprint
2. Ignore and inform parents
3. Data used for recommendations
4. Download from official website, scan with antivirus
5. The ethical rule being broken is honesty or respect to other's work.

E. Identify the Term.

Description	Identify the term
The act of sending fake emails or messages with the intention of stealing personal information.	Phishing
The act of copying someone else's work, text, or project without giving due credit.	Plagiarism
The record of all your online activities, including posts, likes, and websites visited.	Digital footprint
These are the rules and morals that should be followed while using computers and the internet to avoid causing harm.	Computer ethics
A document that explains how a website or app collects, uses, and protects users' personal data.	Privacy policy

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