

GS FOUNDATION (2023-24) BOOKLET 22
&
CSAT FOUNDATION 1.0 (2023-24) BOOKLET 21
CUBES AND DICE FOR LR

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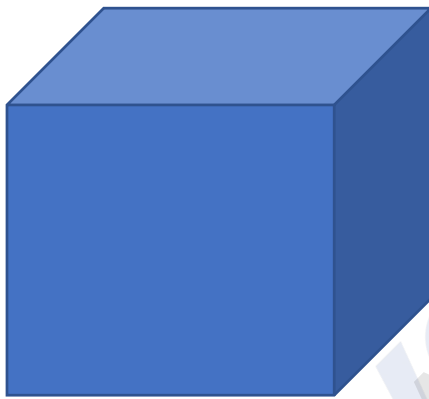
1) INTRODUCTION

These types of problems require you to be little imaginative. How a cube box will look upon colouring and then cut in smaller pieces. Also, unfolding of cube and how an unfolded box will look when reconstructed back as a cube.

Most important aspect we have to consider here is what is there on opposite faces of dice.

2) ABOUT CUBE:

A cube: 6 faces; 12 edges; 8 corners



Painting of Cube: All sides of a cube of side n are painted with a single colour. Then this cube is cut into smaller equal cubes of unit side (or side smaller than n).

n = length of edge of cube/ length of edge of smaller cube

We're asked how many smaller cubes will have: 3 sides/surfaces painted; 2 sides painted; 1 side painted; no side painted; total number of coloured cubes etc.

- **3-surfaces painted:** look at corners: any other pieces with 3 surfaces painted? – It will always be 8.
- **2-surfaces painted:** look at the edges except corner pieces.
($n-2$) on each edge would be having 2-surfaces painted and there're 12 such edges so,
No. of cubes with 2-surfaces painted = $(n-2) * 12$
- **1-surface painted:** look at cubes on each surface that are not on edges – there shall be $(n-2)^2$ cubes on each surface. And there are 6 such surfaces.
No. of cubes with 1-surface painted = $(n-2)^2 * 6$
- **Total number of cubes with no surface painted:** look at smaller cubes inside bigger cubes below the surfaces. We've to go inside one unit from each surface. So, we have cube inside with side $(n-2)$
No. of cubes with no surface painted = $(n-2)^3$

- Total number of smaller cubes = n^3
- Total number of coloured cubes = $n^3 - (n-2)^3$
- Number of cubes with at least 2-surfaces painted = $12(n-2) + 8$

Q. A cube is painted with the red colour on all the six faces and then it is cut into 64 identical smaller cubes. how many of these smaller cubes have,

1. Three faces painted?
2. Two faces painted?
3. One face painted?
4. No face painted?

CSE 2017: The outer surface of a 4 cm x 4 cm x 4 cm cube is painted completely in red. It is sliced parallel to the faces to yield sixty-four 1 cm x 1 cm x 1 cm small cubes. How many small cubes do not have painted faces?

- (a) 8
- (b) 16
- (c) 24
- (d) 36

3) DICE

A dice is basically a cube. It thus has 6 surfaces.

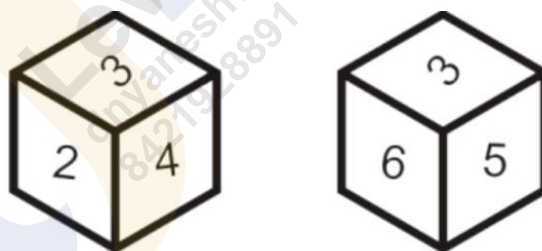
In cube, always four faces are adjacent to one face

There's one upper face of the cube and the bottom of the cube.

Types of dice:

1. Ordinary or simple dice:

In this type of dice, the **sum of opposite sides may be any number except 7**. However, the sum of two adjacent faces is always 7.

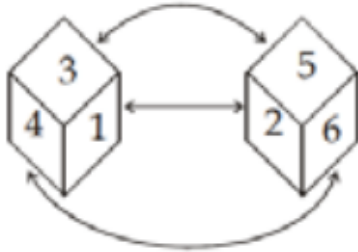


2. Standard dice:

In such type of dice, **the sum of opposite sides is 7 but the sum of adjacent faces may be any number except 7**.

Ordinary dice: 3 possibilities

- A. Case 1: When two different positions of dice have different number then they are opposite to each other.

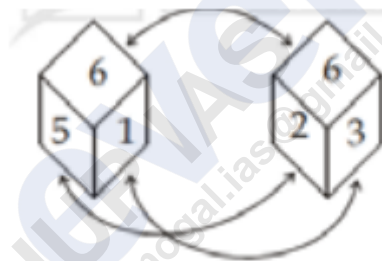


3 will be opposite to 5

4 will be opposite to 6

1 will be opposite to 2

- B. If one side of given two dice is common in the same position then remaining are opposite to each other. And the number which is common will be opposite to the missing number



1 will be opposite to 3

5 will be opposite to 2

6 will be opposite to 4 (Here 4 was the missing number, So the number opposite to 6 which was common in both the dices, will be 4)

Note: If common sides are not in same position, then we rotate it clockwise or anti-clockwise to bring it into the same position.

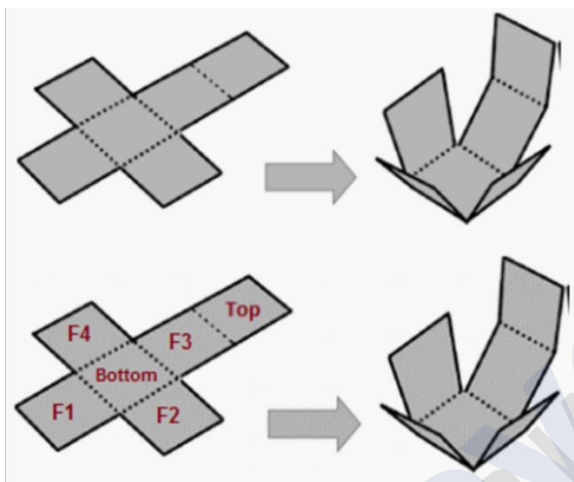
- C. If there are two numbers in the dices that are same irrespective of their position on the dice then the third number left in both the dices will be opposite to each other. **For Remaining numbers, we can't be sure, so the answer will be cannot be determined.**

Following are the two different views of a dice, find the number opposite to 3?



Answer: 5 **Rationale:** As we can see that in both the dice 2 and 6 are common, so the remaining faces i.e. 5 on first die and 3 on the second die must be on opposite faces.

Opening of Dice:



But this is just one form. There are other ways in which cubes can be opened up:

Form I



In this case:

1 lies opposite 5;

2 lies opposite 4;

3 lies opposite 6.

Form II



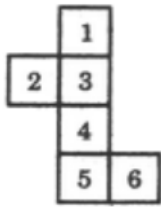
In this case:

1 lies opposite 6;

2 lies opposite 4;

3 lies opposite 5.

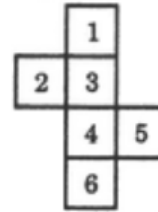
Form III



In this case:

- 1 lies opposite 4;
- 2 lies opposite 6;
- 3 lies opposite 5.

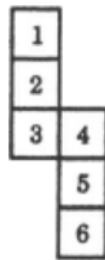
Form IV



In this case:

- 1 lies opposite 4;
- 2 lies opposite 5;
- 3 lies opposite 6.

Form V



In this case:

- 1 lies opposite 3;
- 2 lies opposite 5;
- 4 lies opposite 6.

Form VI



In this case:

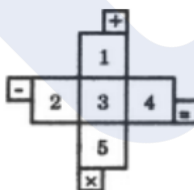


will be the one of the faces of the cube and it lies opposite 3;

2 lies opposite 4;

1 lies opposite 5.

Form VII



In this case:



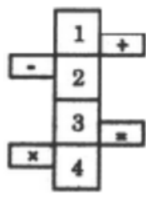
will be the one of the faces of the cube and it lies opposite 3;



2 lies opposite 4;

1 lies opposite 5.

Form VIII

In this case:



 and  are two faces of the cube that lie opposite to each other.

1 lies opposite 3;

2 lies opposite 4;

Questions are asked using one of these forms. Most important are forms 1 to 6.

4) DIRECTIONS

This topic involves four directions (North-West-South-East) and basic concepts of geometry to find distances. We can take directions as used in usual maps to plot the information given and find the answer.

5) PYQ: CUBES AND DICE

CSE 2023: A cuboid of dimensions $7\text{cm} \times 5\text{cm} \times 3\text{cm}$ is painted red, green and blue colour on each pair of opposite faces of dimensions $7\text{cm} \times 5\text{cm} \times 5\text{cm}$, $5\text{cm} \times 3\text{cm}$, $7\text{cm} \times 3\text{cm}$ respectively. Then the cuboid is cut and separated into various cubes each of side length 1cm . Which of the following statements is/are correct?

1. There are exactly 15 small cubes with no paint on any face.
2. There are exactly 6 small cubes with exactly two faces, one painted with blue and the other with green.

Select the correct answer using the code given below:

- (a) 1 Only (b) 2 Only (c) Both 1 and 2 (d) Neither 1 nor 2

CSE 2023: 125 identical cubes are arranged in the form of cubical block. How many cubes are surrounded by other cubes from each side?

- (a) 27 (b) 25 (c) 21 (d) 18

CSE 2019: Each face of a cube can be painted in black or white colours. In how many different ways can the cube be painted?

- (a) 9
(b) 10
(c) 11
(d) 12

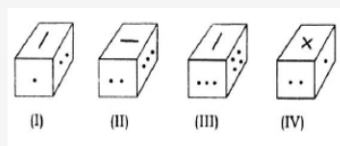
CSE 2019: A solid cube is painted yellow, blue and black such that opposite faces are of same colour. The cube is then cut into 36 cubes of two different sizes such that 32 cubes are small and the other four cubes are Big. None of the faces of the bigger cubes is painted blue. How many cubes have only one face painted?

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

CSE 2018:

Directions for the following 3 (three) items

Rotated positions of a single solid are shown below. The various faces of the solid are marked with different symbols like dots, cross and line. Answer the three items that follow the given figures



14. What is the symbol on the face opposite to that containing a single dot?

- a. Four dots
- b. Three dots
- c. Two dots
- d. Cross

15. What is the symbol on the face opposite to that containing two dots?

- a. Single dot
- b. Three dots
- c. Four dots
- d. Line

16. What is the symbol on the face opposite to that containing the cross?

- a. Single dot
- b. Two dots
- c. Line
- d. Four dots

CSE 2017: The outer surface of a 4 cm x 4 cm x 4 cm cube is painted completely in red. It is sliced parallel to the faces to yield sixty-four 1 cm x 1 cm x 1 cm small cubes. How many small cubes do not have painted faces?

- (a) 8
- (b) 16
- (c) 24
- (d) 36

CSE 2015: Each of the six different faces of a cube has been coated with a different colour i.e., V, I, B, G, Y and

O. Following information is given:

1. Colours Y, O and B are on adjacent faces.
2. Colours I, G and Y are on adjacent faces.
3. Colours B, G and Y are on adjacent faces.

4. Colours O, V and B are on adjacent faces.

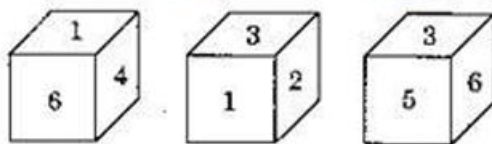
Which is the colour of the face opposite to the face coloured with O?

- (a) B
- (b) V
- (c) G
- (d) I

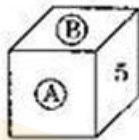
CSE 2013: A gardener has 1000 plants: He wants to plant them in such a way that the number of rows and the number of columns remains the same. What is the minimum number of plants that he needs more for this purpose?

- (a) 14
- (b) 24
- (c) 32
- (d) 34

CSE 2013: A cube has six numbers marked 1, 2, 3, 4, 5 and 6 on its faces. Three views of the cube are shown below:

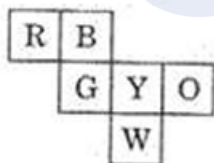


What possible numbers can exist on the two faces marked (A) and (B), respectively on the cube?



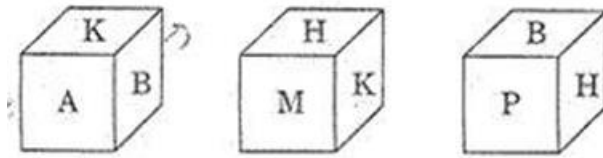
- (a) 2 and 3
- (b) 6 and 1
- (c) 1 and 4
- (d) 3 and 1

CSE 2012: Six squares are coloured, front and back, red(R), blue(B), yellow (Y), green (G), white (W), orange (O) and are hinged together as shown in the figure given below. If they were folded to form a cube what would be the face opposite to white face?



- (a) R
- (b) G
- (c) B
- (d) O

CSE 2012: Three views of a cube following a particular motion are given below:



What is letter opposite to A?

- (a) H
- (b) P
- (c) B
- (d) M

6) PYQ: DIRECTIONS

CSE 2022: Two friends X and Y start running and they run together for 50 m in the same direction and reach a point. X turns right and runs 60 m, while Y turns left and runs 40m. Then X turns left and runs 50m and stops, while Y turns right and runs 50 m and then stops. How far are the two friends from each other now? (a) 100m

- (b) 90m
- (c) 60m
- (d) 50 m

CSE 2022: Consider the Question and two Statements given below in respect of three cities P, Q and R in a State:

Question: How far is city P from city Q?

Statement-1: City is 18 km from city R.

Statement-2: City P is 43 km from city R.

Which one of the following is correct in respect of the Question and the Statements?

- (a) Statement-1 alone is sufficient to answer the Question
- (b) Statement-2 alone is sufficient to answer the Question
- (c) Both Statement-1 and Statement-2 are sufficient to answer the Question
- (d) Both Statement-1 and Statement-2 are not sufficient to answer the Question

CSE 2021: A woman runs 12 km towards her North, then 6 km towards her South and then 8 km towards her East. In which direction is she from her starting point?

- (a) An angle less than 45° South of East
- (b) An angle less than 45° North of East
- (c) An angle more than 45° South of East
- (d) An angle more than 45° North of East

CSE 2020: A man walks down the backside of his house straight 25 metres, then turns to the right and walks 50 metres again; then he turns towards left and again walks 25 metres. If his house faces to the East, what is his direction from the starting point?

- (a) South East
- (b) South West
- (c) North East
- (d) North West

CSE 2019: A started from his house and walked 20 m towards East, where his friend B joined him. They together walked 10 m in the same direction. Then 'A' turned left while 'B' turned right and travelled 2 m and 8 m respectively. Again 'B' turned left to travel 4 m followed by 5 m to his right to reach his office. 'A' turned right and travelled 12 m to reach his office. What is the shortest distance between the two offices?

- (a) 15 m
- (b) 17 m
- (c) 19 m
- (d) 20 m

CSE 2016: A person climbs a hill in a straight path from point 'O' on the ground in the direction of north-east and reaches a point 'A' after travelling a distance of 5 km. Then, from the point 'A' he moves to point 'B' in the direction of north-west. Let the distance AB be 12 km. Now, how far is the person away from the starting point 'O'?

- (a) 7 km
- (b) 13 km
- (c) 17 km
- (d) 11 km

CSE 2016: A person walks 12 km due north, then 15 km due east, after that 19 km due west and then 15 km due south. How far is he from the starting point?

- (a) 5 km
- (b) 9 km
- (c) 37 km
- (d) 61 km

CSE 2016: A person X was driving in a place where all roads ran either north-south or east-west, forming a grid. Roads are at a distance of 1 km from each other in a parallel. He started at the intersection of two roads, drove 3 km north, 3 km west and 4 km south. Which further route could bring him back to his starting point, if the same route is not repeated?

- (a) 3 km east, then 2 km south
- (b) 3 km east, then 1 km north
- (c) 1 km north, then 2 km west
- (d) 3 km south, then 1 km north

CSE 2014: Consider the following statements: There are six villages A, B, C, D, E and F. F is 1 km to the west of D. B is 1 km to the east of E. A is 2 km to the north of E. C is 1 km to the east of A. D is 1 km to the south of A. Which three villages are in a line?

- (a) A, C, B
- (b) A, D, E
- (c) C, B, F
- (d) E, B, D

CSE 2014: Location of B is north of A and location of C is east of A. The distances AB and AC are 5 km and 12 km respectively. The shortest distance (in km) between the locations B and C is

- (a) 60
- (b) 13
- (c) 17
- (d) 7

CSE 2011: The houses of A and B face each other on a road going north-south, A's being on the western side. A comes out of his house, turns left, travels 5 km, turns right, travels 5 km to the front of D's house. B does exactly the same and reaches the front of C's house. In this context, which one of the following statements is correct?

- (a) C and D live on the same street.
- (b) C's house faces south.
- (c) The houses of C and D are less than 20 km apart.
- (d) None of the above

7) COMPREHENSION

Bank credit to the industrial sector has started shrinking. Its decline has been a serious concern as credit growth is essential to revive investment. The problem's origins lie in the incomplete reforms of the last 25 years. An institutional change that should have followed the 1991 reforms should have been setting up of a resolution corporation for banks. In a market economy with booms and busts, banks should be allowed to be set up and to fail. Today, we cannot shut down banks because there is not proper system to shut them down. Weak loss-making banks continue to need more capital.

Q. Which one of the following is the most logical and rational inference that can be made from the above passage?

- (a) Indian banking system is not able to help the country in its economic growth
- (b) Economic reforms that started in 1991 have not helped in improving the economy to expected levels
- (c) India lacks the institutional mechanisms to deal with the failure of banks.
- (d) Encouraging the foreign investments in our industrial sector is a good alternative to this sector's dependence on banks for credit

For two or three generations past, ever-increasing number of individuals have been living as workers merely, not as human beings. An excessive amount of labour is rule today in every circle of society, with the result that man's spiritual element cannot thrive. He finds it very difficult to spend his little leisure in serious activities. He does not want to think; or he cannot even if he wants to. He seeks not Self-improvement, but entertainment which would enable him to be mentally idle and to forget his usual activities. Therefore, the so-called culture of our age is dependent more on cinema than on theatre, more on newspapers, magazines and crime stories than on serious literature.

Q. The passage is based on the idea that

- (a) man should not work hard
- (b) the great evil of our age is overstraining
- (c) man cannot think well
- (d) man cannot care for his spiritual welfare

Mariana Mazzucato describes the rise of the financial class in *The Value of Everything*. The role of banks and financial institutions was to provide lubrication to the wheels of the real economy, rather than making large profits themselves. By the 21st century, production of the lubricant seems to have become the purpose of financial institutions. Innovative ways of making money from money also became the fastest way to increase personal wealth. Inequalities have increased because a much larger share of wealth is sucked into the financial sector. The rules of the economic game are now set by the wealthiest. They influence governments' policies the most. The terms of trade between money and labour are set in their favour. They can determine the wages they will pay workers and prices for small enterprises. Common citizens who earn with their personal labour, as gig workers, small farmers, and informal entrepreneurs, etc., live precariously. Formal jobs in large enterprises, where workers could unite to demand fair treatment from employers, are becoming fewer with the changing shape of the modern, post-industrial, economy.

Q. Which of the following assumptions have been made in the passage?

1. Banks are not performing the role they are supposed to in economy
2. Government's policy is geared towards tackling inequality as it is influenced by the wealthiest
3. Precarious lives of workers are due to lack of avenues to unite in informal jobs

Choose the most appropriate option:

- (a) 1 and 3 only
- (b) 3 only
- (c) 1 and 2 only
- (d) 1, 2 and 3

Disruption of traditional institutions, identifications and loyalties is likely to lead to ambivalent situations. It is possible that some people may renew their identification with traditional groups whereas others align themselves with new groups and symbols emergent from processes of political development. In addition, political development tends to foster group awareness of a variety of class, tribe, region, clan, language, religion, occupation and others.

Q. Which one of the following is the best explanation of the above passage?

- (a) Political development is not a unilinear process for it involves both growth and decay.
- (b) Traditional societies succeed in resisting positive aspects of political development.
- (c) It is impossible for traditional societies to break away from lingering loyalties.
- (d) Sustenance of traditional loyalties is conducive to political development.