

**How to use this sheet.** The sum-to-seven rule applies only to a standard die numbered 1 to 6. For any other die, remember that faces seen together in one view can never be opposite each other. For painted-cube questions, always find  $n$  first by taking the cube root of the total number of small cubes.

**Quick reference** — Standard die:  $1 \leftrightarrow 6$ ,  $2 \leftrightarrow 5$ ,  $3 \leftrightarrow 4$  · Corners = 8 always · Edges =  $12(n-2)$  · Faces =  $6(n-2) \times (n-2)$  · Inside =  $(n-2) \times (n-2) \times (n-2)$

## Section A · Standard dice

All questions are built to the AAI pattern. No question in this chapter was found in any extractable or recovered previous year paper.

1. On a standard die, the face opposite the one showing 3 is:

- (1) 2 (2) 4 (3) 5 (4) 6

2. On a standard die, the face opposite the one showing 6 is:

- (1) 1 (2) 2 (3) 3 (4) 5

3. A die shows colours red, blue, green, yellow, black and white instead of numbers. The sum-to-seven rule:

- (1) Still applies using the colours' alphabetical position (2) Does not apply, since this is not a numbered standard die  
(3) Applies only to red and blue (4) Applies after converting colours to numbers 1 to 6

4. Three faces of a standard die visible in one view show 1, 2 and 3. What is the hidden face directly opposite the visible face 1?

- (1) 6 (2) 4 (3) 5 (4) 2

## Section B · Opposite faces from multiple views

5. Two views of the same die both show faces marked M and N. The first view's third face is O, and the second view's third face is P. What can be concluded?

- (1) M and N are opposite (2) O and P are opposite (3) O and P are the same face (4) Nothing can be concluded

6. A die shows faces X, Y and Z together in one single view. Based on this alone, which statement is correct?

- (1) X and Y might be opposite (2) X, Y and Z cannot be pairwise opposite to each other (3) Z must be opposite X  
(4) Y must be opposite Z

7. A die is shown in three different views covering all six faces: View 1 shows A, B, C. View 2 shows A, D, E. View 3 shows B, D, F. Which pair can be identified as opposite using only the adjacency rule?

- (1) A and D (2) A and B (3) C and F (4) A and F

## Section C · Painted cube cutting

8. A cube is painted and cut into 8 identical smaller cubes. How many of them have three painted faces?

- (1) 4 (2) 6 (3) 8 (4) 0

9. A cube is painted and cut into 64 identical smaller cubes. How many have exactly two painted faces?

- (1) 8 (2) 16 (3) 20 (4) 24

10. A cube is painted and cut into 216 identical smaller cubes. How many have exactly one painted face?

- (1) 54 (2) 64 (3) 96 (4) 24

11. A cube is painted and cut into 216 identical smaller cubes. How many have no painted face at all?

(1) 54 (2) 64 (3) 48 (4) 27

**12.** A cube is painted and cut into 1000 identical smaller cubes. How many have exactly two painted faces?

(1) 12 (2) 60 (3) 96 (4) 84

**13.** For any painted cube cut into  $n \times n \times n$  smaller cubes in total, the four categories of small cube (corner, edge, face, inside) will always add up to:

(1)  $6n$  (2)  $n \times n$  (3)  $n \times n \times n$  (4)  $8n$

**Answer key:** 1. (2) 2. (1) 3. (2) 4. (1) 5. (2) 6. (2) 7. (4) 8. (3) 9. (4) 10. (3) 11. (2) 12. (3) 13. (3)

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