

# Math Challenge #13



First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_ Grade: \_\_\_\_\_

Teacher: \_\_\_\_\_ Parent's email: \_\_\_\_\_



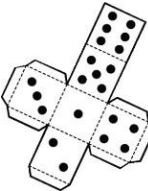




## Playing with Dice and Cubes

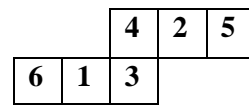
Welcome to Math Challenge #13. In this challenge, we look at die (plural “dice”) a little closer. A die is a solid with markings on each of its faces. The faces are usually all the same size, making it the same as a cube. Dice are used in many games. The most common type of die is a six-sided cube with dots placed on the faces. The value of the roll is indicated by the number of dots showing on the top. For the six-sided die, opposite faces are arranged to always sum to seven. On the last page of the challenge, there are 2 dice cut-outs that you may cut to form regular dice. Don't be shy to ask parents or adults to help you.

**Kinder & First Grade: solve at least 3 problems.**  
**Second & Third Grade: solve at least 7 problems.**  
**Fourth Grade and above: solve at least 12 problems.**

*Answer*

|    |   |   |    |   |  |  |  |   |  |   |   |   |  |  |         |
|----|---|---|----|---|--|--|--|---|--|---|---|---|--|--|---------|
| 1. | Alex rolled 4 dice and the result is as shown on the picture. If he added all the dots on the top of each die, what would he get?   |    | 16 |   |  |  |  |   |  |   |   |   |  |  |         |
| 2. | What is the sum of <b>all dots</b> in a regular die?<br><span style="color: green;"><math>1+2+3+4+5+6 = 21</math></span>  |   | 21 |   |  |  |  |   |  |   |   |   |  |  |         |
| 3. | Two dice were thrown on a table. Lisa was told that on an ordinary standard six-sided die, the number of dots of opposite sides add up to 7. Using the picture shown, what is the sum of dots that are face-down on the table? <span style="color: green;">The two numbers that face up is 4 and 2, so the number that touched the table will be <math>(7-4) = 3</math> and <math>(7-2) = 5</math>. Thus, the sum of dots that touch the table will be <math>3+5 = 8</math></span>  |  | 8  |   |  |  |  |   |  |   |   |   |  |  |         |
| 4. | How many dots lie opposite to the face having two dots, when the figure is folded to form a die?  |  | 5  |   |  |  |  |   |  |   |   |   |  |  |         |
| 5. | On an ordinary standard six-sided die, the number of dots of opposite faces add up to 7. What is the sum of all the dots that you can't see?<br><span style="color: green;">Opposite to 1 is 6. Opposite to 3 is 4. Opposite to 5 is 2. The sum is <math>6 + 4 + 2 = 12</math></span>   |    | 12 |   |  |  |  |   |  |   |   |   |  |  |         |
| 6. | Which two squares overlap when we fold the paper-net below into a cube?<br><table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">4</td> <td style="padding: 5px;"></td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> <td style="padding: 5px;">7</td> <td style="padding: 5px;"></td> </tr> </table> | 1   | 2  | 3 |  |  |  | 4 |  | 5 | 6 | 7 |  |  | 4 and 5 |
| 1  | 2   | 3   |    |   |  |  |  |   |  |   |   |   |  |  |         |
| 4  |   | 5   | 6  | 7 |  |  |  |   |  |   |   |   |  |  |         |
| 7. | What is the most likely sum to be rolled on two regular dice?<br><span style="color: green;">7 because there are the most ways to get this sum: <math>6+1, 1+6, 2+5, 5+2, 3+4, 4+3</math>. Students can best illustrate this situation with a chart of possible outcomes.</span>  |  | 7  |   |  |  |  |   |  |   |   |   |  |  |         |

8. When the given figure is folded to form a cube then which face is opposite to the face with 2?



1

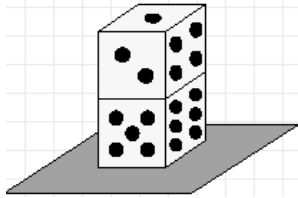
9. What are the two least likely sums to be rolled on two regular dice?

**(2 and 12 because there is only one way to get these sums)**

Students can best illustrate this situation with a chart of possible outcomes.

2 and 12

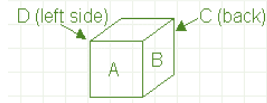
10.



Two ordinary six-sided dice are stacked on top of each other and placed on a table top.

Find the sum of all the dots on the visible faces (faces that don't touch the table or each other).

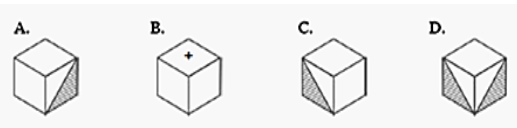
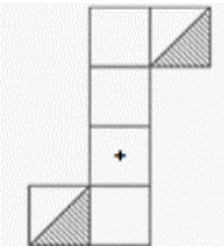
Since opposite faces add up to 7, so  $A+C=7$ ,  $B+D=7$ ,  $A+B+C+D=14$ . Therefore, the sum of visible dots would be  $2 \times 14 + 1 = 29$ .



29

11. Choose two boxes which are similar to the box formed from folding this sheet of paper.

A and C



12.



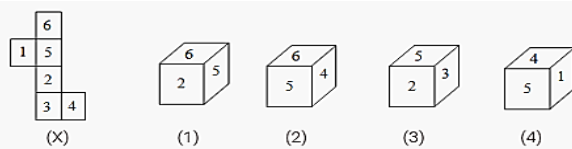
What is the sum of all the dots in a die with 12 faces?

$$1+2+3+4+5+6+7+8+9+10+11+12 = 13 \times 6 = 78$$

78

13. Which box can be formed from the cut out (x)?

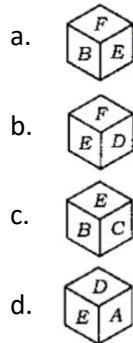
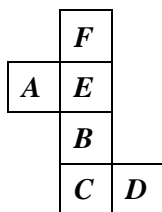
2 (only)




When the given sheet in the fig. (X) is folded to form the hollow cube, then letter '6' appears opposite letter '2', letter '5' appears to be opposite letter '3' and letter '1' appears opposite letter '4'. Hence, the hollow cube in the figure (1) that shows letter '2' adjacent to letter '6', the hollow cube in figure (3) which depicts letter '3' adjacent to number '5' and the hollow cube in the figure (4) which depicts letter '4' adjacent to letter '1' is not at all possible. Therefore, only the hollow cube in the figure (2) is possible.

14. Which one among the following boxes is similar to the box formed from the picture-net below?

b



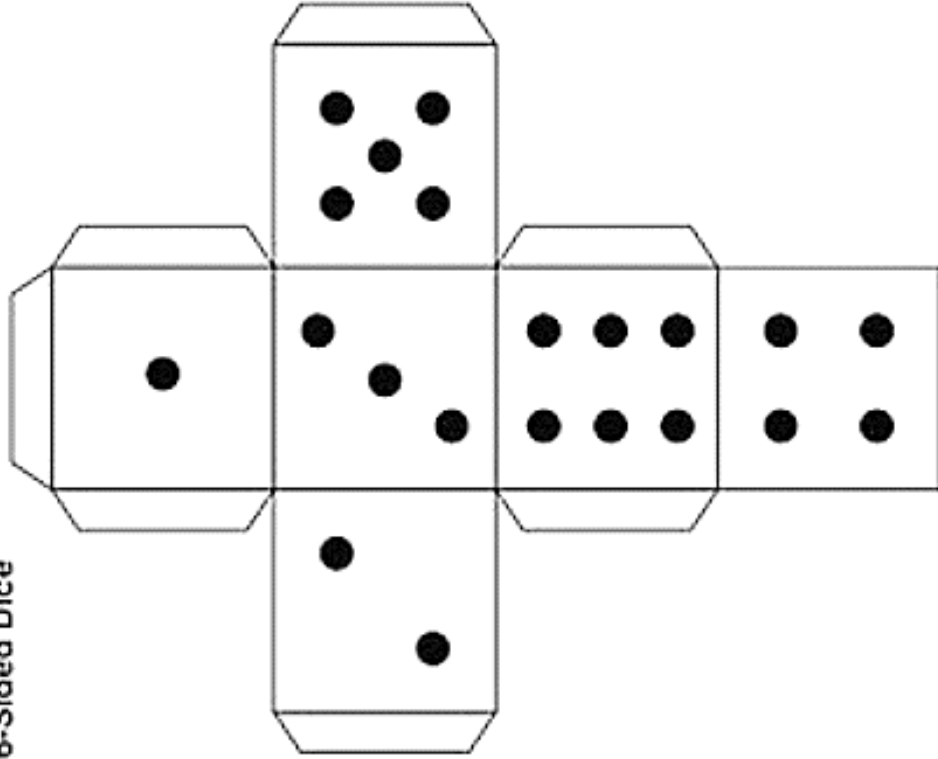
- F & B can't be adjacent faces. We can rule out a.
- D & A can't be adjacent faces. We can rule out d.
- E & C are opposite faces; hence c can be ruled out.
- Therefore, we're left with answer (b)

|     |  |   |           |
|-----|--|---|-----------|
| 15. | <p>Angela stacks 3 dice and then finds the sum of all of the numbers that are visible (on the sides and top of the stack). What is the greatest sum that Angela can make with the three dice tower?</p> <p>The sum of any two opposite faces of a die is 7. So, excluding the top face, the sum of the numbers on the 3-dice tower is always equal to <math>7 \times 2 \times 3 = 42</math>, and it doesn't matter how we arrange the dice. The only thing that affects the total sum is the number showing on the top, which can be any number from 1 to 6. So, the minimum sum is <math>42 + 1 = 43</math> and the maximum sum is <math>42 + 6 = 48</math>.</p>  | 48  |           |
| 16. | <p>On an average, how many times must a 6-sided die be rolled until a 6 turns up?</p> <p>The probability that a 6 will appear is <math>1/6</math>. In theory, it takes 6 throws of a die before a 6 appears.</p>   | 6   |           |
| 17. | <p>A large die was placed in a cubical gift box. The cubical gift box is tied with a piece of ribbon. The gift box has a side length of 6 inches. If the total length of the free ends and the bow is 18 inches, what is the length of the ribbon used?</p> <p><math>(8 \times 6) + 18 = 42 + 18 = 66</math> inches</p>  |  | 66 inches |
| 18. | <p><b><i>This last problem is just for fun:</i></b></p> <p>Take 2 dice. Dice are made up so that opposite faces add up to 7. Make sure that 6 is opposite 1, the 5 is opposite 2, and the 4 is opposite 3. Roll the dice and then</p> <ol style="list-style-type: none"> <li>1. multiply the top two numbers</li> <li>2. multiply the bottom two numbers</li> <li>3. multiply the top of one die by the bottom of the other</li> <li>4. and now multiply the other top and bottom</li> </ol> <p>Now add up all of your (four) answers, and it always adds up to 49. Why?</p> <p>For solution, go to <a href="https://www.cut-the-knot.org/Outline/Arithmetic/TwoDice.shtml#solution">https://www.cut-the-knot.org/Outline/Arithmetic/TwoDice.shtml#solution</a>.</p> |   |           |

Solution is available on April 19, 2019 at [www.mathinaction.org](http://www.mathinaction.org)



6-Sided Dice



6-Sided Dice

