

Math Challenge #2

| | | |
|-------------------|-----------------------|--------------|
| First Name: _____ | Last Name: _____ | Grade: _____ |
| Teacher: _____ | Parent's email: _____ | |

Patterns

In Math, a pattern means things like numbers, shapes, or colors that repeat in a certain way. When numbers follow a special rule and go together, that's called a pattern too. Sometimes, we also call patterns "sequences." In this Math Challenge, all the problems have patterns hiding in them. Have fun solving them!

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

| | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|--|
| <p>1. Jake crossed out every third number on the list starting with 3. How many numbers did he cross out?</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 20px;">1</td><td style="width: 20px;">2</td><td style="width: 20px;">3</td><td style="width: 20px;">4</td><td style="width: 20px;">5</td><td style="width: 20px;">6</td><td style="width: 20px;">7</td><td style="width: 20px;">8</td><td style="width: 20px;">9</td><td style="width: 20px;">10</td><td style="width: 20px;">11</td><td style="width: 20px;">12</td><td style="width: 20px;">13</td><td style="width: 20px;">14</td><td style="width: 20px;">15</td> </tr> </table> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |

| | | | | | | | | | | | |
|---|----|----|----|-----|--|----|----|----|--|-----|----------------------------|
| <p>2. Find each number that is hiding under each flower to complete the pattern.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 20%;">10</td><td style="width: 20%;">20</td><td style="width: 20%;"></td><td style="width: 20%;">40</td><td style="width: 20%;"></td> </tr> <tr> <td>60</td><td>70</td><td>80</td><td></td><td>100</td> </tr> </table> | 10 | 20 | | 40 | | 60 | 70 | 80 | | 100 | = ____ = ____ = ____ |
| 10 | 20 | | 40 | | | | | | | | |
| 60 | 70 | 80 | | 100 | | | | | | | |

| | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|--|
| <p>3. Lilian crossed out all even numbers from the list. Maria then crossed out every fifth number from the original list. How many numbers are left uncrossed?</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 20px;">1</td><td style="width: 20px;">2</td><td style="width: 20px;">3</td><td style="width: 20px;">4</td><td style="width: 20px;">5</td><td style="width: 20px;">6</td><td style="width: 20px;">7</td><td style="width: 20px;">8</td><td style="width: 20px;">9</td><td style="width: 20px;">10</td><td style="width: 20px;">11</td><td style="width: 20px;">12</td><td style="width: 20px;">13</td><td style="width: 20px;">14</td><td style="width: 20px;">15</td> </tr> </table> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |

| | | | | | | | | | | | |
|---|---------------------------|---------------------------|--------------------------|----|----|---------------------------|----|----|--------------------------|----|--|
| <p>4. The following list of numbers follows a pattern. Three numbers are covered by a rabbit, a turtle and a zebra. What is the sum of the numbers under these animals?</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 20%;">5</td><td style="width: 20%;"> <small>rabbit</small></td><td style="width: 20%;">15</td><td style="width: 20%;">20</td><td style="width: 20%;">25</td> </tr> <tr> <td> <small>turtle</small></td><td>35</td><td>40</td><td> <small>zebra</small></td><td>50</td> </tr> </table> | 5 | <small>rabbit</small> | 15 | 20 | 25 | <small>turtle</small> | 35 | 40 | <small>zebra</small> | 50 | |
| 5 | <small>rabbit</small> | 15 | 20 | 25 | | | | | | | |
| <small>turtle</small> | 35 | 40 | <small>zebra</small> | 50 | | | | | | | |

| | | | |
|---|--|--|--|
| <p>5. Most numbers listed below can be added to another number in the list to give a sum of 99. However, there are 3 numbers that do not have another number in the list that sums to 99. Find the 3 numbers and list them from smallest to largest.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="width: 50%;"> <p>97, 15, 84, 42, 67, 21, 36, 57, 2, 6, 78, 26, 86, 77, 13, 63, 8, 73, 22, 29, 91.</p> </td> <td style="width: 50%;"></td> </tr> </table> | <p>97, 15, 84, 42, 67, 21, 36, 57, 2, 6, 78, 26, 86, 77, 13, 63, 8, 73, 22, 29, 91.</p> | | |
| <p>97, 15, 84, 42, 67, 21, 36, 57, 2, 6, 78, 26, 86, 77, 13, 63, 8, 73, 22, 29, 91.</p> | | | |

6. The following are some arithmetic sequences. In an arithmetic sequence, the difference between one number and the next is a constant; it does not change. Name the missing numbers.

a.

| | | | | |
|---|--|---|--|----|
| 2 | | 6 | | 10 |
|---|--|---|--|----|

b.

| | | | | | |
|---|--|---|--|----|----|
| 3 | | 9 | | 15 | 18 |
|---|--|---|--|----|----|

c.


| | | | | | | |
|---|--|----|--|----|--|----|
| 4 | | 10 | | 16 | | 22 |
|---|--|----|--|----|--|----|

a.
b.
c.

7. Suppose that you adopted a puppy today at noon and immediately called your two close friends. 10 minutes later, at 12:10 p.m., they each call 2 friends to tell the news. Another 10 minutes later, at 12:20 p.m., these friends call 2 others each. This continues for an hour. In total, how many people were told the news by 1 p.m. today through these phone calls?

8. Ananya has a 'function machine' that follows a rule to change numbers that she puts in. On the right is a chart of what happened the last time she used the machine. What is the output when she puts in the number 10?

Inputs and Outputs



| Input | Output |
|-------|--------|
| 1 | 5 |
| 2 | 7 |
| 3 | 9 |
| 4 | 11 |
| ... | ... |
| 10 | ? |

9. A Yohaku is a new type of number puzzle that will test your number sense and problem solving skills. Each Yohaku is either an additive or a multiplicative puzzle (as indicated by the symbol in the bottom right of the grid).

| | | |
|---|----|----|
| 4 | 3 | 12 |
| 2 | 5 | 10 |
| 8 | 15 | x |

The following are multiplication puzzles using 4 consecutive numbers. Name the 4 consecutive numbers used in the following multiplication in order from least to greatest.

a.

| | | |
|----|----|----|
| | | 30 |
| | | 56 |
| 40 | 42 | x |

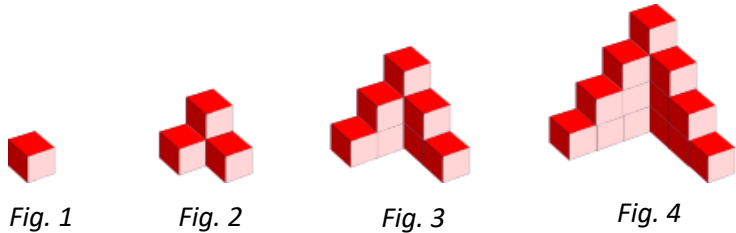
b.

| | | |
|----|----|----|
| | | 72 |
| | | 70 |
| 90 | 56 | x |

a.
b.

Consecutive numbers are the numbers that continuously follow each other, one after another in a regular counting order or in the order from least to greatest.

10. Here is a picture of four models. Some of the cubes are hidden behind other cubes. How many cubes would it take to build the fifth figure?



11. The following are some arithmetic sequences. **In an arithmetic sequence, the difference between one number and the next is a constant; it does not change.** List the missing numbers in order from least to greatest.

| | | | | | |
|----|----|--|----|----|-----|
| a. | 2 | | 10 | | 18 |
| b. | 4 | | 26 | | 48 |
| c. | 11 | | | 47 | |
| d. | 9 | | | | 101 |

a.
b.
c.
d.

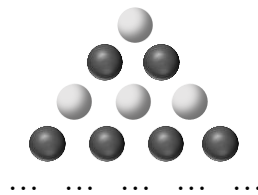
12. Jamie spent \$9.60 on three different-sized muffins. The medium muffin cost \$1 more than the small muffin, and the large muffin cost \$1 more than the medium muffin. How much did each muffin cost?

Small muffin:
Medium muffin:
Large muffin:

13. There are 300 mailboxes in a local post office. They are numbered consecutively from 1 to 300. Every fifth mailbox must be opened with a key instead of using a combination. Every sixth mailbox has a window, and every eighth mailbox is oversized. Which mailboxes meet all three criteria - oversized, with a window, and have a key lock?

14. A regular alarm clock (not set in military time) beeps the same number of times as the hour. It beeps once at 1:00, twice at 2:00, and so on, and it beeps only on the hour marks. How many times does it beep from 12:01 a.m. on Friday until 12:01 a.m. the following day?

15. Sohum arranges the following black and white balls as in the picture on the right.
If he continues, how many white balls will there be when there are 13 fewer white balls than black balls?



16. The following are geometric sequences. In a **geometric sequence**, each term is found by multiplying the previous term by a constant.

For example, in the sequence 1, 2, 4, 8, 16, 32, 64, 128, 256, ... , it has a factor of 2 between each number. Each term is found by multiplying the previous term by 2.



Find the missing terms below.

| | | | | |
|----|----|----|-----|--|
| a. | 8 | 24 | | |
| b. | 15 | | 240 | |
| c. | 13 | | 117 | |

- a.
b.
c.

17. The following are Yohaku puzzles using only prime numbers. Name the prime numbers used in the following multiplication in order from the smallest to greatest.

a.

| | | |
|-----|-----|-----|
| | | 161 |
| | | 115 |
| 161 | 115 | × |

b.

| | | |
|-----|-----|------|
| | | 1273 |
| | | 62 |
| 589 | 134 | × |

- a.
b.

Prime numbers are numbers that have only 2 factors: 1 and themselves. For example, the first 5 prime numbers are 2, 3, 5, 7, and 11.

18. Melody organized some whole numbers in a chart with a specific pattern as follow:

| N ₁ | N ₂ | N ₃ | N ₄ | N ₅ | N ₆ |
|----------------|----------------|----------------|----------------|----------------|----------------|
| 1 | | 2 | | 3 | |
| 9 | 8 | 7 | 6 | 5 | 4 |
| | 10 | | 11 | | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | | 20 | | 21 | |
| 27 | 26 | 25 | 24 | 23 | 22 |
| ... | ... | ... | ... | ... | ... |
| | | | | | |

In which column will the number 550 appear?