

Math Challenge #7

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

Patterns

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.

	<i>Answer</i>																				
<p>1. Look at the following pattern. The pattern is alternating between a square and a circle.</p> <div style="display: flex; align-items: center; justify-content: center; gap: 10px;"> <div style="text-align: center;"> 1st</div> <div style="text-align: center;"> 2nd</div> <div style="text-align: center;"> 3rd</div> <div style="text-align: center;"> 4th</div> <div style="text-align: center;">5th</div> <div style="text-align: center;">6th</div> <div style="text-align: center;">7th</div> <div style="text-align: center;">8th</div> <div style="text-align: center;">?</div> </div> <p>What would be the 8th shape?</p> <p><i>Extra: Without drawing it out, what would be the 12th shape?</i></p> <p style="color: blue;"><i>On every even place we have a circle, thus on both 8th and 12th place there will be a circle.</i></p>	<p><i>Circle or</i> </p> <p><i>Extra: Circle or</i> </p>																				
<p>2. The following is part of a 100s chart. What are the two numbers covered by the stars?</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td>33</td><td></td><td style="background-color: red; color: white;">★</td><td>36</td></tr> <tr><td></td><td></td><td>45</td><td></td></tr> <tr><td></td><td></td><td>55</td><td></td></tr> <tr><td></td><td style="background-color: red; color: white;">★</td><td></td><td></td></tr> </table>	23	24	25	26	33		★	36			45				55			★			<p><i>35 and 64</i></p>
23	24	25	26																		
33		★	36																		
		45																			
		55																			
	★																				
<p>3. What is the next insect in this pattern?</p> <div style="display: flex; align-items: center; justify-content: center; gap: 10px;"> </div> <p><i>Extra: Without drawing it out, what would be the 15th insect?</i></p> <p style="color: blue;"><i>The pattern is made out of 2 butterflies and 3 bees. The next insect on the pattern is butterfly.</i></p> <p style="color: blue;"><i>Extra: notice that the pattern repeats in a way that the 5th, the 10th, and the 15th will have the same insect, which is a bee.</i></p>	<p><i>Butterfly or</i> </p> <p><i>Extra: bee or</i> </p>																				
<p>4. The following number is subtracted by the same number (covered by the owl) three times. What is the number covered by each owl?</p> $17 - \text{owl} - \text{owl} - \text{owl} = 8$ <p style="color: blue;"><i>3 owls stand for $17 - 8 = 9$, thus one owl is 3.</i></p>	<p><i>3</i></p>																				
<p>5. Group A has 10 bears. It can be shared equally. Group B has 15 bears, so it can't be shared equally. Group C has 13, therefore, it can't be shared equally either.</p>	<p><i>Group A</i></p>																				
<p>6. a. Looking at 7, 10, and then 16, 19 we can see that the step is +3, so the missing numbers are 4 and 13.</p> <p>b. Looking at 3, 13, we can notice the pattern of +10. Thus, the missing numbers are 23 and 43.</p> <p>c. Looking at 1,6 and then 16, 21 we can see the pattern of +5. The missing numbers are 11 and 26.</p> <p>d. Looking at 12, 8, we check the pattern of -4. It works. So, the missing numbers are 16 and 4.</p>	<p><i>a. 4 and 13</i></p> <p><i>b. 23 and 43</i></p> <p><i>c. 11 and 26</i></p> <p><i>d. 16 and 4</i></p>																				

7. a. What number is behind the number 100? **91**
 b. What number is behind the number 19? **12**
 c. What number is behind the number 23? **28**
 d. What number is behind the number 67? **64**

One way is to set a mirror line as follow:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Another way: we can solve this by counting spaces from the left then counting the same number of spaces from the right.

a. **91**
 b. **12**
 c. **28**
 d. **64**

8. $31 \times 2 - 3 = 62 - 3 = 59$ **59**

9. If you continue the pattern, you will get:
 $7+8+9+10+11 = 45$ $11+12+13+14+15 = 65$
 $8+9+10+11+12 = 50$ $12+13+14+15+16 = 70$
 $9+10+11+12+13 = 55$ **$13+14+15+16+17 = 75$**
 $10+11+12+13+14 = 60$


Another way:
 We add 5 consecutive numbers and get 75, it means that each number is more than 10. Let's subtract five tens from 70, we'll get 25. And looking at the pattern it must be $3 + 4 + 5 + 6 + 7 = 25$, so to get to 75 we must add **$13 + 14 + 15 + 16 + 17$** .

13, 14, 15, 16, 17
 Or
 $13+14+15+16+17$

10. There are 5 letters in Lydia's name and the last letter A always appears in the positions which are multiples of 5 (5^{th} , 10^{th} , 15^{th} , 20^{th} , etc.).

a. The 6^{th} 'A' appears at the 30^{th} or it appears after **29 letters**.
 b. The 38^{th} letter would be a 'D'. $38 \div 5 = 7 \text{ R}3$, so, it is the third letter in her name, or **D**.

a. **29 [letters]**
 b. **D**

11. a. $3+6+9=18$ 
 b. We can organize our thoughts using a table:

Row number	1	2	3	4	5	6	7
Total small triangles	1	$1+3=4$	$1+3+5=9$	16	25	36	49
Total sticks used	3	$3+6=9$	$3+6+9=18$	$18+12=30$	$30+15=45$	$45+18=63$	$73+21=84$

If she used 84 sticks, she has completed **7 rows** of small triangles in the pattern.

a. **18**
 b. **7 [rows]**

12. There are 8 letters in his name. Spelled backward, it becomes SALOHCIN.
 $787 \div 8 = 98 \text{ R}3$. The third letter when spelled backward is the letter 'L'.

L or letter L

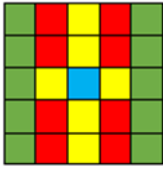
13. The side length of each square is halved, so to find the side length of the 5th square, you can continue halving the previous side length. Starting with 4 cm:
 1st square: 4 cm
 2nd square: 2 cm
 3rd square: 1 cm
 4th square: 0.5 cm
 5th square: **0.25 cm**

0.25 [cm]

14. $z = 1,234,321$. The sum of the digits of z is $1+2+3+4+3+2+1 = 16$.

16

15. Examine the pattern. There is one wall piece behind each car plus 2 wall pieces on the ends. 75 cars split equally in three garages, means there will be 25 cars per garage. For one garage holding 25 cars, he will need 25 + 2 or 27 wall pieces. So, for 3 garages, he will need $27 \times 3 = 81$ wall pieces.

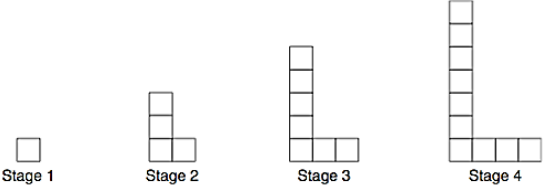
16. 

G : R G : B R : Y
 5 : 4 10 : 1 4 : 3
 To combine the first two ratios together by common color Green (G), which is 10.
 G : R : B = 10 : 8 : 1
 To add the last ratio here, we need to have Red (R) as 8.
 G : R : B : Y = 10 : 8 : 1 : 6

a. $8 - 1 = 7$
 b. $6/25$
 c. $(25 - 8)/25 = 17/25$

a. 7
 b. 6/25
 c. 17/25

17. Notice that each stage is increasing by 3 blocks.



Stage	Blocks	Total Blocks
1	1	1
2	4	1+4
3	7	5+7
4	10	12+10 = 22
5	13	22+13 = 35
6	16	35+16 = 51
7	19	51+19 = 70
8	22	70+22 = 92
9	25	92+25 = 117

8 [stages]

18.

A	B	C	D
3	6	9	12
15	18	21	24
27	30	33	36
39	42	45	48
...

$2025 \div 3 = 675 \rightarrow 2025$ is the 675th multiple of 3.
 Since the column is repeating, column A has the 1st, 5th, 9th, 13th, 17th, 21st, 25th, ...
 $675 \div 4 = 168$ r3
 2025 will be in **Column C**.

C or Column C