Math Challenge #9

First Name: _____ **Last Name:** _____ **Grade:** _____

Teacher: _____ **Parent's email:** _____

Patterns

Welcome to the Math Challenge #9. In this challenge, once again we look at problems involving Patterns. The ability to identify patterns and sequences is an important aspect of critical thinking and problem solving.

Kinder & First Grade: solve <u>at least</u> 3 problems.
Second & Third Grade: solve <u>at least</u> 7 problems.
Fourth Grade and above: solve <u>at least</u> 12 problems.

Answer

1. Draw the shape that comes next in this sequence.

2. Complete this sock pattern.

blue, yellow, blue

3. Below are two sequences of letters. What letter will come next in each sequence?

a. X Y X Y Y X Y Y Y ___

b. A A B C A A B C A ___

a. X

b. A

4. Which shape comes next in the sequence?

i. 

ii. 

iii. 

i. b

ii. b

iii. c

5. Complete the following patterns:

a. 

b. 

c. 

a. 23, 28

b. 24, 96

c. 33, 31

6. Tala cleans her hamster's house every 7 days. If she cleaned it on January 14, what are the dates in February when she will clean her hamster's house?

Feb 4, 11, 18 and 25

7. Fill in each blank with the correct number to continue each pattern.

a. 10 | 15 | ____ | 25 | 30 | ____ | 40 | 45

b. 24 | ____ | 20 | 18 | 16 | ____ | 12 | 10

c. 3 | 6 | ____ | 15 | 21 | 28 | ____ | 45

a. 20, 35

b. 22, 14

c. 10, 36

8. Fill in each blank to complete each pattern.

a. ☐ 22 ☐ 44 55 ☐ ☐ ☐ ☐

b. 1 10 2 9 3 ○ ○ ○ ○ ○

c. ☐ ☐ 75 70 65 ☐ 55 ☐ ☐

a. 11, 33, 66, 77, 88, 99

b. 8, 4, 7, 5, 6

c. 85, 80, 60, 50, 45

9. Mark bought 5 toy cars for $4.50, 10 cars for $9.00 and 15 cars for $13.50. If the pattern continues, what would be the total cost for 21 toy cars?
Every 5 toy cars cost $4.50, so 1 toy car costs $0.90. 21 toy cars will cost $0.90×**21** = $18.90.

$18.90

10. Mia runs 3 miles every other day for the month of January. If Mia ran on January 1st, how many total miles would she have run in January? January has 31 days, so she'll run 16 days. Mia would have run 3 miles in each of 16 days. 16 x 3 = 48 miles.

48 miles

11. A swimmer is gradually increasing the distance he swims each week. The chart below shows the distances he swims for the first 5 weeks of his program. If he continues the same pattern of increase, how far will he swim during the tenth week?

Swimming Distances (miles)				
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**
1.3	1.4	1.6	1.9	2.3

The pattern is increasing by 0.1, 0.2, 0.3, and so on. During the 10th week, he will swim 5.8 mi.

5.8 miles

12. A sequence is called linear when the change from one number to the next is always the same. For example, 10, 16, 22, 28, 34, … is linear because the increase from one number to the next is always 6. The following are linear sequences.

a. What is the 2nd term in the following linear sequence?

	?			76				108
1st	2nd	3rd	4th	5th	6th	7th	8th	9th

b. What is the 11th term in the following linear sequence?

		51			84					?
1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th

c. What is the 6th term in the following linear sequence?

		62			?				167	
1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th

a. 52

*The number increase by 32 from 5th term to the 9th term. Each term increases by 8 (32÷4). Since the 5th term is 76, the second term is 76 – (3*8) = 52.*

b. 139

*The increase on each term is 11 (33÷3). Since the 6th term is 84, the 11th term is 84 + (5*11) = 139.*

c. 107

*The increase on each term is 15 (105÷7). Since the 3rd term is 62, the 6th term is 62 + (3*15) =107*

13. If you know that $2^1 = 2, 2^2 = 4, 2^3 = 8, 2^4 = 16, 2^5 = 32$, what is the ones digit of 2^{25}? Notice that the pattern of the ones digit: 2, 4, 8, 16, 2, … unit digits repeats in pattern of every 4. 25/4 = 6R1 Therefore, the one's digit of 2^{25} is **2**.

2

14. A **geometric sequence** is a **sequence** of numbers that follows a pattern were the next term is found by multiplying by a constant called the common ratio. Fill in each blank with the correct number to continue each geometric sequence.

a. | 324 | 108 | ___ | ___ | 4 | ___ | $\frac{4}{9}$ |

b. | $\frac{3}{25}$ | ___ | 3 | 15 | ___ | 375 | ___ |

c. | ___ | $\frac{3}{2}$ | ___ | 6 | ___ | 24 | 48 |

a. Notice that 108 is a third of 324. The rule of this sequence is dividing by 3 (or multiplying by 1/3.

b. The rule is multiplying by 5.

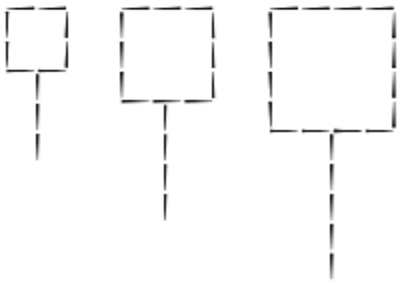
c. The rule is doubling.

a. 36, 12, 4/3

b. 3/5, 75, 1875

c. ¾, 3, 12

15. The terms of a pattern are made using toothpicks. Term 1 and Term 5 are not shown. Find the total number of toothpicks used in Term 1 to Term 5 of this pattern.



	Term2	Term3	Term4
square	2×4	3×4	4×4
leg	3	4	5

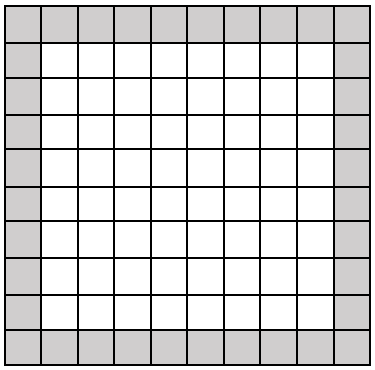
The sum of the terms from Term 1 to Term 5: $(1 \times 4 + 2) + (2 \times 4 + 3) + (3 \times 4 + 4) + (4 \times 4 + 5) + (5 \times 4 + 6) = 6 + 11 + 16 + 21 + 26 = 80$

80

16. If the 13th term in a linear sequence is 92 and the 28th term in the sequence is 152, what is the 6th term in the sequence? Notice that when you are going through 15 terms (from the 13th to the 28th), the number increases by 60 (152-92=60). So, each term increases by 4 (60÷15). Since the 13 term is 92, the 6th term is 92 – (7*4) = 92-28 = 64

64

17. Squares along the border of a 10 by 10 grid are shaded as shown in the picture.



a. How many unit squares are shaded?
(2*10) + (2*8) = 36 or you may think this way:
(10*10) – (8*8) = 36

b. If in a similar manner, squares are shaded along the border of a 50 by 50 grid, how many unit squares are shaded? (2*50) + (2*48) =196

a. 36

b. 196

18. The Redmond International School auditorium has exactly 26 rows of seats. The rows are labeled, in order, from the front of the auditorium to the back from A through Z. There are 10 seats in row A. Each row after the first row has two more seats than the previous row. There are 12 seats in row B, 14 seats in row C and so on. What is the total number of seats in the school auditorium?

The number of seats in each row form the arithmetic sequence 10, 12, 14, 16, …
The common difference is d = 2. There are 25 spaces in between 26 rows A-Z. Thus, in the row Z auditorium has 10 + (2 x 25) = 60 seats.
The sum of the seats: 10 + 12 + 14 +…+56+58+60 = 70×13 = 910

12+58 = 70

10+60 = 70

There are 13 pairs that will make the sum of 70

910 seats