



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.

Answer

1.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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5 [numbers]

2.

10	20		40	
60	70	80		100

 = 30
 = 50
 = 90

3.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----

6 [numbers]

4.

 rabbit	= 10	}	$10 + 30 + 45 = 85$
 turtle	= 30		
 zebra	= 45		

85

5. Cross out those with a partner:
 97 and 2, 15 and 84, 42 and 57, **67 does not have a partner**,
 21 and 78, 36 and 63, **6 does not have a partner**,
 26 and 73, 86 and 13, 86 and 13, 77 and 22, 8 and 91, and
29 does not have a partner.

97, 15, 84, 42, 67, 21,
 36, 57, 2, 6, 78, 26, 86,
 77, 13, 63, 8, 73, 22, 29,
 91.

6, 29, 67

6. a.

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

 b.

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

 c.

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

a. 4 and 8
b. 6 and 12
c. 7, 13, and 19

7.

	# of people to tell	# of people told
At noon	1	2
By 12:10	2	4
By 12:20	4	8
By 12:30	8	16
By 12:40	16	32
By 12:50	32	64
By 1 p.m.	64	128

254 [people]
 By phone there were $2 + 4 + 8 + 16 + 32 + 64 + 128 = 254$ people, who got the news.

8. Notice that the rule is 2 times the input plus 3.
 If the input is 4, the output is $4 \times 2 + 3 = 11$
 If the input is 10, the output is $10 \times 2 + 3 = 23$.

The other pattern you may notice is that the output column increases by 2 each line. To get to the 10th row you'll do 9 steps, or $5 + 9 \times 2 = 23$.

23

9. a.

□	□	30
□	□	56
40	42	×

 b.

□	□	72
□	□	70
90	56	×

a. 5, 6, 7, 8

b. 7, 8, 9, 10

10. First, we need to find the number of cubes used in each figure. We can solve this problem by noticing the pattern: 1 cube; 4 cubes; 9 cubes; 16 cubes; ___ cubes.
 Each time, we add the next odd number to the number of cubes: $1 + 3$, $4 + 5$, $9 + 7$, $16 + 9 = 25$




Fig. 1




Fig. 2




Fig. 3




Fig. 4

25

11. a.

2	□	10	□	18
---	---	----	---	----

 b.

4	□	26	□	48
---	---	----	---	----

 c.

11	□	□	47	□
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 d.

9	□	□	□	101
---	---	---	---	-----

 Check on the number of steps to reach from one number to the other. Find the difference between two closest numbers and divide by the number of the steps between them.

a. $(10-2)/2 = 4$. The pattern is adding 4.
 b. $(26-4)/2 = 11$. The pattern is adding 11.
 c. $(47-11)/3 = 12$. The pattern is adding 12.
 d. $(101-9)/4 = 23$. The pattern is adding 23.

a. 6 and 14

b. 15 and 37

c. 23, 35 and 59

d. 32, 55 and 78

12.

Small muffin	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>□</td></tr></table>	□	}	\$9.60
□				
Medium muffin	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>□</td><td>\$1</td></tr></table>	□		
□	\$1			
Large muffin	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>□</td><td>\$1</td><td>\$1</td></tr></table>	□	\$1	\$1
□	\$1	\$1		

 3 rectangles or 3 units = $\$9.60 - \$3.00 = \$6.60$.
 1 rectangle or 1 unit = $\$6.60 \div 3 = \2.20
 Small muffin = \$2.20
 Medium muffin = \$3.20
 Large muffin = \$4.20

Small muffin: \$2.20

Medium muffin: \$3.20

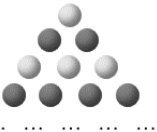
Large muffin: \$4.20

13. We can make three lists of the numbers corresponding to the clues.
 For the first list we'll skip count by 5, for the second list we skip count by 6, for the third list we skip count by 8. We then find the numbers that are divisible at the same time by 5, 6, and 8.
 Another way is to find the least common multiple of (5, 6, 8), which is 120. The mailbox that corresponds to all three clues will repeat every 120 mailboxes. Thus, there are 2 mailboxes that will work: #120 and #240.

120 and 240

14. $(1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12) \times 2 = 78 \times 2 = 156$

156 [times]

15. 

Sohum will need to put 13 rows of white balls before there is a difference of 13, so the number of white balls is $1 + 3 + 5 + \dots + 21 + 23 + 25 = 169$ white balls.

169

16.

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

Check on the number of steps to reach from one number to the other. Find the quotient between two closest numbers and think what number multiplied as many times as the number of the steps will give this result.

a. $24/8 = 3$, so the pattern is multiplying by 3.
 b. $240/15 = 16$ and is reached in 2 steps. So, the pattern is multiplying by 4.
 c. $117/13 = 9$. The pattern is multiplying by 3.

a. 72 and 216
 b. 60 and 960
 c. 39 and 351

17.

a.	<table border="1" style="display: inline-table;"><tr><td></td><td></td><td>161</td></tr><tr><td></td><td></td><td>115</td></tr><tr><td>161</td><td>115</td><td>×</td></tr></table>			161			115	161	115	×	<table border="1" style="display: inline-table;"><tr><td>7</td><td>23</td></tr><tr><td>23</td><td>5</td></tr></table>	7	23	23	5
		161													
		115													
161	115	×													
7	23														
23	5														
b.	<table border="1" style="display: inline-table;"><tr><td></td><td></td><td>1273</td></tr><tr><td></td><td></td><td>62</td></tr><tr><td>589</td><td>134</td><td>×</td></tr></table>			1273			62	589	134	×	<table border="1" style="display: inline-table;"><tr><td>19</td><td>67</td></tr><tr><td>31</td><td>2</td></tr></table>	19	67	31	2
		1273													
		62													
589	134	×													
19	67														
31	2														

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.
 $161 = 7 \times 23$, $115 = 5 \times 23$
 $1273 = 19 \times 67$, $62 = 2 \times 31$, $589 = 19 \times 31$, $134 = 2 \times 67$

a. 5, 7, 23, 23 or 5, 7, 23
 b. 2, 19, 31, 67

18.

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
...

Notice that the pattern repeats itself every 4 rows. The first 4 rows contain 18 numbers.
 $550 \div 18 = 30 \text{ r}10$
 The number 550 will appear in the same column as 10, which is N₂.
 Another way:
 Every other line starts with a multiple of 9: 9, 18, ..., the closest multiple of 9 to the 550 is $61 \times 9 = 549$. And this number is in the first column, thus, 550 is in the next or N₂.

N₂

Solution is available on October 20, 2023
www.mathinaction.org