Math Challenge #9

More Patterns

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

#	Problem	Answer
1.	How many buttons will be in the next two figures in the pattern? Figure 1, Figure 2, Figure 3, Figure 4, _____ Figure 5, _____ Figure 6	*Figure 5: 10 [buttons]* *Figure 6: 12 [buttons]*
2.	Below are two sequences of letters. What letters will be in the next two spaces of each pattern? a. A A B C A A B C A __ __ b. X Y X Y Y X Y X Y __ __	*a. A, B* *b. Y, X*
3.	Brenda joined a basketball team. The first game they played, she scored 1 point. The next game she scored 3 points and the following game she scored 5 points. If this pattern continues, how many total points would she have scored **by the end of the fourth game?** Total point scored: scores from game 1 to 3 = 1 + 3 + 5 + 7 = **16 points.**	*16 [points]*
4.	Look at the number sequences below and find the missing numbers. a. 4, 7, 10, ___, 16, ___, 22 b. 15, 13, 11, ___, 7, 5, ___ c. 5, 10, ___, ___, 25, 30, ___	*a. 13, 19* *b. 9, 3* *c. 15, 20, 35*
5.	Felicity collects 4 more cans for the recycling center than the day before. She made a chart to record the number of cans she collects. Complete her chart and find out how many cans will she collect on Friday? Since there are 4 more cans collected in each day, on Thursday Felicity will collect 14 + 4 = 18 and on Friday he will collect 18 + 4 = 22 <table><tr><td>Monday</td><td>6</td></tr><tr><td>Tuesday</td><td>10</td></tr><tr><td>Wednesday</td><td>14</td></tr><tr><td>Thursday</td><td></td></tr><tr><td>Friday</td><td></td></tr></table>	*22 [cans]*
6.	Look at the pattern on the right. If the pattern continues, what is the letter <u>under</u> which the number 24 would go? In each column the numbers increase by 5. 24 − 5×4=4, which is in the column marked as D <table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>11</td><td>12</td><td>13</td><td>…</td><td>…</td></tr><tr><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr></table>	*D*

7.	Study the figures on the right. How many layers will there be if the well is built using 64 cubes? *Each layer uses 8 cubes.* *64÷8 = 8 layers*	This well uses 8 cubes This well uses 16 cubes This well uses 24 cubes	*8*

8.	Alex loves cookies. He ate 10 cookies on Monday, 9 on Tuesday, 8 on Wednesday, and so on through Sunday. How many cookies did he eat in all from Monday through Sunday? *10 + 9 + 8 + 7+ 6 + 5+ 4 = 49*	*49 [cookies]*

9.	A farmer uses bales of hay to fence his pigs. Bales are shown as white squares. Pigs live in the dashed squares. Top views of his pens are shown below. How many bales of hay will the farmer need for 10 pigs?	*26 [bales]*

This pen holds 1 pig.   This pen holds 2 pigs.   This pen holds 3

One way: make a table

Number of pigs	1	2	3	4	5	6	7	8	9	10
Number of bales of hay	8	10	12	14	16	18	20	22	24	26

Or notice another pattern: there are always 3 bales on each end (shown as white square). This makes 6. For each pig (shown as lined square) there are two other bales (shown as gray square). So, for 10 pigs, there would be 2 x 10 + 6, which is 26 bales.

10.	A repeating pattern is shown below. What is the 50th figure in the pattern?	

Since the pattern repeats after 4 figures, the 50th figure is ➡
50 ÷ 4 = 12 r2

| 11.	Tina started building trains with shapes. Look for a pattern to help you complete the table. Using the table, how many squares, rectangles and circles does Tina need to make train #100?	*Number of squares: 100* *Number of rectangles: 101* *Number of circles: 101*

Train #1   Train #2   Train #3

Train	1	2	3	4	5	10	100
Number of squares	1	2	3	4	5	10	100
Number of rectangles	2	3	4	5	6	11	101
Number of circles	2	3	4	5	6	11	101

12.	The stars below are made up of white triangles and shaded triangles. Look for a pattern to help you complete the table. How many white triangles and shaded triangles needed to make star #100?	*White triangles: 401* *Shaded triangles: 300*

Star #1 Star #2 Star #3
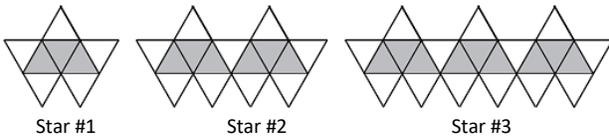
For every star, the number of shaded triangles is 3 times the 'star number'. The number of white triangles is 4 times the 'star number', plus 1 extra at the beginning.

Star #1 Star #2 Star #3
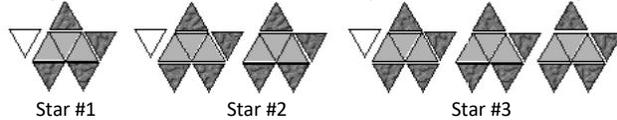
Star	1	2	3	4	5	10	100
Shaded Triangles	3	6	9	12	15	30	300
White Triangles	5	9	13	17	21	41	401

13.	The table below shows the number of pennies Angela places in a jar each day. If the pattern continues, on what day will Angela place 1024 pennies in her jar.	*Day 11*

Day	1	2	3	4	5	6	7	8	9	10	11
Number of pennies placed in the jar	1	2	4	8	16	32	64	128	256	512	1024

Notice that the number of pennies placed in the jar is doubled from the previous day.

14.	Diana hired a carpenter to replace some missing steps at the front of her house. The bottom three steps are missing. The carpenter wants to use the same heights for the new steps as the old steps. The carpenter measures the height from the ground to the top for each remaining step.	*First Step: 16.5 cm* *Second Step: 33 cm* *Third Step: 49.5 cm*

- The fourth step is 66 cm from the ground.
- The fifth step is 82.5 cm from the ground.
- The sixth step is 99 cm from the ground.

The carpenter plans to make each step increase by the same amount. What is the height of the first, second, and third steps?
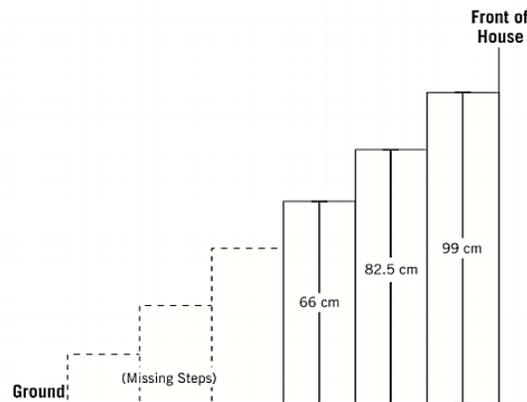
Since each step rises by 16.5 cm, the height of the third step is 66 – 16.5 = 49.5 cm, the second step is 49.5 – 16.5 = 33 cm and the first step is 33 – 16.5 = 16.5 cm

For problems 15 to 17, record the corresponding numbers in the following chart.

| Term	1	2	3	4	5	6	10
Triangular Numbers	1	3	6	10	15	21	55
Square Numbers	1	4	9	16	25	36	100
Pentagonal Numbers	1	5	12	22	34	105	145
Hexagonal Numbers	1	6	15	28	45	66	190

|		
15.	The first few **triangular numbers** are given below. Determine the next two triangular numbers and add these numbers to the chart. What is the 10th triangular number?	*55*

1   3   ___   ___   ___
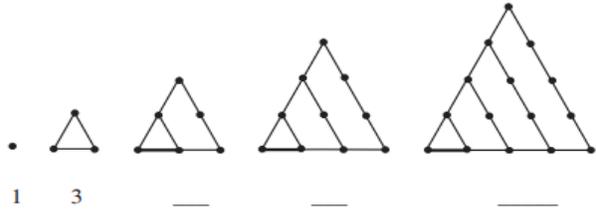
16.	The first few **hexagonal numbers** are illustrated below (1, 6, 15, 28). Determine the next two hexagonal numbers and add them to the chart. What will be the 10th hexagonal number?	*190*
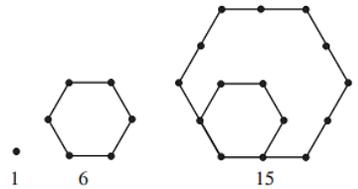
1   6   15

17.	The first few **pentagonal numbers** are illustrated below. Add them to the chart. Determine the next two hexagonal numbers and add them to the chart. What will be the 10th pentagonal number?	*145*
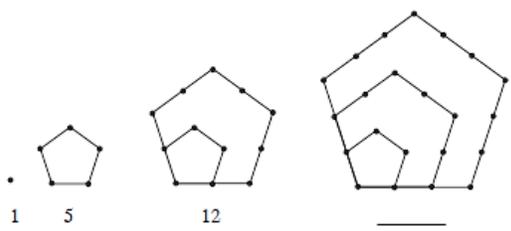
1   5   12   ___

18.	Look at the number sequences below and find the missing numbers.

a.
2	8	18	32	50	___	___

b.
1	8	27	64	125	___	___

c.
0	3	___	15	24	35	___

a.   72 and 98

b.   6^3 and 7^3 or 216 and 343

c.   8 and 48

In pattern a. 2 + **6** = 8, 8 + (**6+4**) = 18, 18 + (10 + **4**) = 32, …, so the patten is increasing by 4 more than on the previous step, thus, 50 +**22 = 72**, 72+**26 = 98**

Pattern b. is cubic numbers, 1 = 1^3, 8 = 2^3, 27 = 3^3, 64 = 4^3, so the missing numbers are **6^3 = 216** and **7^3 = 343**

In pattern c. the number increase 2 more than on the previous step. 0+3 = 3, 3+ **(3+2) = 8**, 8 + **(3+2+2)** = 15, 15 + **(7+2)** = 24, 24 + **(9+2)** = 35, 35+**(11+2) = 48**

Solution is available on February 21, 2020 at www.mathinaction.org