Math Kangaroo

Level 5-6

Patterns

Warm Up

Instruction

Pattern Problems

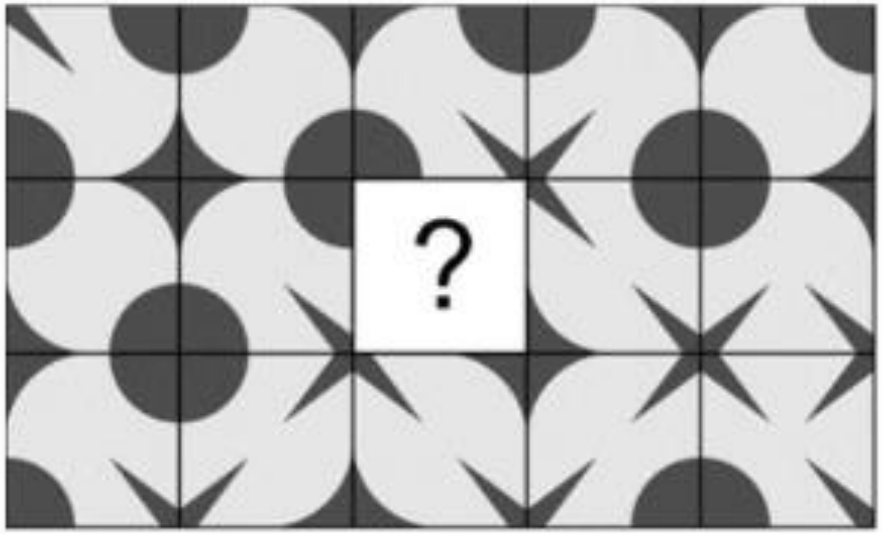
Wrap Up

Bonus Slides

Warm Up

MK 2020 #1

Draw the piece that completes the pattern.



What is a pattern?

- In mathematics, a pattern is characterized by the arrangement or repetition of numbers, shapes, colors, and so on, although not all patterns involve repetition.
- If in a set numbers are related to each other following a specific rule, then the rule or manner is called a pattern. Sometimes, a pattern is also known as a sequence. For example, in the sequence 2, 4, 6, 8, ?, each number is increasing by 2. So, the last number will be 8 + 2 = 10.
- The pattern can be related to any type of event or object.

Main types of patterns in Math Kangaroo

- Number patterns
- Color patterns
- Image patterns

Pattern recognition helps us solve problems

- Simplify a complex problem
- Reduce the number of calculations
- Save time
- Increase accuracy

When we don't see the pattern right away, we can try solving a simpler question first.

Color patterns

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Patterns

MK 2003 #2

1. Zosia is drawing flowers of different colors. The first flower is blue, the second white, the next one red, the next one yellow, and again blue, white, red, yellow, and so on in the same order. What is the color of the twenty ninth flower drawn by Zosia?

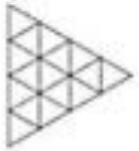
Number patterns

MK 2012 #6

2. The picture to the right shows a pattern of hexagons. We draw a new pattern by connecting all the centers of neighboring hexagons. Which of the figures below do we get?

(A) 

(B) 

(C) 

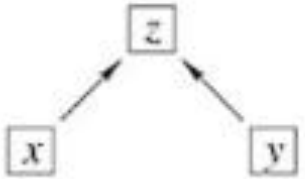
(D) 

(E) 

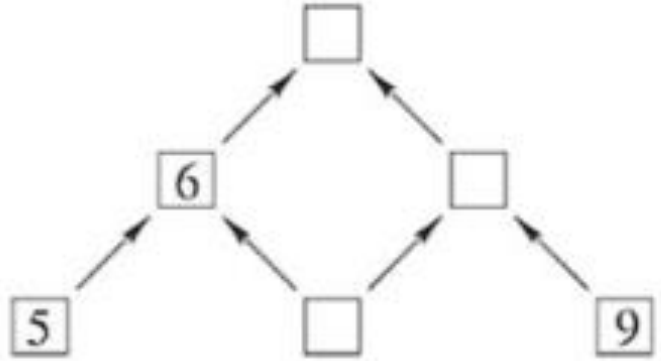
Number patterns

MK 1998 #11

3. What number is at the top of the pyramid if it is formed according to the pattern shown below?



$$z = \frac{x + y}{2}$$



Number and color patterns

(MK 2012 #14)

4. The positive integers have been colored red, blue or green: 1 is red, 2 is blue, 3 is green, 4 is red, 5 is blue, 6 is green, and so on. Renate calculates the sum of a red number and a blue number. What color can the resulting number be?

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Number patterns

MK 2017 #16

5. Peter went hiking in the mountain for 5 days. He started on Monday and his last hike was on Friday. Every day he walked 2 km more than the day before. When the whole trip was over, his total distance was 70 km. What distance did Peter walk on Thursday?

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(MK 2018 #17)

6. On Monday, Alexandra emails a picture to 5 friends. For several days everybody who receives the picture emails it the next day to two friends who haven't received the picture yet. On which day does the number of people who have received the picture become greater than 100?

Image patterns

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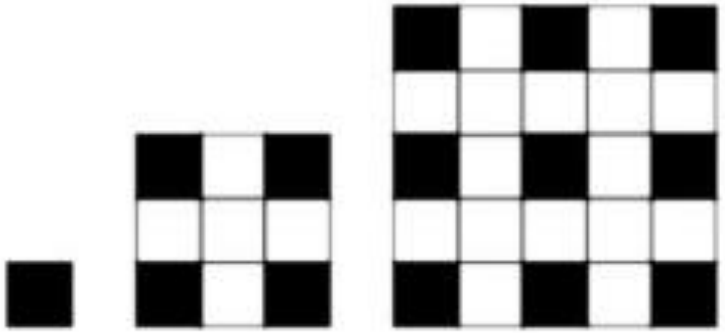
(MK 2011 #24)

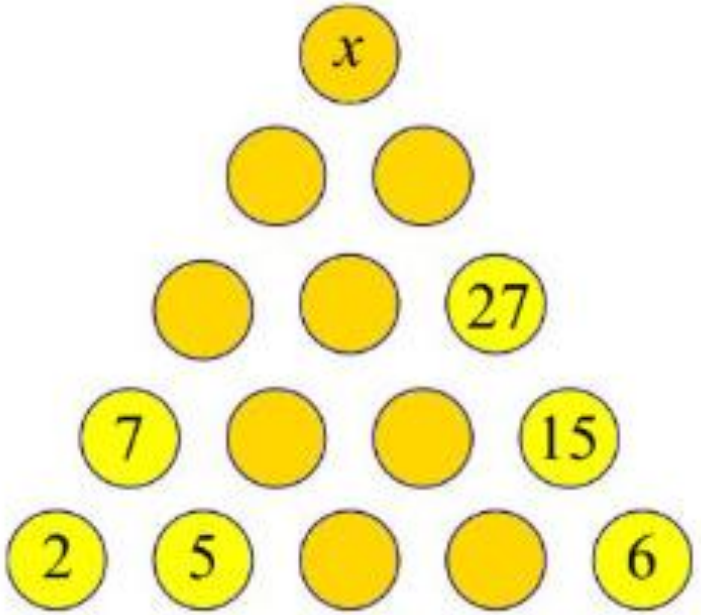
7. We have several square grids with odd numbers of rows and columns. All the small squares in the grid which are either in a row or in a column with an even number are painted white. The rest of the small squares are painted black. Grids that are 1×1, 3×3, and 5×5 are shown in the picture. How many small white squares will there be in a grid that has 25 small black squares?



Bonus Question - Number pattern

(MK 2005 #22)

What number should replace *x* if we know that the number in the circle in the upper row is the sum of the numbers from the two circles right below it?

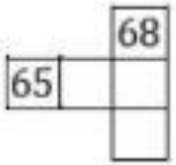


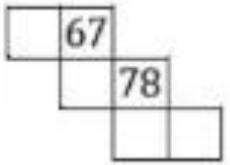
Bonus Question - Number pattern

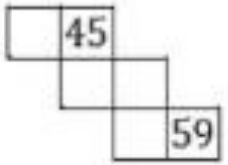
(MK 2003 #24)

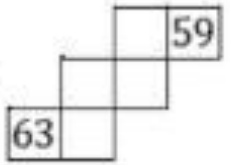
Piotrek is writing the numbers from 0 to 109 into a five-column table using a rule which is easy to figure out (see the picture). Which of the pieces below can't be filled in with numbers to fit Piotrek's table?

0	2	4	6	8
1	3	5	7	9
10	12	14	16	18
11	13	15	17	19
20	22	24	26	28
21	23	25	27	⋮
⋮	⋮	⋮	⋮	⋮

(A) 

(B) 

(C) 

(D) 

(E)