MO MATH
NATIONAL MUSEUM OF MATHEMATICS

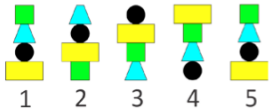
Level 1

1. Which shape *cannot* be formed using  and  ?

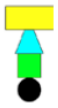
A.  B.  C.  (D.) 

E. 

2. Emilie builds towers in the following pattern:



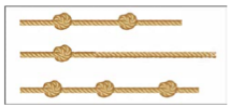
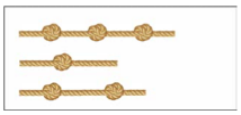
Which will be the tower number 6?

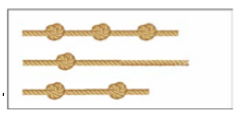
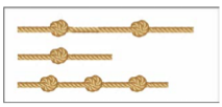
A.  (B)  C.  D.  E. 

3. If $\diamond + \diamond = 4$ and $\triangle + \triangle + \triangle = 9$, what is the value of $\diamond + \triangle = ?$

A. 2 B. 3 C. 4 (D.) 5 E. 6

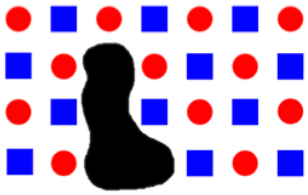
4. Charles cut a rope in three equal pieces and then made some equal knots with them. Which figure correctly shows the three pieces with the knots?

A.  (B.)  C. 

D.  

Problems selected from Kangaroo Math

5. How many circles and how many squares are covered by the blot in the picture?

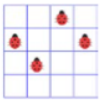
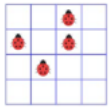
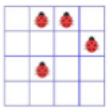
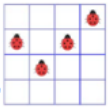
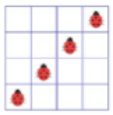


A. 1 circle and 3 squares B. 2 circles and 1 square C. 3 circles and 1 square
D. 1 circle and 2 squares E. 2 circles and 2 squares

6. There are four ladybugs on a 4 X 4 board. Two are asleep and do not move. The other two ladybugs move one square every minute (up, down, left, or right). Here are the pictures of the board for the first four minutes:

Minute 1 Minute 2 Minute 3 Minute 4

Which of the following is a picture of the fifth minute (Minute 5)?

A.  B.  C.  D.  E. 

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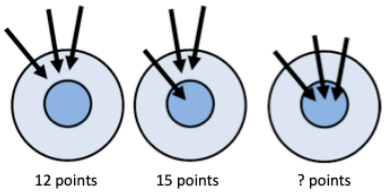
Level 2

1. Lea has 10 rubber stamps. Each stamp has one of the digits:
0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
She prints the date of St. Patrick's Day 2018:

How many different stamps does she use?

A. 5 (B) 6 C. 7 D. 9 E. 10

2. First, Diana scores 12 points in total with three arrows. On her second turn she scores 15 points.



How many points does she score on her third turn?

A. 18 B. 19 C. 20 (D) 21 E. 22

3. How many different numbers greater than 12 and smaller than 58 with distinct digits can we make by using any two of the digits 0, 1, 2, 5, and 8?

A. 3 B. 5 C. 7 D. 8 (E) 9

4. Peta rabbit had 20 carrots. She ate two carrots every day. She ate the twelfth carrot on Wednesday. On which day did she start eating the carrots?

A. Monday B. Tuesday C. Wednesday D. Thursday (E) Friday

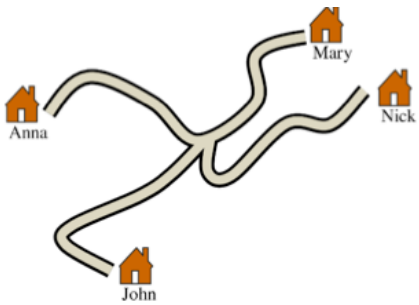
Problems selected from Kangaroo Math

5. The belt shown in the drawing can be fastened in five ways.

How much longer is the belt fastened in one hole than the belt fastened in all five holes?

A. 4 cm (B) 8 cm C. 10 cm D. 16 cm E. 20 cm

6. The distance from Anna's to Mary's house is 16 kilometers along the shown road. The distance from Mary's to Nick's house is 20 kilometers. The distance from Nick's to John's house is 19 kilometers. How far is Anna's house from John's?



(A) 15 km B. 16 km C. 18 km
D. 19 km E. 20 km

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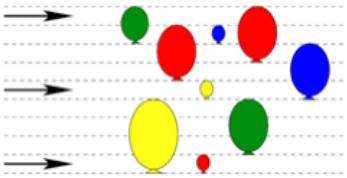
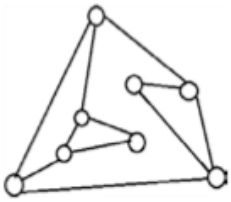
Level 3

1. The drawing shows 3 flying arrows and 9 fixed balloons. When an arrow hits a balloon, it bursts, and the arrow flies further in the same direction. How many balloons will not be hit by arrows?



(A) 3 B. 2 C. 6 D. 5 E. 4

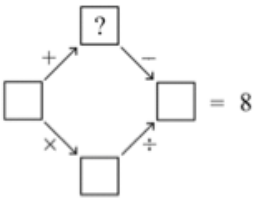
2. In the following figure, the circles are light bulbs connected to some other light bulbs. Initially all the light bulbs are off. When you touch a light bulb, this light bulb and all of its neighbors (e.g., the light bulbs connected to it) are lit.



At least how many light bulbs do you have to touch to turn on all the light bulbs?

(A) 2 B. 3 C. 4 D. 5 E. 6

3. Each square contains one of the numbers 1, 2, 3, 4, or 5, so that both of the calculations following the arrows are correct. A number may be used more than once. What number goes into the box with the question mark?



A. 1 B. 2 C. 3 D. 4 (E) 5

4. Annie replaced the letters with numbers in the word KANGAROO (identical letters with the same digits, different letters with different digits) so that she got the largest possible 8-digit number, which is not a multiple of 4. What is the sum of the last three digits replacing the word ROO?

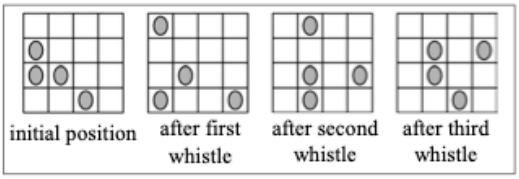
A. 13 B. 14 C. 12 D. 15 (E) 11

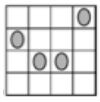
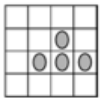
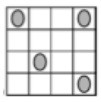
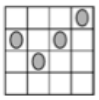
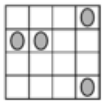
Problems selected from Kangaroo Math

5. Captain Hook has plundered a safe that contains 2520 gold coins. During the night, each of his pirates secretly took out some coins just for themselves. The first one took out $\frac{1}{2}$ of the coins, the second one $\frac{1}{3}$ of the remaining coins, the third one $\frac{1}{4}$ of the remaining coins and so on. When Captain Hook opened the safe in the morning, he found only 252 coins inside. How many pirates are commanded by Captain Hook?

A. 8 (B) 9 C. 10 D. 11 E. 12

6. Four ladybugs sit on different cells of a 4 X 4 grid. One of them is sleeping and does not move. Each time you whistle, the other three ladybugs move to a free neighboring cell. They can move up, down, left, or right but they are not allowed to go back to the cell they just came from. Which of the following images might show the result after the fourth whistle?



(A)  B.  C.  D.  E. 

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Level 4

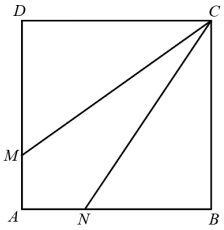
1. When the letters of the word MAMA are written vertically above one another, the word has a vertical line of symmetry. Which of these words also has a vertical line of symmetry when written in the same way?

A. ROOT B. BOOM C. BOOT D. LOOT (E.) TOOT

2. Only one of the digits in the year 2018 is a prime number. How many years will pass until the next year when all of the digits in the year are prime numbers?

A. 201 B. 202 C. 203 (D.) 204 E. 205

3. Square $ABCD$ has sides of length 3 cm. The points M and N lie on AD and AB so that CM and CN split the square into three pieces of the same area. What is the length of DM?



A. 0.5 cm B. 1 cm C. 1.5 cm (D.) 2 cm E. 2.5 cm

4. Yesterday, 03/17/2018, was John's birthday. Now his age is equal to the sum of the digits of the year he was born. How old is John?

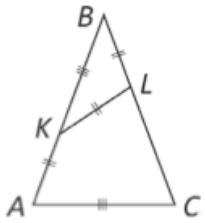
A. 5 years old B. 7 years old C. 9 years old D. 11 years old
(E.) 10 years old

5. There are three candidates for one position as class supervisor and 130 students are voting. Suhaimi has 24 votes so far, while Khairul has 29 votes, and Akmal has 37 votes. How many more votes does Akmal need in order to receive more votes than any of the two other candidates?

A. 13 B. 14 C. 15 D. 16 (E.) 17

Problems selected from Kangaroo Math

6. In isosceles triangle ABC, points K and L are located on sides AB and BC respectively so that $AK = KL$ and $KB = AC$. What is the size of angle ABC?



A. 30° B. 35° C. 36° D. 40° E. 44°

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Level 5

1. In my family each child has at least two brothers and at least one sister. What is the smallest number of possible children in my family?

   A. 3 B. 4 (C.) 5 D. 6 E. 7

2. The lengths of the two sides of a triangle are 5 and 2, and the length of the third side is an odd integer number. Find the length of the third side.

   A. 3 B. 4 (C) 5 D. 6 E. 7

3. Two buildings are located on one street at a distance of 250 meters from each other. There are 100 students living in the first building, and there are 150 students living in the second building. Where should a bus stop be built so that the total distance that all the residents of both buildings have to walk from this bus stop to their buildings would be the least possible?

   A. in front of the first building
   B. 100 meters from the first building
   C. 100 meters from the second building
   (D) in front of the second building
   E. anywhere between the buildings

4. There are two diagonals drawn in a regular 2018-gon with its vertices numbered from 1 to 2018. One diagonal connects the vertices with the numbers 18 and 1018, the other connects the vertices with the numbers 1018 and 2000. How many vertices do the resulting three polygons have?

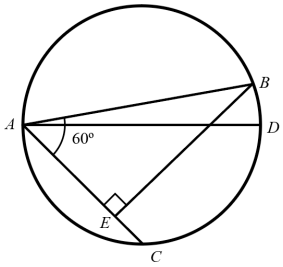
   (A) 38, 983, 1001 B. 37, 983, 1001 C. 38, 982, 1001
   D. 37, 982, 1000 E. 37, 983, 1002

5. Several integers are written on a blackboard, including the number 2018. The sum of all of these integers is 2018. The product of these integers is also 2018. Which of the following could be the numbers of integers written on the blackboard?

   A. 2016 (B) 2017 C. 2018 D. 2019 E. 2020

Problems selected from Kangaroo Math

6. Two chords AB and AC are drawn in a circle with diameter AD. The angle $\angle BAC = 60°$, $BE \perp AC$, $AB = 24$ cm, $EC = 3$ cm. What is the length of chord BD?



A. $\sqrt{3}$ cm B. 2 cm C. 3 cm (D) $2\sqrt{3}$ cm
E. $3\sqrt{2}$ cm

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Level 6

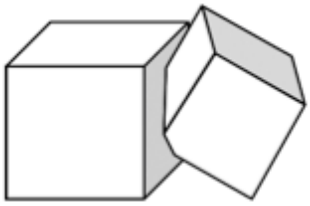
1. Which of the following numerical expressions has the highest value?

A. $2-0\times1+8$ B. $2+0\times1\times8$ C. $2\times0+1\times8$
(D) $2\times(0+1+8)$ E. $2\times0+1+8$

2. If a and b are digits and $\frac{a}{b}=b\,.\,a$ ($b\,.\,a$ is a decimal), find $a+b$.

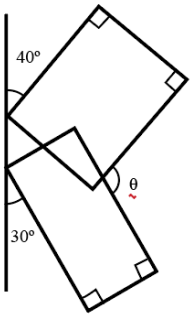
(A) 7 B. 8 C. 9 D. 10 E. 11

3. Two cubes of volumes V and W intersect. The parts of the cube of volume V which is not common to the two cubes is 90% of the volume. The part of the cube of volume W which is not common to the two cubes is 85% of its volume. What is the relationship between V and W?



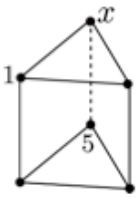
A. $V=\frac{2}{3}W$ (B) $V=\frac{3}{2}W$ C. $V=\frac{85}{90}W$ D. $V=\frac{90}{85}W$
E. $V=W$

4. Two rectangles are inclined to the vertical line at angles 40° and 30° as shown. What is the measure of the angle θ?



A. 105° B. 120° C. 130° D. 135°
(E) None of these

5. The prism in the picture is formed of two triangles and three squares. The six vertices are numbered from 1 to 6 in such a way that that sum of the four vertices of each square is the same for all three squares. Numbers 1 and 5 are already shown. What number is the vertex labelled x?



(A) 2 B. 3 C. 4 D. 6

Problems selected from Kangaroo Math

E. the situation is impossible

6. Archimedes calculated $15!$. The result is written below. Unfortunately, two of the digits, the second and the tenth, are not visible. Which are these two digits?

$$1\square 0\,7\,6\,7\,4\,3\,6\square 0\,0\,0$$

A. 2 and 0 B. 4 and 8 C. 7 and 4 D. 9 and 2
E. 3 and 8