MO☀MATH

Level 1

1. Who caught the fish?

   (A) Adam
   (B) Basil
   (C) Charlie
   (D) David
   (E) Edgar
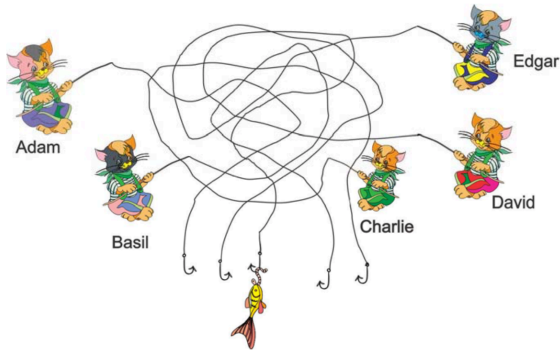
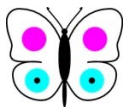2. Ellen wants to decorate the butterfly ![butterfly] with these stickers
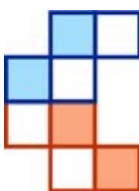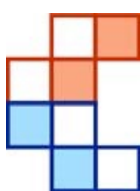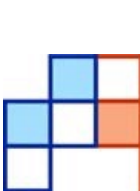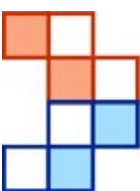
   ●●❙❙●●. Which butterfly can she make?

   (A)   (B)   (C)   (D)   (E)

3. Alfred was turning a shape. The first three turns are shown in the picture.
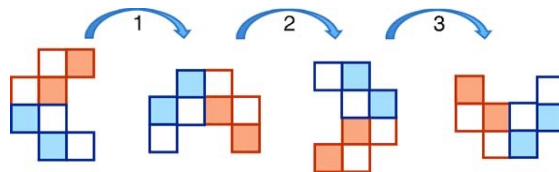
   He did six turns in total. What does the shape look like at the end?

   (A)   (B)   (C)   (D)   (E)

Problems selected from Math Kangaroo

4. Looking at the picture below
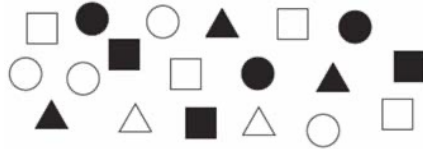
find the number in the lower right corner of the table.

	□	○	△
black		3	
white	4		?

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

5. The picture shows a group of building blocks and a plan of the same group. Some ink has dripped onto the plan. What is the sum of the numbers under the ink blots?
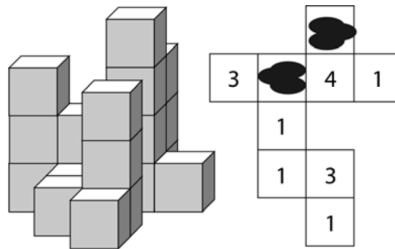
(A) 3   (B) 4   (C) 5   (D) 6   (E) 7

6. Which stamp was used to get the picture?

(A)   (B)   (C)   (D)

(E)

Level 2

1. Two 3×3 transparent sheets are darkened in some squares, as shown. They are both slid on top of the board shown in the middle.

   Pictures behind the darkened squares cannot be seen. Only one of the pictures can still be seen; which one is it?

   (A)   (B)   (C)   (D)   (E)

2. How many triangles (of any size) are there in the figure?

   (A) 2   (B) 6   (C) 7   (D) 8   (E) 9

3. A five-digit number has four equal digits and the sum of the digits is 43. Which one is the different digit?

   (A) 1   (B) 3   (C) 5   (D) 7   (E) 9

4. The Modern Sofa Furniture store is selling a sofa and a loveseat made from identical modular pieces as shown in the picture.

sofa
220 cm wide

loveseat
160 cm wide

The width, including the seating and the armrests, is given below each item. How wide is an armrest?
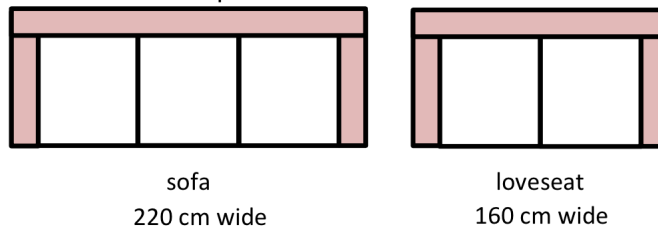
(A) 15 cm   (B) 20 cm   (C) 30 cm   (D) 40 cm   (E) 60 cm

5. Identical cubes are glued together. The figures below show the structure seen from the front, from the left, and from above.

1) front   2) left   3) above
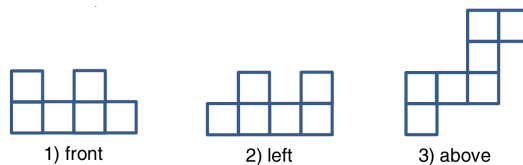
What number of cubes does the structure contain?

(A) 6   (B) 9   (C) 10   (D) 11   (E) 12

6. Kate has 4 flowers, one with 6 petals, one with 7 petals, one with 8 petals, and one with 11 petals.

Kate chooses three flowers and tears off one petal from each flower. She does this several times, choosing any three flowers each time. She stops when she can no longer tear one petal from three flowers. What is the smallest number of petals which can remain?

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

Level 3

1. Alice has 4 three-square tiles like this one: [tile image]. Which picture can she not make using her 4 tiles?
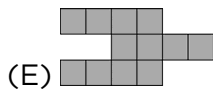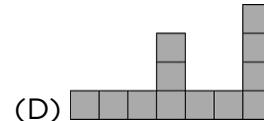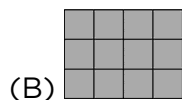
   (A) [figure]   (B) [figure]   (C) [figure]   (D) [figure]

   (E) [figure]
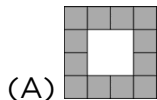
2. Peter and Nick are both working on "Kangaroo" contest problems. For every two problems that Peter solves, Nick manages to solve three problems. In total, the boys solved 30 problems. How many more problems did Nick solve than Peter?

   (A) 5   (B) 6   (C) 7   (D) 8   (E) 9

3. Tom wrote all the numbers from 1 to 20 in a row and obtained the 31-digit number

   1234567891011121314151617181920.

   Then he deleted 24 of the 31 digits, so that the remaining number was as large as possible. Which number was it?

   (A) 9671819   (B) 9567892   (C) 9781920   (D) 9912345
   (E) 9818192

4. A vase weighs 600 g when it is one third filled with water. The same vase weighs 800 g when it is two thirds filled with water. What is the weight of the vase when it is empty?

   (A) 100 g   (B) 200 g   (C) 300 g   (D) 400 g   (E) 500 g

5. There are eight balls numbered with the numbers 40, 80, 100, 101, 190, 200, 260, and 292 in a bag. Martina takes four balls out of the bag and calculates the sum of the numbers on these balls. It appears that this sum is half of the sum of the numbers on the balls that remain in the bag. What is the greatest number written on the balls taken out?

(A) 101   (B) 200   (C) 260   (D) 190   (E) 292

6. Julia has four pencils of different colors and wants to use some or all of them to paint the map of an island divided into four countries, as in the picture. Any two countries with a common border must be colored differently on the map. How many different colorings of this map are possible? (Two colorings are considered different if at least one of the countries is colored differently.)
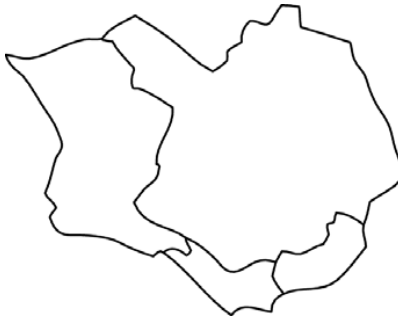
(A) 12   (B) 18   (C) 24   (D) 36   (E) 48

Level 4

1. A group of girls stands in a circle. Xena is the fourth on the left from Yana and the seventh on the right from Yana. How many girls are in the group?

   (A) 9   (B) 10   (C) 11   (D) 12   (E) 13

2. There are nine houses in a row on Deer Street. At least two people live in every house. There are no two neighboring houses where more than ten people live altogether. What is the maximum number of people who can live in the nine houses?

   (A) 96   (B) 49   (C) 48   (D) 47   (E) 46

3. In the diagram, the dashed line and the black path form seven equilateral triangles. The length of the dashed line is 20 cm. What is the length of the black path, in cm?
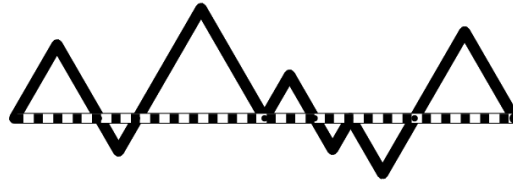
   (A) 25   (B) 30   (C) 35   (D) 40   (E) 45

4. In 16 years Dana will be five times older than she was four years ago. In how many years will Dana celebrate her 16th birthday?

   (A) 4   (B) 7   (C) 8   (D) 9   (E) 12

5. Buses leave the airport every 3 minutes to drive to the city center. A car leaves the airport at the same time as one bus and drives to the city center by the same route. It takes each bus 60 minutes and the car 35 minutes to drive from the airport to the city center. How many buses does the car pass on its way to the center, excluding the bus with which it left?

   (A) 8   (B) 9   (C) 10   (D) 11   (E) 13

6. Sarah wrote a natural number in each of the five boxes in the bottom row of the diagram. Then she wrote in each of the other boxes the sum of the two numbers in the boxes immediately underneath. What is the maximum number of odd numbers that could appear in the completed diagram?
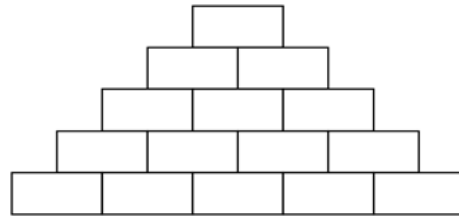
(A) 5   (B) 7   (C) 8   (D) 10   (E) 11

Level 5

1. My new printer prints 24 pages in 1.5 minutes. How many pages does it print in 5 minutes?

   (A) 60   (B) 72   (C) 80   (D) 96   (E) 100

2. One eighth of the guests at a wedding were children. Three sevenths of the adult guests were men. What fraction of the wedding guests were women?

   (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{3}$ (C) $\dfrac{1}{5}$ (D) $\dfrac{1}{7}$ (E) $\dfrac{3}{7}$

3. How many pairs (a, b) of digits a and b satisfy the condition that the product $\overline{30a} \bullet \overline{7b8}$ of the three-digit numbers $\overline{30a}$ and $\overline{7b8}$ is positive and divisible by 15?

   (A) 1   (B) 4   (C) 10   (D) 14   (E) 100

4. Jenny decided to enter numbers into the cells of the 3 × 3 table so that the sums of the numbers in all four 2 × 2 squares are the same. The three numbers in the corner cells have already been written as shown in the figure. Which number should she write in the fourth corner cell marked with the "?"?


   (A) 5   (B) 4   (C) 1   (D) 0   (E) impossible to determine

5. On the six faces of a given die the following numbers are written: –3; –2; –1; 0; 1; 2. All six numbers are equally likely to appear. Richard rolled the die twice and multiplied the outcomes that appeared. What is the probability that the product is a negative number?

   (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{4}$ (C) $\dfrac{11}{36}$ (D) $\dfrac{13}{36}$ (E) $\dfrac{1}{3}$

Problems selected from Math Kangaroo

6. Points A and B are on the circle with center M. PB is tangent to the circle at B, therefore perpendicular to radius MB. The distances $\overline{PA}$ and $\overline{MB}$ are integers, $\overline{PB} = \overline{PA} + 6$. How many possible values are there for $\overline{MB}$?
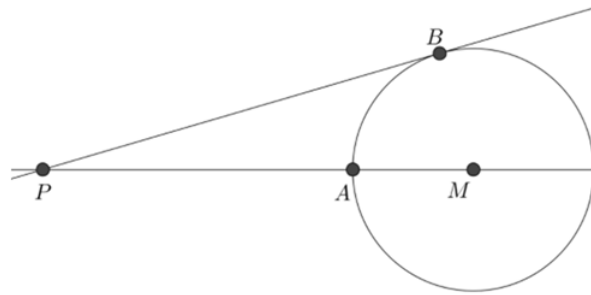
(A) 0   (B) 2   (C) 4   (D) 6   (E) 8

Level 6

1. Ben has a scale model of a railroad built in the 1:87 ratio. It contains a 2 cm high model (reproduction) of his brother. In the real world, how tall is his brother?

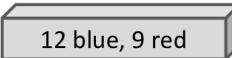(A) 1.74 m   (B) 1.62 m   (C) 1.86 m   (D) 1.94 m   (E) 1.70 m

2. Each of the following five boxes is filled with red and blue balls as labelled. Ben wants to take one ball out of a box without looking. From which box should he take the ball to have the highest probability of getting a blue ball?

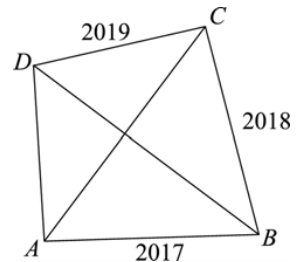(A) | 10 blue, 8 red | (B) | 6 blue, 4 red | (C) | 8 blue, 6 red |

(D) | 7 blue, 7 red | (E) | 12 blue, 9 red |

3. The positive number p is less than 1, and the number q is greater than 1. Which of the following numbers is the largest?

(A) $p \bullet q$ (B) $p + q$ (C) $\dfrac{p}{q}$ (D) p (E) q

4. In a convex quadrilateral $ABCD$, the diagonals are perpendicular. The sides have lengths $|AB| = 2017$, $|BC| = 2018$, and $|CD| = 2019$ (figure not to scale). What is the length of AD?

(A) 2016   (B) 2018   (C) $\sqrt{2012^2 - 4}$

(D) $\sqrt{2018^2 + 2}$ (E) 2020

5. The picture shows a regular hexagon with side lengths equal to 1. The flower was constructed with sectors of circles of radius 1 and centers in the vertices of the hexagon. What is the area of the flower?
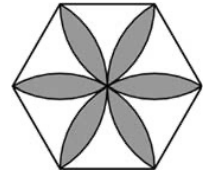
(A) $\dfrac{\pi}{2}$ (B) $\dfrac{2\pi}{3}$ (C) $2\sqrt{3} - \pi$ (D) $\dfrac{\pi}{2} + \sqrt{3}$ (E) $2\pi - 3\sqrt{3}$

6. If $f(xy) = f(x + y)$ and $f(11) = 22$, what is the value of $f(33)$?

(A) 11   (B) 22   (C) 33   (D) 44   (E) 66