***Cracking Challenge***

Station 1

Replace the correct whole number or mathematical symbol for the letters from A to E, then read clockwise the two mathematical expressions, and then calculate so that the final result of both inner and outer circles is equal to 49.



Solution：

The two mathematical expressions that we obtain are

first expression: 

second expression: 

By trial and error, we know that

in the first expression,  and so



in the second expression,  and so



Hence, 

New Station 2

Alex and Betty, standing facing each other, see the numbers in front of them as not exactly the same. What is the final result when the correct numbers are filled in the squares that make their calculations the same?



88 + 8 + 9 + 69 + 91 + 68

Solution：

The mathematical expression that Alex saw was:



The mathematical expression that Betty saw was:



Therefore, the final result is 421.

Station 3

There is a mathematical expression:  where  are two of the operators among  The Chart below indicates the results in calculation of four pairs of *A* and *B*. What is the value of 



Solution:

From the given information, we know that  and



Since  and so we conclude that  must be replaced by  while must be replaced by 

It follows  

Thus, 

Station 4

Place an A, B or C in each empty cell so that no three consecutive cells in a horizontal, vertical or diagonal line may contain a set of identical letters (for example, B-B-B) or a set of three different letters (for example, C-A-B). Can you ensure a set-free grid?

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | **B** |
| **B** |  | **C** |  |
| **A** |  |  |  |
|  | **A** | **C** |  |

Solution:

|  |  |  |  |
| --- | --- | --- | --- |
| **A** | **B** | **A** | **B** |
| **B** | **C** | **C** | **B** |
| **A** | **C** | **A** | **C** |
| **A** | **A** | **C** | **C** |

Station 5

As shown in the figure, a straight line is drawn cutting a  grid, at most passing 3 (three) squares. At most how many squares does the straight line pass when drawing a straight line that cuts a  grid?

Solution:

When drawing a straight line to cut a  grid, it will at most pass  squares.

When drawing a straight line to cut a  grid, it will at most pass  squares.

By analogy, when drawing a straight line to cut a  grid, it will at most pass  squares.

Therefore, when drawing a straight line to cut a  grid, it will at most pass  squares.

Station 6

Mrs. Santos bought 100 apples and put them in 6 different paper bags. Each bag, containing the number of apples, has the number 6. List the number of apples from the biggest number to the smallest number of apples that Mrs. Santos has loaded in each bag.

Solution:

Because 100 apples must packed in 6 different bags, since the single digit of 100 is 0, so it is impossible the unit digit of these 6 bags all be 6. It follows that we must assume one bag will have 60 apples, then the other 5 bags will have 40 apples. Since the digit in the number of apples in the other bags must contain the number 6, it is obvious that it is 30 apples (suppose each of 5 bags will packed 6 apples) and adding the extra 10 apples to one of the bags, which will become is 16. Now, we have  apples. Then the remaining 4 bags must each contain 6 apples. Therefore, the number of apples in the 6 bags are 60, 16, 6, 6, 6, 6.

Perk Up challenge

Station 1

You will be given 5 quadrilaterals of the same size and same shape. Cut each of the quadrilaterals into 5 (five) pieces pattern the guidelines in each quadrilateral and use each set of 5 pieces to assemble each of the following geometric figures and paste it in the answer sheet.

(1) Greek cross

(2) square

(3) rhombus

(4) rectangle

and (5) right-angled triangle

Solution:

Perk Up Challenge Station 2

Fill in the integers 1 to 12 into the 12 triangles of the star-shaped polygon so that the sum of each group (or each row, consisting of 5 triangles) is 33.



Solution:

This problem is not simple. There is a total of 12! Ways to fill in integers 1 to 12 in the star-shaped polygon, one of which is shown in the figure below.



Perk Up Challenge Station 3

Cut a square piece of paper into 8 pieces, 4 of which are congruent triangles and other 4 pieces are congruent trapezoid. Assemble a rectangle and a square whose area are equal. Use these 8 pieces to assemble a rectangle and a square of equal area.

Cut a square piece of paper into 8 pieces, resulting to 4 congruent triangles and 4 congruent trapezoids. Use these 8 pieces to form a rectangle and a square of equal area.

Solution:



Perk Up Challenge Station 4

Place two identical checkers in a  grid (where each grid is a  square) such that each grid can have only 1 checker. How many ways of arranging these two identical checkers in the  grid? (Note: If two arrangement can coincide when doing by rotation, then they will be consider as only one arrangement)

Place two identical checkers in a  grid (where each grid is a  square) such that each grid can have only 1 checker. How many ways can these two identical checkers in the  grid be arranged? (Note: If two arrangements coincide when they are rotated, then they will be considered as only one arrangement)

Solution:

Since we can't quickly find the easiest calculation method, we can enumerate it by pattern. After putting two pieces of checkers, the rectangle of the two checkers will be named. If there are several different rectangles, there will be several ways to put them. Then we classify the items according to the rectangular place of the pieces.  
There are 3 different arrangements for 2 checkers occupied in a 1 × 2 grid, this also include 2 × 1 grid, that is; commutative law!

There are 2 different arrangements for 2 checkers occupied in a 1 × 3 grid.

There are 2 different arrangements for 2 checkers occupied in a 2 × 2 grid.

There are 2 different arrangements for 2 checkers occupied in a 2 × 3 grid.

There is only 1 arrangement for 2 checkers occupied in a 3 × 3 grid.

Perk Up Challenge Station 5

Arrange *n* identical square pieces of paper on a piece of white paper such that the arrangement of these *n* pieces must be without overlapping, they must form a pattern consisting of at least two layers of rectangular rectangles (including squares), and each upper square piece of paper must have two vertices in each of their lower layer of square paper is on the midpoint of one side. All of the different arrangement of  are given below.

Arrange *n* identical square pieces of paper without overlapping them on a sheet of white paper to form a pattern consisting of at least two layers of rectangular rectangles (including squares). And each upper square piece of paper which must have two vertices in each of their lower layers of square paper is on the midpoint of one side. All of the different arrangements of  are given below.

Give the different ways of arranging when  by illustration.

Solution:

Perk Up Challenge Station 6

The instructions of this station puzzle are simple. Fill the grids so that each cell contains a digit. A bold outlined group of two cells contains the digits 1 and 2, a group of three cells contains the digits 1, 2 and 3, and so on. The other rule is that no two adjacent cells including diagonal ones can contain the same number.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2 |  |  |  |  | 1 |  |  |
|  |  |  | 3 |  |  |  | 5 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| 1 |  | 2 |  | 4 |  | 5 |  |
|  |  |  |  |  |  |  |  |
| 4 | 1 |  | 5 |  | 1 |  |  |
|  |  |  | 1 |  |  |  |  |

Solution:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 2 | 1 | 5 | 1 | 4 | 1 | 3 | 4 |
| 4 | 3 | 4 | 3 | 2 | 5 | 2 | 5 |
| 5 | 1 | 2 | 5 | 4 | 1 | 3 | 1 |
| 4 | 3 | 4 | 1 | 3 | 2 | 4 | 2 |
| 1 | 5 | 2 | 5 | 4 | 1 | 5 | 3 |
| 2 | 3 | 4 | 3 | 2 | 3 | 2 | 1 |
| 4 | 1 | 2 | 5 | 4 | 1 | 5 | 3 |
| 2 | 5 | 3 | 1 | 2 | 3 | 2 | 1 |

Solution: