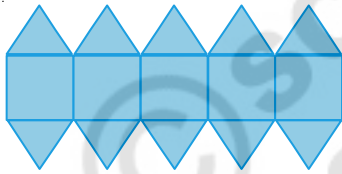
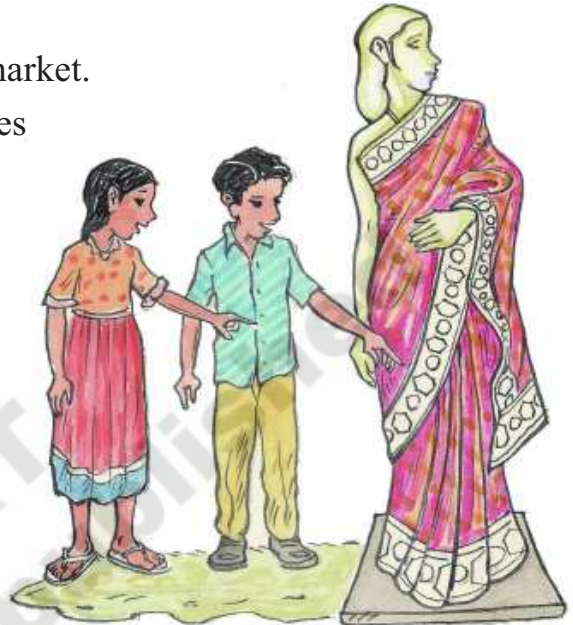


One day, Sharada and Srikar went to the market. They saw some sarees in a shop. The sarees had beautiful borders with lovely patterns!!

Look at some of the patterns in the borders.

In this pattern  is repeating itself continuously.






Here  this and  are repeating alternately.



### Do This

1. Extend the border patterns given below and state the rule for each.



Now make more patterns using these shapes- ,  and . You can use one, two or all three shapes in one pattern.

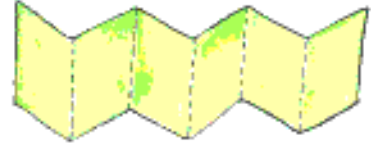
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## Activity

### Paper chains

Take a long thin strip of paper.

Fold it like a fan.



Draw a doll on the folded paper like shown.

Cut along the dark lines. Now open it and observe.



Try to make paper chains using other figures.

### Patterns that rotate and repeat

Now let us learn about some other types of patterns.

Extend the patterns given below and also write the rule. .



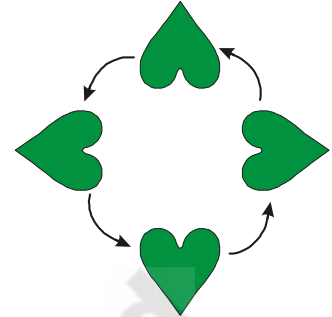
### Do This

1. Now make two more patterns using the same block.

Now look at this pattern-



How will you extend this pattern? If you see carefully, you will find that the leaves turn by an equal amount till they complete a circle. Look at this picture and understand the movement of leaves better. Each turn is  $\frac{1}{4}$  part of the entire circular rotation.



Look at the leaves in this pattern they are repeatedly taking  $\frac{1}{2}$  turns.



Now carry forward this pattern and identify the turn that is being taken. What is the difference between this pattern and the pattern given right about it?



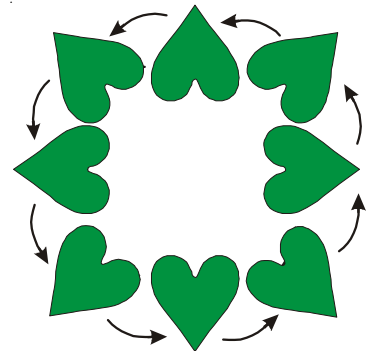
Look at this pattern



Here the leaf is repeatedly making less than  $\frac{1}{4}$  turn.

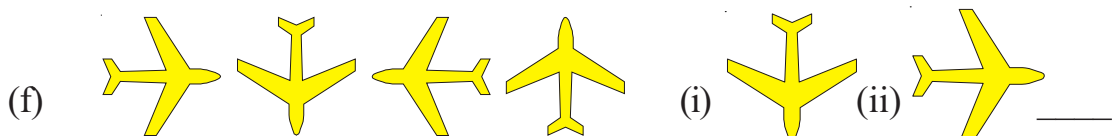
Look at the picture and understand the movement of leaves better.

Each turn is  $\frac{1}{8}$  part of the entire circular rotation.



## Do This

1. Look at the patterns given below. Tick the block that will come next and identify the turns that are being taken in each case?





## Number Patterns

Some patterns follow number rules. See how the number of match sticks keeps increasing by one.



Draw the next figure in the pattern. Write the pattern in numbers. 3, 4 \_\_\_\_\_

Sharada drew two more patterns.



Sharada is adding two leaves each time.



We can write Sharada's patterns like this:

(a) 2       $2+2=4$      $4+2=6$     $6+2=8$       .....

(b) 1       $1+2=3$      $3+2=5$     $5+2=7$       .....

So these series of numbers make a pattern and can be extended based on their rule.

### Do This

1. Look carefully at given number series.

5      10      15      20      25      ..

### Who is right?

The rule is to multiply 1, 2, 3 ... by 5



The rule is to add 5 to the number before.



2. Can you complete the given series in both directions?

(a) \_\_\_\_\_ 125 130 135 \_\_\_\_\_

(b) \_\_\_\_\_ 30 40 50 \_\_\_\_\_

(c) \_\_\_\_\_ 120 110 \_\_\_\_\_ 70 \_\_\_\_\_

(d) \_\_\_\_\_ 600 700 \_\_\_\_\_

3. Carry forward the pattern and make one more pattern based on the rule.

(a) 40, 35, 30, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(b) 11, 16, 21, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(c) 15, 30, 45, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(d) 33, 36, 39, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(e) 1, 5, 9, 13, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(f) 82, 76, 70, 64, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

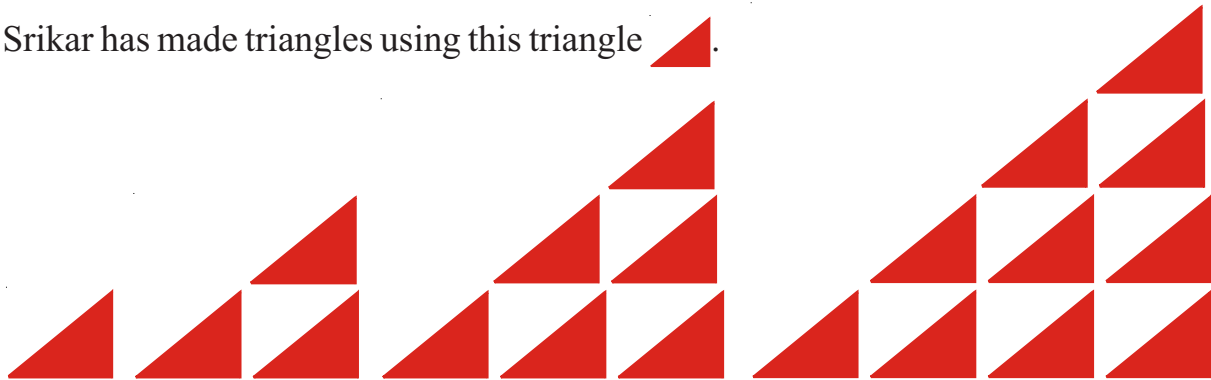
(g) 91, 84, 77, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(h) 123, 112, 101, 90, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Srikar has made triangles using this triangle .



We can write the rule as a series of numbers like this.

$$1 \quad 1 + 2 = 3 \quad 1 + 2 + 3 = 6 \quad 1 + 2 + 3 + 4 = 10$$

(a) Write the next numbers that will come in this sequence. \_\_\_\_\_

We added consecutive numbers to get a triangle shape. Suppose we added only odd numbers-

$$1$$

$$1 + 3 = 4$$

$$1 + 3 + 5 = 9$$

$$1 + 3 + 5 + 7 = 16$$

Srikar tried to arrange these numbers using dots. This what he got-



Sharada realized that she could write the rule of the number pattern 1, 4, 9, 16 as

$$1 = 1 \times 1$$

$$4 = 2 \times 2$$

$$9 = 3 \times 3$$

$$16 = 4 \times 4$$

(b) Write the next 3 numbers in the series given above. \_\_\_\_\_



### Tricks with your age

- (a) Ask your friend- "Write down your age. Add 5 to it. Multiply the sum by 2. Subtract 10 from it. Next divide it by 2. What do you get?"

Is your friend surprised?

- (b) Write you age \_\_\_\_\_

Multiply it by 7 \_\_\_\_\_

Again multiply the answer by 13 \_\_\_\_\_

Multiply again that answer by 11 \_\_\_\_\_

Now look at your last answer. Can you find your age in that answer? How many times does your age show in the answer?

Now try these tricks with other people.

### Some more tricks

- (c) Take a number

Double it

Multiply by 5

Divide your answer by 10.

Why do you think this is the case?

- (d) Take a number

Double it

Again double it

Add the number you took first to the answer

Now again double it

Divide by 10

Why do you think this is the case?

(e) Now take a two digit number, such that both digits are different, say- 27

Now reverse the digits 72

Subtract the smaller number from the bigger number  $72 - 27 = 45$

Is the number a multiple of 9 ?

Now reverse the digits of the difference = 54

Add these two numbers  $45 + 54 = 99$

Is the number divisible by 11 ?

Try with many more two digits numbers and see if the above is true.

**Srikar was learning the nine's table.**

$$9 \times 1 = 09$$

$$9 \times 2 = 18$$

$$9 \times 3 = 27$$

$$9 \times 4 = 36$$

$$9 \times 5 = 45$$

The digit in unit place  
is decreasing by 1.

The digit in 10's place  
is increasing by 1.



Is Sharada right? Check.

$$9 \times 6 = 54 \quad 9 \times 7 = 63 \quad 9 \times 8 = 72 \quad 9 \times 9 = 81 \quad 9 \times 10 = 90$$

Srikar: What about  $9 \times 11 = 99$  ? I don't think it follows your rule.

Help Sharada think of a rule that is followed by all multiples of 9.

Suppose we add individual digits of the multiples of 9.

$$18 \quad 1+8 = 9$$

$$27 \quad 2+7 = 9$$

$$36 \quad 3+6 = 9$$

$$45 \quad 4+5 = 9$$

Rule : We get 9 on adding the individual digits of the multiples of 9.

Check the addition rule for other multiples of 9.

$$9 \times 6 = 54$$

$$9 \times 7 = 63$$

$$9 \times 8 = 72 \dots\dots\dots$$

What happens when we come to  $9 \times 11 = 99$  ? This time the rule does not break.

$$9 + 9 = 18$$

$$1 + 8 = 9$$

## Do This

1. Circle the numbers that are multiples of 9.

243 889 556 666 775 432 360 621 988 927

2. Write a three digit number that is a multiple of 9.
3. Write a four digit number that is a multiple of 9.
4. Write a five digit number that is a multiple of 9.

### Magic squares

Look at the given grid.

- (a) Add the numbers in the first row. We get  $8+1+6 = \underline{\quad}$ .

- (b) Add the numbers in the last row. We get  $\underline{\quad}$ .

- (c) Add the numbers in the middle column. We get  $\underline{\quad}$ .

- (d) Add the numbers on the diagonal. We get  $6+5+4 = 15$ .

6	1	8
7	5	3
2	9	4

This special number grid is called a magic square.

1. Fill the grid with numbers between 11 and 19.

Each number should come once.

The total of each line should be 45.

	11	
		13
12		14

2. Fill the grid with numbers between 21 and 29.

Each number should come once.

The total of each line should be 75.

	21	
	29	

3. Fill the grid with numbers between 41 and 49.  
Each number should come once.  
The total of each line should be 135.

46		
	45	43
		44

4. Now look at all the 4 magic squares you have made so far and answer the following :
- Write the 4 numbers that were in the centre of each magic square.
  - The sum of each line in first magic square is  $15 = 3 \times$  \_\_\_\_\_
  - The sum of each line in second magic square is  $3 \times$  \_\_\_\_\_
  - The sum of each line in third magic square is  $3 \times$  \_\_\_\_\_
  - The sum of each line in fourth magic square is  $3 \times$  \_\_\_\_\_

### Try This

- Complete the given magic square by filling numbers between 121 and 129. The sum of the numbers in each line should be 375.
- Try to make a magic square using numbers between 26 and 34.

128		124
	127	

### Do This

- Carry forward the pattern and make one more pattern based on the rule.
  - 8, 16, 24, 32, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
 Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(b) 45, 54, 63, 72, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(c) 49, 56, 63, 70, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(d) 3, 6, 10, 15, 49 \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(e) 16, 25, 36, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(f) 3, 15, 75, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(g) 10, 40, 160 \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(h) 7, 21, 63 \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(i) 6, 12, 24 \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(j) 16, 8, 4, 2 \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(k) 125, 25, 5 \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

(l) 150, 30, 6 \_\_\_\_\_

Your pattern \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_