

# Recreational Activities as an Integral Part of Innovative Mathematical Pedagogy

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## ABSTRACT

As mathematics teachers we know this fact that students of all the levels feel anxiety while learning mathematics. This may be because of our conventional way of teaching and following traditional pedagogy of teaching mathematics. That's why, when student does not understand any topic, step, formula, he starts cramming or memorizing facts. We need such innovative pedagogy which will focus on students' centred strategies, interesting activities of teaching mathematics. Innovative pedagogical approach indicates towards imbining recreational activities which will help in enhancing student participation while learning mathematical facts, such mathematical activities which will motivate students in learning collaboratively and in enjoyable way. This paper is an attempt to introduce such recreational activities in mathematics which are an integral part of innovative pedagogy through years and which can give U turn of conventional mathematical teaching to innovative activity based enjoyable mathematics learning.

**Ke words:** Recreational activities in Mathematics, List of Recreational activities, Innovative pedagogy, Recreational Mathematics

## 1. INTRODUCTION ABOUT RECREATIONAL ACTIVITIES

Recreational means to create something new or modified already done, in a new way. It can be new instructional material, it can be a new activity, it can be a modified method, it can be new strategies, new games to a related field in which students, teachers can participate for learning, sharing and to feel satisfaction of creating "something new and meaningful."

According to Wilson, "Recreation is concerned with those activities in which a person participates during hours other than work. It implies that the individual has chosen certain activities in which he is voluntarily engaged because of an inner self motivating desire."

For a recreational program or activity should be effective and to benefit the individual or participant to the fullest it must have the following characteristics:

### 1.1 Leisure Time

Proper utilisation of free time by engaging students in some math game, puzzle, creating scrapbook or interactive booklet.....so that math concepts can be learnt in detail and in creative way.

### 1.2 Enjoyable

Recreational activities should be enjoyable for the learners as well as for the teachers.

### 1.3 Self-satisfaction

When the students play math games or sort out puzzles, riddles, any creative assignment, it provides them sense of satisfaction of completing work or sorting out problem. It enhances their confidence.

### 1.4 Voluntary Participation

It enhances the leadership qualities among students to complete work or sort out problems in groups.... communication skills, sharing ideas, how to present the content in creative way, analytical skills, reasoning skills and motivates students to participate willingly and to lead the group.

### 1.5 Constructive approach

To present ideas, traditionally written content in creative way needs constructive approach. To understand and represent ideas in creative way means first to relate the content with real life surroundings.

## 2. WHAT IS INNOVATIVE PEDAGOGY?

Pedagogy is any that method or activity by using which, teachers can teach effectively and students can learn concepts interestingly and willingly. The creative ways of teaching along with an exploration of how the process of teaching is impacted is known as innovation.

Innovative Pedagogy in mathematics is the process of introducing new teaching strategies and methods, resources, activities into the classroom for improving students' performance in mathematics and by which students can be able to connect mathematics knowledge with real life.

## 3. RECREATIONAL ACTIVITIES IN MATHEMATICS

The study of mathematics and the development of diverse problem-solving skills, as well as the growth of imaginative and analytical thinking, are greatly aided by recreational activities. Recreational mathematics is now widely acknowledged to have pedagogical value, which benefits math students by reducing their anxiety for the subject and turning them into math lovers.

Recreational mathematics means when mathematical facts are carried out for enjoyment, creating in new way rather than as a strictly research and conventional mathematics activity or formal education. To think and implement Recreational activities in field of mathematics is the need of time. It includes any form of free time activity in which students and teachers want to participate willingly because of the enjoyment and satisfaction in creating some new idea of understanding, exploring and delivering mathematical concepts.

It can be thought of recreating teaching learning material by multidisciplinary approach of imbibing art skills, math skills, music skills, analytical skills, constructivism approach, co-operative learning approach of students and teachers. list of trending recreational activities in mathematics for imparting mathematical concepts in creative way to students, for engaging students actively. Recreational activities in mathematics are Math Games. Magic squares, Math puzzles, Math riddles, creating scrapbook, Interactive workbooks, Interactive worksheets.....few of these are included in this paper for making mathematics enjoyable:

### 3.1 MATH GAMES

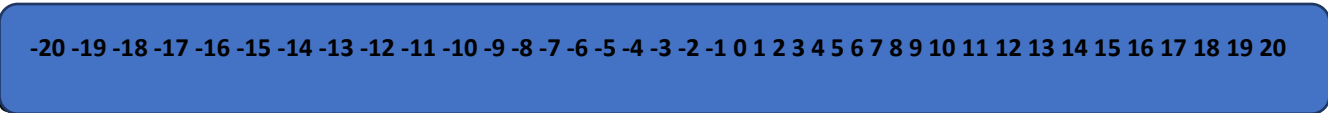
When it comes to math, games can provide the key of arising interest and unlocking a student’s true abilities. Teachers use math games to help students understanding many of the concepts in mathematics in enjoyable way.

Math game is a game whose rules, strategies and outcomes are defined by clear mathematical parameters. Math games provide a structure and process for children to engage in problem solving in order to reach a particular goal or objective. It can be played individually or in groups. In NCERT books of mathematics, many games are there at primary, elementary, secondary level for arising students interest in mathematics as....

**3.1.1 GAME 1....GAME ON INTEGERS**

First teacher will tell the instructions of playing the games....at a time two students can participate and will use two dices, one having 3 +sign and 3- signs, other will be simple number dice from 1 to 6. The number strip from -20 to 20is required.

The player who will get the sum near +20 or -20 will be the winner.



PLAYER ANKIT: Both dices will be thrown simultaneously....for example he gets +6.....then he will move 6places in right direction

PLAYER SANYOG: Throw both dices sign die and number die simultaneously and for example he will get – and 4 on other dice...then he have to move -4 in left direction.

The game will carry on till one get count of +20 or -20 or nearby it will be a winner.

**3.1.2 GAME 2.....PRIME NUMBERS**

**SIEVE OF ERATOSTHENES** is a game to find prime numbers 1 to 100 without checking the factors given by mathematician ERATOSTHENES in 3<sup>rd</sup> century.

**Step1: write all numbers from 1 to 100 in the following way....**

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

**Step 2...** keep 1 out of game as it is neither prime nor composite.

**Step3 ....** encircle 2 and say students to mark cross sign on all multiples of 2 as 4,6,8,10.....100

1	2	3	4 <del>x</del>	5	6 <del>x</del>	7	8 <del>x</del>	9	10 <del>x</del>
11	12 <del>x</del>	13	14 <del>x</del>	15	16 <del>x</del>	17	18 <del>x</del>	19	20 <del>x</del>
21	22 <del>x</del>	23	24 <del>x</del>	25	26 <del>x</del>	27	28 <del>x</del>	29	30 <del>x</del>
31	32 <del>x</del>	33	34 <del>x</del>	35	36 <del>x</del>	37	38 <del>x</del>	39	40 <del>x</del>
41	42 <del>x</del>	43	44 <del>x</del>	45	46 <del>x</del>	47	48 <del>x</del>	49	50 <del>x</del>
51	52 <del>x</del>	53	54 <del>x</del>	55	56 <del>x</del>	57	58 <del>x</del>	59	60 <del>x</del>
61	62 <del>x</del>	63	64 <del>x</del>	65	66 <del>x</del>	67	68 <del>x</del>	69	70 <del>x</del>
71	72 <del>x</del>	73	74 <del>x</del>	75	76 <del>x</del>	77	78 <del>x</del>	79	80 <del>x</del>
81	82 <del>x</del>	83	84 <del>x</del>	85	86 <del>x</del>	87	88 <del>x</del>	89	90 <del>x</del>
91	92 <del>x</del>	93	94 <del>x</del>	95	96 <del>x</del>	97	98 <del>x</del>	99	100 <del>x</del>

**Step4...** now encircle 3 and mark cross on all multiples of 3...what we will get

1	2	3	4 <del>x</del>	5	6 <del>x</del>	7	8 <del>x</del>	9 <del>x</del>	10 <del>x</del>
11	12 <del>x</del>	13	14 <del>x</del>	15 <del>x</del>	16 <del>x</del>	17	18 <del>x</del>	19	20 <del>x</del>
21 <del>x</del>	22 <del>x</del>	23	24 <del>x</del>	25	26 <del>x</del>	27 <del>x</del>	28 <del>x</del>	29	30 <del>x</del>
31	32 <del>x</del>	33 <del>x</del>	34 <del>x</del>	35	36 <del>x</del>	37	38 <del>x</del>	39 <del>x</del>	40 <del>x</del>
41	42 <del>x</del>	43	44 <del>x</del>	45 <del>x</del>	46 <del>x</del>	47	48 <del>x</del>	49	50 <del>x</del>
51 <del>x</del>	52 <del>x</del>	53	54 <del>x</del>	55	56 <del>x</del>	57 <del>x</del>	58 <del>x</del>	59	60 <del>x</del>
61	62 <del>x</del>	63 <del>x</del>	64 <del>x</del>	65	66 <del>x</del>	67	68 <del>x</del>	69 <del>x</del>	70 <del>x</del>
71	72 <del>x</del>	73	74 <del>x</del>	75 <del>x</del>	76 <del>x</del>	77	78 <del>x</del>	79	80 <del>x</del>
81 <del>x</del>	82 <del>x</del>	83	84 <del>x</del>	85	86 <del>x</del>	87 <del>x</del>	88 <del>x</del>	89	90 <del>x</del>
91	92 <del>x</del>	93 <del>x</del>	94 <del>x</del>	95	96 <del>x</del>	97	98 <del>x</del>	99 <del>x</del>	100 <del>x</del>

**Step5**....now encircle 5 , 7 and cross their multiples respectively....

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
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81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

**Step6**...write down all encircled and those numbers without cross sign

2,3,5,7,11,13,17,19,23,29,31,37,41,43,47,53,59,61,67,71,73,79,83,89,97 =25 prime numbers

### 3.2 MAGIC SQUARES

Magic square is an ordered squared arrangement of positive integers in rows and columns in such a way that row wise sum, column wise sum, diagonal wise sum will be same.

2	7	6
9	5	1
4	3	8

= 15
= 15
= 15

= 15
15
15

The sum of magic square is known as magic constant. Here the magic constant is 15. Order of a magic square means number of positive integers row wise and column wise.....as in the above given square n=3, so order is 3x3.

If a magic square has repeated integers then that is known as trivial and a magic square whose row wise, column wise sum is equal but diagonal wise sum or magic constant is not equal are known as semi magic squares. Parkar square is semi magic square consisting entries of perfect squares created by Matt Parkarin 2016

29x29	1x1	47x47
41x41	37x37	1x1
23x23	41x41	29x29

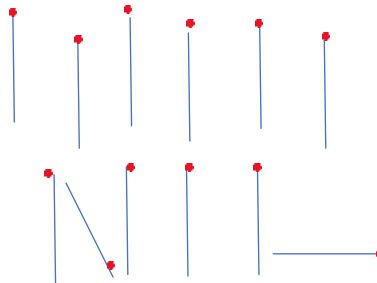
3051
3051
3051
4107
33051
3051=3

row wise magic constant is...3051, column wise magic constant is 3051, sum of entries of one diagonal  $29 \times 29 + 37 \times 37 + 29 \times 29 = 3051$ , but sum of other diagonal  $23 \times 23 + 37 \times 37 + 47 \times 47 = 4107$ .....so, Parkarmagic square is an example of trivial semi magic square.

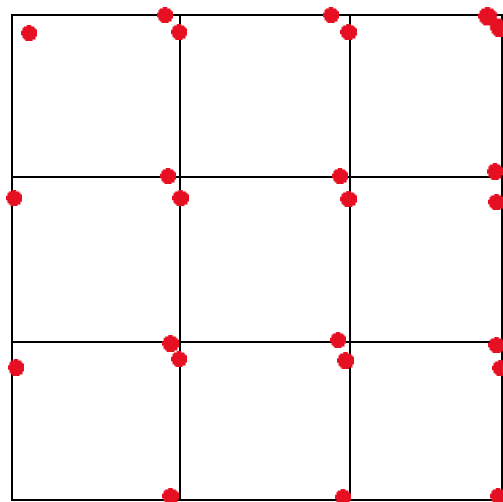
### 3.3 MATH PUZZLES

Mathematical puzzles are an important part of recreational activities. Puzzles follow specific rules but focused on solution individually, don't emphasize generally on competition between two or more players. In solving a puzzle, student feel satisfaction of finding the solution. Initially conditions of sorting out puzzles are set, then following the rules, individual make subsequent changes and moves to find solution. Mathematics puzzles develops strategic thinking in learners.

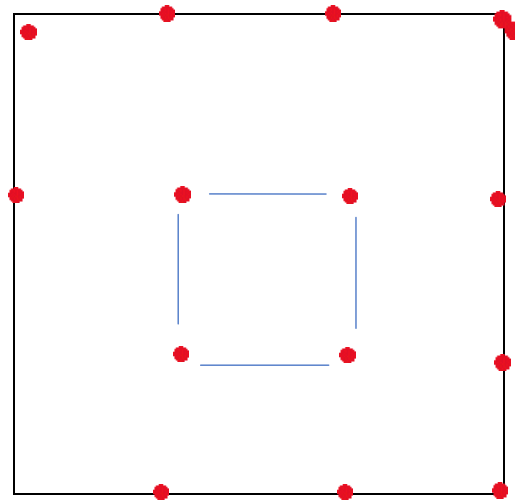
**PUZZLE 1**..... We can arrange 6 match sticks in such a way that it can create a word means nothing. we can move as many sticks as we want or condition may be move only two sticks to find solution.



**PUZZLE 2**.....THIS IS 3X3 SQUARE MADE UP OF 24 MATCH STICKS, BY REMOVING 8 MATCHSTICKS, WE CAN HAVE JUST TWO SQUARES.

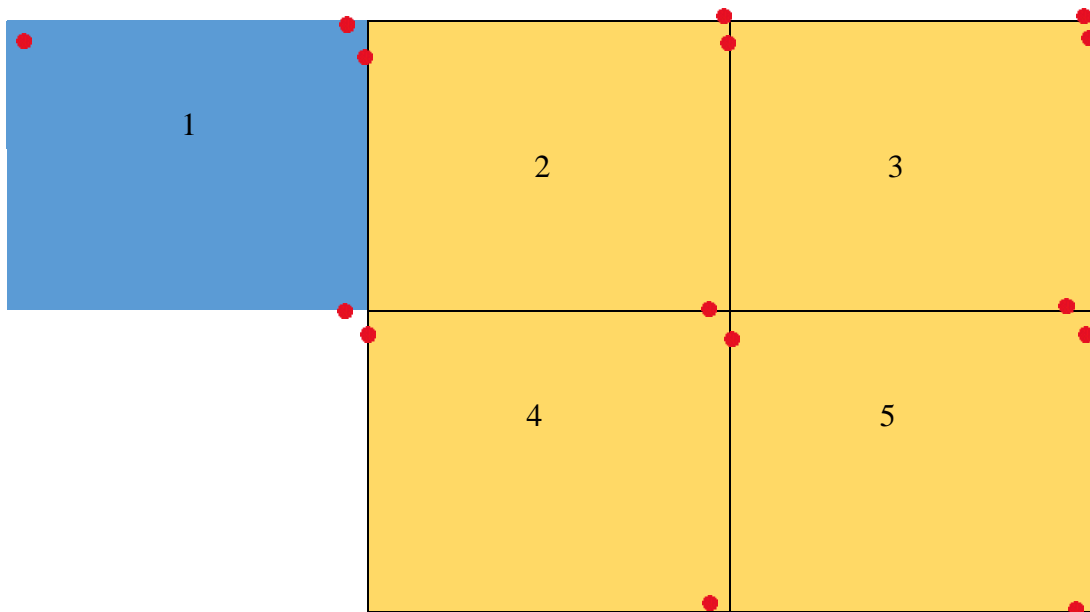


Solution:

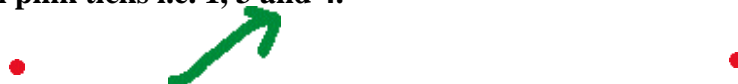


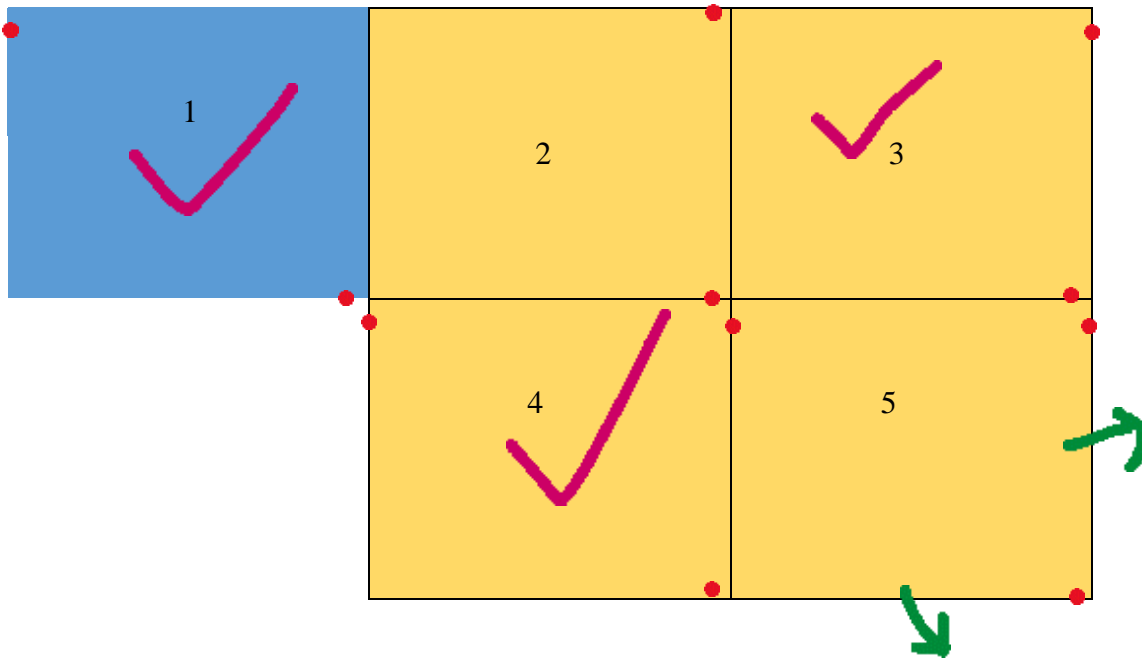
**PUZZLE 3.....NOW WE HAVE 5SMALL SQUARES AND ONE LARGER SQUARE.**

IS IT POSSIBLE TO TAKE AWAY 3 MATCH STICKS AWAY AND HAVE 3 SQUARES ONLY?



**SOLUTION.....After removing the 3 match sticks marked by green arrow we will be left with 3 squares highlighted with pink ticks i.e. 1, 3 and 4.**





### 3.4 MATH RIDDLES:

A riddle is a statement, question or phrase having a hidden meaning, put forth as a puzzle to be solved. For a child to be Mentally Active is also important as being Physically Active. Riddles are the better way to give our brain an exercise in the funniest way. Most of the students are afraid from doing Mathematics and take it most difficult. To test the student's math knowledge with fun is the smartest approach of math riddles.

By using such type of fun strategies while approaching the subject help both parents and teachers to inculcate some interest among learners. Students can easily crack these riddles if they pay some concentration, apply critical thinking, and logical reasoning. As this activity is student centred, fun giving and develops critical thinking and attentiveness of students, so this is an integral part of recreational activities and innovative math pedagogy. Here are some easiest math riddles for students which can be sorted out in few minutes.....

3.4.1 How we can make the number 7 even without addition, subtraction, multiplication, or division?.....(**drop "s" from seven**)

3.4.2 A family has five sons, and each of them has a sister. How many kids does this family have in total?  
(**1 sister**)

3.4.3 When I add five to nine, then I get two. The answer is correct but how?  
(**2pm**)



3.4.4 Three times of which number will not be larger than two times of that same number?

(0)

3.4.5 I am a number, but when you add the letter G to me, I go away. What number am I?

(one)

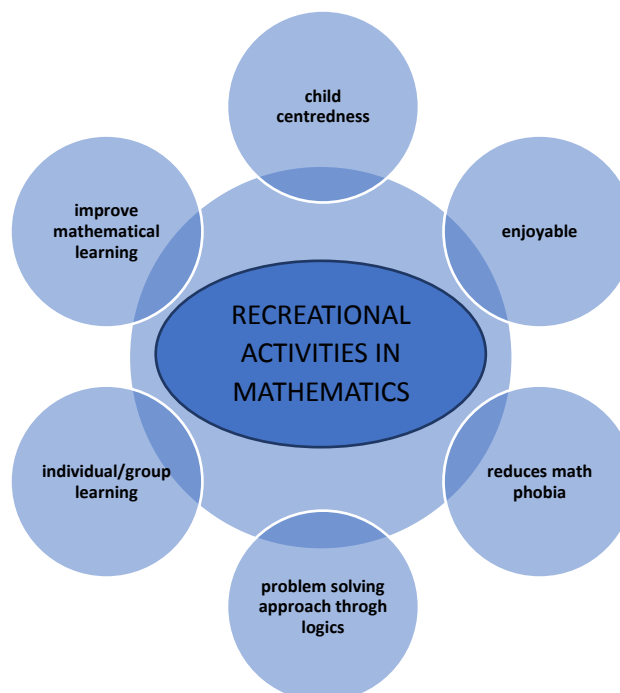
3.4.6 How do you go from 908 to 720 by using just one symbol?

(90x8)

#### 4. RECREATIONAL ACTIVITIES AS INTEGRAL PART OF INNOVATIVE PEDAGOGY:

Traditional teaching is text book oriented, delivering the mathematical concepts by chalk and talk method and it is expected that syllabus completion in prescribed time is mandatory whether the students are understanding the concepts or not. Students have to go with speed of teachers. but innovative pedagogy focusing on students, i.e we need to develop students centred content, we need to adopt student centred methods, we need to think over activities in which students can participate willingly, can get hands on experiences, can enjoy learning. Such learning style where student can devote hours without pressure of teachers and parents to the subject. Such assignments in mathematics which will help students in learning the concept in detail, to analyse how to complete creatively and critical thinking about exploring and representation of ideas.

Recreational activities in mathematics have student centeredness, ability of providing fun and hands on experiences to students, combination of analytical+logical thinking, to reduce the phobia of mathematical learning among students. That's why recreational activities in mathematics like games, puzzles and riddles, magic squares are integral part of innovative mathematics pedagogy.



## 5. CONCLUSION

In the educational curriculum, mathematics is a compulsory subject at school level. Mathematical curiosity among students can be highly influenced by recreational mathematics. This paper has reflected those recreational activities in mathematics as mathematical games, riddles, magic square, puzzle activities can help students more easily understand the fundamentals of studying mathematics. We should try to make mathematical concepts at school level so easy that their learning can be fun, it can be enjoyable for students. Innovative pedagogy's objectives of child centredness, creative thinking, flexible approach, enjoyable learning, can be achieved through above explained recreational activities in mathematics and similar activities which will help in creating an open-minded attitude of mathematics students and support in the development of their clear thinking and logical thinking with analytical skills.

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