Simple Patterns in Mathematics
Lesson Plan: Class 05 / IPP / 02

Overall goal of the lesson: Children will learn about mathematical activities, multiplication tables with patterns and about greatest common divisor (gcd).

Prior knowledge required: Knowledge of the basic mathematics (done in prior standards).

MODULE 1:
Module time: 30 minutes
Goal: To give a brief introduction to multiplication as repeated addition, some patterns with multiplication and gcd. Through this make the children understand different patterns in mathematics.
Description: Children will learn about multiplication as repeated addition, different patterns with multiplication tables, about gcd and computing gcd using different methods.

Material required:
Physical:
1. One copy of the worksheet (Lesson 2 - Simple Patterns in Mathematics) per child.
2. Writing material to solve the worksheet: pencil and eraser.

Electronic:
1. PPT Presentation for Lesson 2 – Simple Patterns in Mathematics

Procedure Summary:
1. Distribute the worksheets (Lesson 2 - Simple Patterns in Mathematics) to the children.
2. Read through the worksheet and discuss with the class the importance of understanding the mathematical activities using patterns.

Procedure Details:
1. Start the class by talking to the children about the topics getting covered in this class which are multiplication as repeated addition, multiplication patterns, about gcd and computing the gcd of two numbers using different methods.
2. Ask children about did they know that multiplication is repeated addition.
3. Explain them that adding the same number over and over again is same as multiplication.
4. Give them an example, refer slide 4 from the PPT.
5. The picture in the slide shows that there are 2 cats in each group and there are 4 groups.
6. Now find out totally how many cats are there we can add each group 4 times as there are 4 groups which is 2+2+2+2
7. Note that 2 is repeatedly added 4 times to get the result as 8.
8. If we see this as multiplication then it will be 4x2=8
9. Now tell the children that there are lot of patterns in multiplication activity and lets look at couple of them.
10. Refer the slide 5 from PPT. Let's see the table for 5, ask the children to look at the table and ask them if they are noticing anything which looks common.
11. Hear them and then tell that whenever you multiply any number with 5, the product will always be either 5 or 0
12. Ask the children to look the table again and do they see something more accurately?
13. Well there is a pattern, whenever you multiply 5 with even number the product always ends with '0'
14. Whenever you multiply 5 with odd number the answer always ends with '5'
15. Explain this with the examples given in slide 6.
16. Now let's see another pattern. Take the table for 10. Very easy table to remember.
17. Are you observing a pattern with the table?

18. Yes there is a pattern which is, when 10 is multiplied with any number all you need to do is just add '0' in front of the number that is getting multiplied.
19. So if you understand the pattern then you can guess certain things accurately and do things fast.
20. Similarly let's see another pattern now with table 9. This is about writing the table for 9. Please refer slide 8.
21. You can write the table for 9 very easily with one pattern.
22. How do we do that?
    a. Write down 0 to 9 starting from 1st row till 10th row
    b. Now starting from 10th row, start writing 0 to 9
    c. Isn't this table for 9
23. Now ask the children to look at another interesting pattern of 9 table. Tell them the clue is when 9 is multiplied with any number the result is a tricky number!
24. Well guess what is tricky? Ask them have a closer look that there is a pattern...
25. Hear them out and tell them if you add the digits of the result, they add up to 9
26. Explain this using the examples given in slide 10
27. Ask the children to check with any other number as well.
28. So the patterns exist in many multiplication activities.
29. For table 11 also there is a pattern from row 1 till 9. And this pattern changes after the 10th row.
30. You can ask the children to write the table for 11 and ask them observe the pattern.
31. Now you can explain the importance of mathematical patterns.
    a. Patterns give a sense of order, which otherwise might look chaotic or messy.
    b. When you notice that things happen in a certain pattern - even something as usual as a bus always stopping at a certain bus stop at 10am - order is provided. You can give other examples as well like Sunday being a holiday for the school. And hear from children what other patterns that they see.
    c. Understanding mathematical patterns allows you to identify such patterns when they exist.
    d. You will not be able to gain the benefit of patterns unless you see them and notice.
    e. Mathematical pattern analysis is important for predictions(making guesses) based on logic.
32. Now lets move to understanding and computing the GCD.
33. GCD stands for Greatest Common Divisor. It is the largest common number that divides two numbers.
34. There are other names also for GCD which are Greatest Common Factor, Highest Common Factor, Highest Common Divisor.
35. Give an example of gcd(24,36) is 12 and gcd(20,30) is 10 and we will see how to compute this later.
36. If the two numbers are equal then gcd is that number itself. Example gcd(24,24)=24
37. Lets see how to compute GCD with factorization method.
38. Refer slide 14 and explain the procedure with an example of gcd(8,12)
    a. Step 1. write down all the factors which give you 8 when multiplied starting from 1
    b. 1x8, 2x4 which is **1,2,4,8**
    c. Step 2. write down all the factors which give you 12 when multiplied starting from 1
        i. 1x12, 2x6, 3x4 which is **1,2,3,4,6,12**
    d. Step 3 – take out the common numbers from Step 1 and 2
        i. 1, 2, 3, 4
    e. Step 4 – highest number from step 3 which is **4** is the GCD of 8 and 12
    f. So gcd(8,12)=4
39. The same can be repeated with another example of 24 and 36
40. Explain that GCD can be computed using different methods. One of the popular method is called as Euclidean Method.
41. GCD can be computed using Euclidean division method or Euclidean subtraction method. This can be done with multiplication or division.
42. With subtraction method all you need to know is the subtraction operation and you can find gcd. But this might take more number of steps for some numbers.
43. You can talk about mathematician Euclid who developed a subtraction method over 2000 years ago, and the only operation you need to apply is subtraction.
44. Lets take an example of gcd(24,40) and understand the procedure:

a. You begin with your original numbers, say 24 and 40, and subtract the smaller from the larger:
    i. 40 − 24 = 16
b. The two smallest numbers in this set are 24 and 16. Again, we subtract the smaller from the larger:
    i. 24 − 16 = 8
c. And again:
    i. 16 − 8 = 8
d. And again, until we get down to 0 for an answer:
    i. 8 − 8 = 0
e. Once we got to 0, the number we subtracted from itself (8) is our greatest common factor: 24 = 3 × 8 and 40 = 5 × 8

45. You can reinforce the method with another example gcd(351,221) by referring to slide 18
46. Now take the same example of gcd(351,221) and see how to compute using division method.
47. Tell the students that division is a process of repeated subtraction just like multiplication is repeated addition.
48. If one is comfortable with division, this can actually be done more efficiently by using the remainders of divisions instead of subtraction, all they need to do is keep dividing. In the first step the larger number is dividend and the divisor the smaller number. Then keep dividing using the last step's divisor and remainder till the remainder becomes 0. As follows:
    a. 351 ÷ 221 = 1 R 130 (R – Reminder)
    b. 221 ÷ 130 = 1 R 91
    c. 130 ÷ 91 = 1 R 39
    d. 91 ÷ 39 = 2 R 13
    e. 39 ÷ **13** = 3 R 0
49. In this procedure, it is the divisor when the remainder equals 0 that is our greatest common factor. Hence gcd(351,221)=13
50. Once again reinforce the method with another example gcd(12,34), please refer slide 20.
51. GCD helps in many real life applications and one of them is for solving the space/volume issues.
52. Please explain the real life application with the situation explained in slide 21.

Assessments: as in the work sheet

1. Write the table for 8, observe and write the pattern you see.

Tip 1 is like we saw for table 9, for 8 also we can write 0,1,2,3,4,5 starting from row 1 as the first digit and whenever you come across multiple of 4 then repeat that number one more time and continue with the next number. As a second digit start writing from 8 and skip count by 2 like 8,6,4,2,0. When you reach 0 start writing from 8 again. That would give the 8 table. You can write like this till wherever you want.

Another tip is when multiplied the result will always end up with 9 when the multiplier and the digits of product are added together. Example 1+8=9, 2+1+6=9, 3+2+4=9

8	1	8
8	2	16
8	3	24
8	4	32
8	5	**40**
8	6	**48**
8	7	56
8	8	64
8	9	72
8	10	**80**
8	11	**88**
8	12	96
8	13	104
8	14	112
8	15	**120**
8	16	**128**
8	17	136
8	18	144
8	19	152
8	20	**160**
8	21	**168**
8	22	176
8	23	184
8	24	192
8	25	**200**
8	26	**208**

1. Compute the gcd(8, 20) using the factorization method
2. Compute the gcd(36, 54) using the factorization method
3. Compute the gcd(16, 24) using the subtraction method
4. Compute the gcd(12,30) using the division method

Information Broadcast : Leant about mathematical activities, multiplication as repeated addition, multiplication tables with patterns and about greatest common divisor (gcd) and computing the gcd with different methods, real life application of gcd.