Based on GANITA PRAKASH New NCERT Textbook

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Mathematics

GANITA PRAKASH

For the Student of Class 6

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Contents

PATTERNS IN MATHEMATICS

What is Mathematics?

- Mathematics may be viewed as the search for patterns and for the explanations as to why those patterns exist.
- You will get a chance to see the creativity and artistry involved in discovering and understanding mathematical patterns.
- For example, the understanding of patterns in the motion of stars, planets, and their satellites led humankind to develop the theory of gravitation, allowing us to launch our own satellites and send rockets to the Moon and Mars; similarly, understanding patterns in genomes has helped in diagnosing and curing diseases.

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Q. 1. Can you think of other examples where mathematics helps us in our everyday lives?

Solution : Mathematics helps us in our everyday life very much, in which some examples are given below—

(1) In Shopping : When we buy goods at a shop, we have to calculate how much money we have to pay and how much we have to take.

(2) In Time Management : Mathematics is used to read clocks and keep track of time.

(3) Measurements and Sizes : Mathematics is used to measure the length, width and height of any object.

(4) In Sports : Keeping score while playing requires math for measuring distances and keeping records.

(5) In Accounts : We use maths to understand our pocket money and save money.

Q. 2. How has mathematics helped propel humanity forward? (You might think of examples involving: carrying out scientific experiments; running our economy and democracy; building bridges, houses or other complex structures; making TVs, mobile phones, computers, bicycles, trains, cars, planes, calendars, clocks, etc.)

Solution : Mathematics has helped to advance and inspire humanity in many important ways, some of which are as follows—

(1) Development of problem solving ability

(2) Development of science and technology

(3) Invention and innovations

(4) Financial management

(5) Contribution in the building of modern society

(6) Education and intellectual development.

Patterns in Numbers

- Number sequences are the most basic and among the most fascinating types of patterns that mathematician study.
- The branch of Mathematics that studies patterns in whole numbers is called number theory.
- Examples of Number sequences :

(a) 1, 2, 3, 4, 5, 6, ...	(Counting numbers)
(b) 1, 3, 5, 7, 9, 11	(Odd numbers)
(c) 2, 4, 6, 8, 10, ...	(Even numbers)
(d) 1, 3, 6, 10, 15, 21, 28, ...	(Triangular numbers)
(e) 1, 4, 9, 16, 25, 36, ...	(Square numbers)
(f) 1, 8, 27, 64, 125, ...	(Cubes)
(g) 1, 2, 3, 5, 8, 13, 21, ...	(Virahānka numbers)
(h) 1, 2, 4, 8, 16, 32, 64, ...	(Powers of 2)
(i) 1, 1, 1, 1, ...	(All 1's)

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Q. 1. Can you recognise the pattern in each of the sequences in Table 1?

(a) 1, 1, 1, 1, 1, 1, 1, ...	(All 1's)
(b) 1, 2, 3, 4, 5, 6, 7, ...	(Counting numbers)
(c) 1, 3, 5, 7, 9, 11, 13, ...	(Odd numbers)
(d) 2, 4, 6, 8, 10, 12, 14, ...	(Even numbers)
(e) 1, 3, 6, 10, 15, 21, 28, ...	(Triangular numbers)
(f) 1, 4, 9, 16, 25, 36, 49, ...	(Squares)
(g) 1, 8, 27, 64, 125, 216, ...	(Cubes)
(h) 1, 2, 3, 5, 8, 13, 21, ...	(Virahānka numbers)
(i) 1, 2, 4, 8, 16, 32, 64, ...	(Powers of 2)
(j) 1, 3, 9, 27, 81, 243, 729, ...	(Powers of 3)

Solution : (a) Repetition of number '1'.

(b) Counting numbers starting from 1 : 1, 1 + 1, 1 + 1 + 1, ...

(c) Odd numbers starting from 1 : 1, 1 + 2 = 3, 3 + 2 = 5, 5 + 2 = 7, ...

(d) Even numbers starting from 2 :

2, 2 + 2 = 4, 4 + 2 = 6, 6 + 2 = 8, 8 + 2 = 10, ...

(e) Triangular numbers :

$$1 = 1$$
$$1 + 2 = 3$$
$$3 + 3 = 6$$
$$6 + 4 = 10$$
$$..............$$
$$..............$$

(f) Square numbers (Squares of counting numbers) :

$$1^2 = 1 \times 1 = 1$$
$$2^2 = 2 \times 2 = 4$$
$$3^2 = 3 \times 3 = 9$$
$$4^2 = 4 \times 4 = 16$$
$$5^2 = 5 \times 5 = 25$$
$$...........................$$
$$...........................$$

(g) Cubes :

$$1^3 = 1 \times 1 \times 1 = 1$$
$$2^3 = 2 \times 2 \times 2 = 8$$
$$3^3 = 3 \times 3 \times 3 = 27$$
$$4^3 = 4 \times 4 \times 4 = 64$$
$$..............................$$
$$..............................$$

(h) Virahānka numbers (Sum of last two numbers) :

1, 2, 1 + 2 = 3, 2 + 3 = 5, 3 + 5 = 8, 5 + 8 = 13, ...

(i) Powers of 2 :

$$2^0 = 1, 2^1 = 2$$
$$2^2 = 2 \times 2 = 4$$
$$2^3 = 2 \times 2 \times 2 = 8$$
$$2^4 = 2 \times 2 \times 2 \times 2 = 16$$
$$..$$

(j) Powers of 3 :

$$3^0 = 1, 3^1 = 3$$
$$3^2 = 3 \times 3 = 9$$
$$3^3 = 3 \times 3 \times 3 = 27$$
$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$
$$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$$
$$3^6 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 729$$
$$...$$

Q. 2. Rewrite each sequence of Table 1 in your notebook, along with the next three numbers in each sequence! After each sequence, write in your own words what is the rule for forming the numbers in the sequence.

Solution : (a) 1, 1, 1, 1, 1, 1, 1, $\boxed{1}$, $\boxed{1}$, $\boxed{1}$, ...   (Repeat 1 three times)

(b) 1, 2, 3, 4, 5, 6, 7, $\boxed{8}$, $\boxed{9}$, $\boxed{10}$, ...   (Next three counting numbers)

(c) 1, 3, 5, 7, 9, 11, 13, $\boxed{15}$, $\boxed{17}$, $\boxed{19}$, ...   (Next three odd numbers)

(d) 2, 4, 6, 8, 10, 12, 14, $\boxed{16}$, $\boxed{18}$, $\boxed{20}$, ...   (Next three even numbers)

(e) 1, 3, 6, 10, 15, 21, 28, $\boxed{36}$, $\boxed{45}$, $\boxed{55}$, ...   (Next three triangular numbers)

(28 + 8 = 36, 36 + 9 = 45, 45 + 10 = 55)

(f) 1, 4, 9, 16, 25, 36, 49, $\boxed{64}$, $\boxed{81}$, $\boxed{100}$, ...   (Next three squares)

8 × 8 = 64, 9 × 9 = 81, 10 × 10 = 100

(g) 1, 8, 27, 64, 125, 216, $\boxed{343}$, $\boxed{512}$, $\boxed{729}$, ...   (Next three cubes)

7 × 7 × 7 = 343, 8 × 8 × 8 = 512, 9 × 9 × 9 = 729

(h) 1, 2, 3, 5, 8, 13, 21, $\boxed{34}$, $\boxed{55}$, $\boxed{89}$, ...   (Next virahānka numbers)

13 + 21 = 34, 21 + 34 = 55, 34 + 55 = 89

(i) 1, 2, 4, 8, 16, 32, 64, $\boxed{128}$, $\boxed{256}$, $\boxed{512}$, ...   (Next three powers of 2)

64 × 2 = 128, 128 × 2 = 256, 256 × 2 = 512

(j) 1, 3, 9, 27, 81, 243, 729, $\boxed{2187}$, $\boxed{6561}$, $\boxed{19683}$, ... (Next three powers of 3)

729 × 3 = 2187, 2187 × 3 = 6561, 6561 × 3 = 19683

Visualising Number Sequences

● Visualising number sequences using pictures can help to understand sequences and the relationships between them. For example—
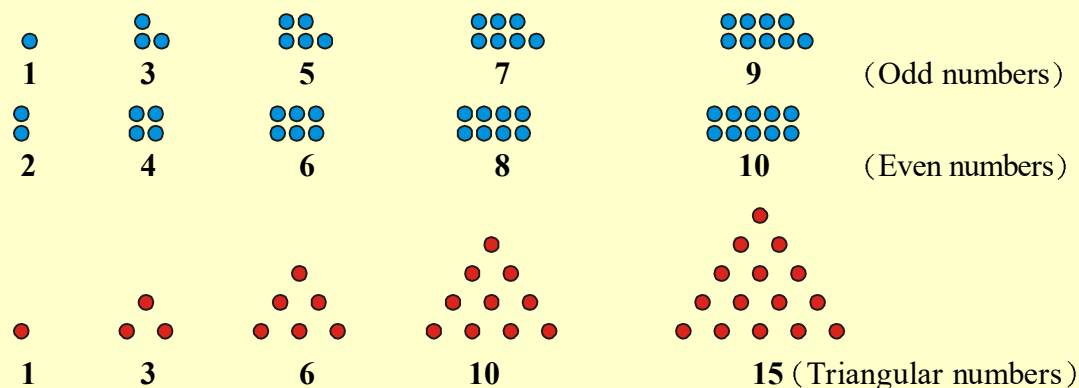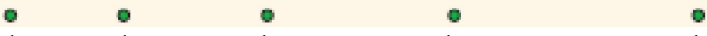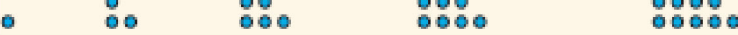

1   **3**   **5**   **7**   **9**   (Odd numbers)

2   **4**   **6**   **8**   **10**   (Even numbers)

1   **3**   **6**   **10**   **15** (Triangular numbers)
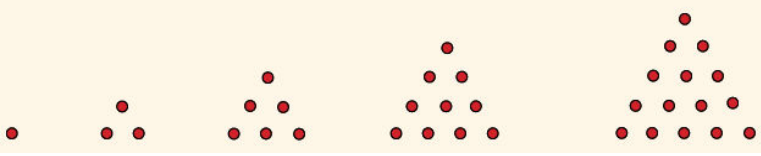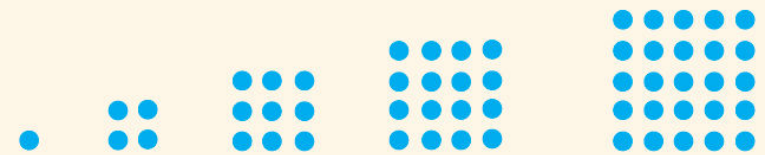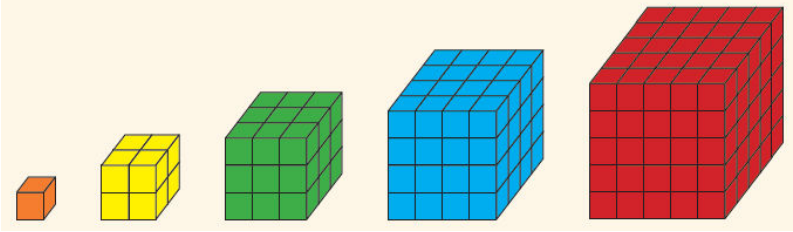
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Q. 1. Copy the pictorial representations of the number sequences in Table 2 in your notebook, and draw the next picture for each sequence!

Table 2—Pictorial representation of some number sequences

(a)
| 1 | 1 | 1 | 1 | 1 | (All 1's) |

(b)
| 1 | 2 | 3 | 4 | 5 | (Counting numbers) |

(c)
| 1 | 3 | 5 | 7 | 9 | (Odd numbers) |

(d)
| 2 | 4 | 6 | 8 | 10 | (Even numbers) |

(e)
| 1 | 3 | 6 | 10 | 15 | (Triangular numbers) |

(f)
| 1 | 4 | 9 | 16 | 25 | (Squares) |

(g)
| 1 | 8 | 27 | 64 | 125 | (Cubes) |

Solution : (a) 1   (b) 6   (c) 11   (d) 12