*** Choose The Right Answer From The Given Options.** [22]

1. Virahanka numbers are

(A) 1,3,6, 10, 15... (B) 1,2, 3, 5, 8... (C) 1, 8, 27, 64, 125... (D) 1, 7, 19, 37...

Ans. : (B) 1,2, 3, 5, 8...

2. If you start with the number 2 and keep adding 2, what sequence are you creating?

(A) Even numbers (B) Prime numbers (C) Odd numbers (D) Square numbers

Ans.: (A) Even numbers

3. Which of the following is a triangular number?

(A) 5 (B) 10 (C) 12 (D) 16

Ans. : (B) 10

4. What is the next number in the sequence 1, 4, 9,16...?

(A) 20 (B) 24 (C) 25 (D) 30

Ans. : (C) 25

5. How many sides does a hexagon have?

(A) 5 (B) 6 (C) 7 (D) 8

Ans. : (B) 6

6. How many sides does a pentagon have?

(A) 5 (B) 6 (C) 7 (D) 8

Ans.: (A) 5

7. _____ is both a triangular number and a square number.

(A) 25 (B) 36 (C) 8 (D) 4

Ans. : (B) 36

8. Hexagonal numbers are _____

(A) 1, 3, 6, 10... (B) 1, 4, 9, 16... (C) 1, 8, 27, 64 ..... (D) 1, 7, 19, 37...

Ans. : (D) 1, 7, 19, 37...

9. Triangular numbers are _____

(A) 1,3,6, 10... (B) 1,4,9,16... (C) 1,8, 27, 64, ... (D) 1, 7, 19, 37...

Ans.: (A) 1,3,6, 10...

10. Square numbers are

(A) 1,3,6, 10... (B) 1,4, 9, 16... (C) 1, 8, 27, 64 .... (D) 1, 7, 19, 37...

Ans. : (B) 1,4, 9, 16...

11. If you start with the number 1 and keep adding 2, what sequence are you creating?

(A) Even numbers (B) Prime numbers (C) Odd numbers (D) Square numbers

Ans. : (C) Odd numbers

12. The next term of the sequence 2, 3, 5, 7, ..., is

(A) 9 (B) 11 (C) 13 (D) 8

Ans. : (B) 11

13. The missing term in the sequence 1, 4, 16, 25,... is

(A) 9 (B) 10 (C) 15 (D) 36

Ans.: (A) 9

14. The sequence 1, 3, 6, 10, 15,... is called as

(A) Squares (B) Counting Numbers

(C) Triangular Numbers (D) Odd Numbers

Ans. : (C) Triangular Numbers

15. The even number sequence is

(A) 1, 2, 3, 4, 5,... , (B) 2, 4, 6, 8, 10,... (C) 1, 3, 5, 7, 9,... (D) 1, 4, 9, 16, 25,...

Ans. : (B) 2, 4, 6, 8, 10,...

16. What sequence do we get when we start adding up Odd numbers?

(A) Squares (B) Cubes

(C) Triangular Numbers (D) Even Numbers

Ans.: (A) Squares

17. The sequence 1, 7, 19, 37,... is called as

(A) Squares (B) Triangular Numbers

(C) Cubes (D) Hexagonal Numbers

Ans. : (D) Hexagonal Numbers

18. The sequence of cubes is

(A) 1,8,27,64,... (B) 1,4,9, 16,... (C) 2,4, 6, 8,... (D) 1,3, 5,7,...

Ans.: (A) 1,8,27,64,...

19. The missing term in the sequence 1, 3, 6,..., 15,... is

(A) 25 (B) 9 (C) 10 (D) 8

Ans. : (C) 10

20. The sum of first five odd numbers is

(A) 16 (B) 25 (C) 9 (D) 36

Ans. : (B) 25

21. Which of the following is an example of a shape sequence?

(A) Regular polygons

(B) Adding counting numbers up and down

(C) Adding odd numbers to get square number

(D) None of the above

Ans.: (A) Regular polygons

22. Which visual representation technique used to understand number sequence in mathematics?

(A) Tables (B) Graphs (C) Pictures (D) Equations

Ans. : (C) Pictures

*** a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.** **[2]**

23. **Assertion (A)** The sequence 1, 3, 6,10, ... is called Triangular Numbers.
Reason (R) The sequence 1, 4, 9, 16,... is called squares.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Ans. : (B) Both A and R are true but R is not the correct explanation of A.

24. **Assertion (A)** The next term in the sequence 2, 3, 5, 7, ... is 11.
Reason (R) Prime numbers have two factors, which are 1 and itself.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

Ans.: (A) Both A and R are true and R is the correct explanation of A.

*** State Whether The Following Sentences Are True Or False.** **[7]**

25. The sequence 1, 2, 3, 4, 5, 6, ... is called counting numbers.

Ans. : True

26. The next term in the sequence 1, 2, 4, 8, ... is 32.

Ans. : False

27. The sequence 1, 2, 3, 5, 8, 13, ... is called Virahanka Numbers.

Ans. : True

28. The missing term in the sequence 1, 3, 9, ..., 81, 243, 729, ... is 16.

Ans. : False

29. The sequence 1, 8, 27, 64, ... is an example of square of numbers.

Ans. : False

30. A shape sequence starting with a triangle and adding one side each time would form polygons with increasing number Of sides.

Ans. : True

31. The number 36 can be both a square number and a triangular number.

Ans. : True

*** Fill In The Blanks With Correct Alternative.** **[6]**

32. The next term in the sequence 0, 1, 1, 2, 3, 5, ... is _____

Ans. : 8

33. The missing term in the sequence 1, 10, ..., 1000, 10000, ..., is _____ .

Ans. : 100

34. The missing term in the sequence 3, 6, 9, ..., 15, ... is _____ .

Ans. : 12

35. A _____ polygon is a shape with all sides and angles equal.

Ans. : regular

36. The squares 1, 4, 9, 16, ... represents the _____ of numbers.

Ans. : Square

37. The pattern 1, 3, 5, 7, 9, ... is a sequence of _____ numbers.

Ans. : Odd

*** Answer The Following Questions In One Sentence.[1 Marks Each]** **[5]**

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

Ans. : Mathematics helps us in managing money, preparing food, figuring out distance, time and cost of travel, baking, home decorating etc.

39. 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.)

Ans. : Mathematics is an essential part of our life and helps us to understand the world in different way. It teaches us to analyse data, identify patterns and develop creative solutions to complex problems. These skills are essential in today's fast

paced, data driven world and are highly valued in many industries, including finances, healthcare and technology.

40. By imagining a large version of your picture, or drawing it partially, as needed, can you see what will be the value of 1 + 2 + 3+.....+99 + 100 + 99+.....+ 3 + 2 + 1?

Ans. :

$$1 = 1$$
$$1 + 2 + 1 = 4$$
$$1 + 2 + 3 + 2 + 1 = 9$$
$$1 + 2 + 3 + 4 + 3 + 2 + 1 = 16$$
$$\vdots$$
$$1 + 2 + 3 + \ldots + 99 + 100 + 99 + \ldots + 3 + 2 + 1 = 10000$$

Yes, we can see what will be the value of
1 + 2 + 3 +...+ 99 + 100 + 99 + ... + 3 + 2 + 1

41. Which sequence do you get when you start to add the All 1's sequence up? What sequence do you get when you add the All 1's sequence up and down?

Ans. : Adding all I's sequence up

$$1 = 1$$
$$1 + 1 = 2$$
$$1 + 1 + 1 = 3$$
$$1 + 1 + 1 + 1 = 4$$
$$\vdots$$

and so on.

Here, we get a sequence of counting numbers
ie. 1, 2, 3, 4, ...
Adding all 1's sequence up and down

$$1 = 1$$
$$1 + 1 + 1 = 3$$
$$1 + 1 + 1 + 1 + 1 = 5$$
$$\vdots$$

and so on.

Here, we get a sequence of odd numbers.

42. Find your own patterns or relations in and among the sequences in Table 1. Can you explain why they happen with a picture or otherwise?

Ans. : Given table is as

1, 1, 1, 1, 1, 1, ... (All 1's)

1, 2, 3, 4, 5, 6, 7, ... (Counting numbers)

1, 3, 5, 7, 9, 11, 13, ... (Odd numbers)

2, 4, 6, 8, 10, 12, 14, ... (Even numbers)

1, 3, 6, 10, 15, 21, 28, ... (Triangular numbers)

1, 4, 9, 16, 25, 36, 49, ... (Squares)

1, 8, 27, 64, 125, 216, ... (Cubes)

1, 2, 3, 5, 8, 13, 21, ... (Virahanka numbers)

1, 2, 4, 8, 16, 32, 64, ... (Powers of 2)

1, 3, 9, 27, 81, 243, 729, ... (Powers of 3)

From the above table, we see that

On adding the counting numbers up and turn down we get the square numbers.

$1 = 1$

$1 + 2 + 1 = 4$

$1 + 2 + 3 + 2 + 1 = 9$

$1 + 2 + 3 + 4 + 3 + 2 + 1 = 16$

$1 + 2 + 3 + 4 + 5 + 4 + 3 + 2 + 1 = 25$

$1 + 2 + 3 + 4 + 5 + 6 + 5 + 4 + 3 + 2 + 1 = 36$

$\vdots$

and so on.

Thus, counting number is relate with square numbers.

Also, we see triangular numbers added together for square numbers.

$1 + 3 = 4$

$3 + 6 = 9$

$6 + 10 = 16$

$10 + 15 = 25$

$10 + 15 = 25$

$\vdots$

and so on.

Also, we can look following patterns,

$1^3 = 1^2 = 1$

$1^3 + 2^3 = (1 + 2)^2 = 9$

$1^3 + 2^3 + 3^3 = (1 + 2 + 3)^2 = 36$

$1^3 + 2^3 + 3^3 + 4^3 = (1 + 2 + 3 + 4)^2 = 100$

$\vdots$

and so on.

Here, we get a sequence of square of triangular numbers.

Thus, we can say that sequence relate to each other.

*** Questions With Calculation.[2 Marks Each]** **[36]**

43. Can you recognise the pattern in each of the sequence in Table 1?

Ans. : Yes, we can recognise the pattern in each of the sequence in table 1.

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

Ans. : • **All 1's** 1, 1, 1, 1, ... (The next three numbers are 1, 1, 1. The rule is that every number is 1.)

• **Counting numbers** 1, 2, 3, 4, 5, 6, 7, ... (The next three numbers are 8, 9, 10. The rule is to add 1 to the previous number.)

• **Odd numbers** 1, 3, 5, 7, 9, 1,... (The next three numbers are 15, 17, 19. The rs to add 2 to the previous number.)n numbers 2, 4, 6, 8, 10, 12, 14, ... (The next three is to add 2 to the previous number.)

• **Triangular numbers** 1, 3, 6, 10, 15, 21, 28, ... (The next three numbers are 36, 45, 55. The rule is to add the next natural number is sequence.)

• **Squares** 1, 4, 9, 16, 25, 36, 49, ... (The next three numbers are 64, 81, 100. The rule is to square the next natural number.)

• **Cubes** 1, 8, 27, 64, 125, 216, ... (The next three numbers are 343, 512, 729. The rule is to cube the next natural number.)

• **Virahanka numbers** 1, 2, 3, 5, 8, 13, 21, ... (The next three numbers are 34, 55, 89. The rule is to add the last two numbers.)

• **Powers of 2** 1, 2, 4, 8, 16, 32, 64, ... (The next three numbers are 128, 256, 512. The rule is to multiply the last number by 2.)

• **Powers of 3** 1, 3, 9, 27, 81, 243, 729, ... (The next three numbers are 2187, 6561, 19683. The rule is to multiply the last number by 3.)

45. Copy the pictorial representations of the number sequences in Table 2 in your notebook and draw the next picture for each sequence.

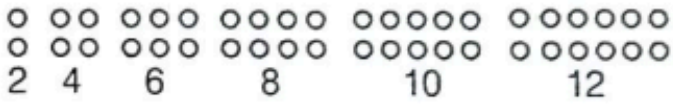
Ans. :

All 1's

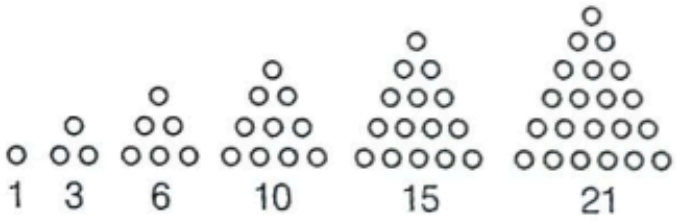
Counting Numbers

Odd Numbers

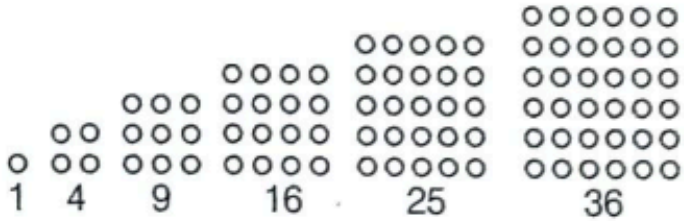
Even Numbers



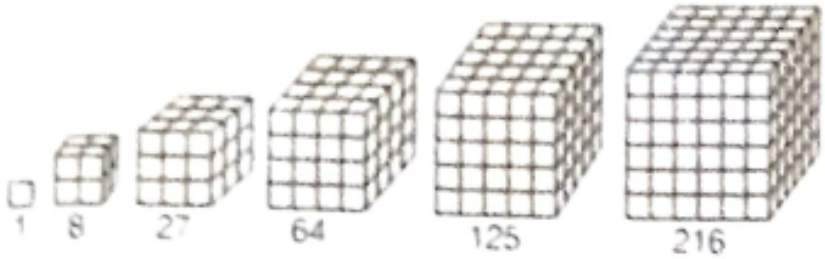
Triangular Numbers



Squares



Cubes



46. Why are 1. 3, 6, 10, 15, ... called triangular numbers? Why are 1, 4, 9, 16, 25, ...

called square numbers or squares? Why are 1, 8, 27, 64, 125, ... called cubes?

Ans. : 1, 3, 6, 10, 15, ... sequence forms a triangles, therefore it is called triangular numbers.

1, 4, 9, 16, 25, ... sequence forms a square, therefore, it is called square numbers.

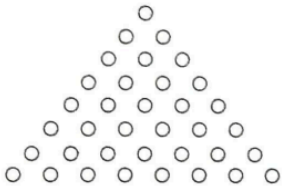
1. 8. 27, 64, 125, ... sequence forms a cube, therefore, it is called cubes.

47. You will have noticed that 36 is both a triangular number and a square number! That is, 36 dots can be arranged perfectly both in a triangle and in a square. Make pictures in your notebook illustrating this!

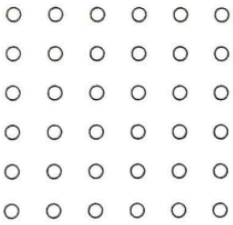
This shows that the same number can be represented differently and play different roles, depending on the context. Try representing some other numbers pictorially in different ways!

Ans. :

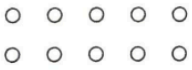
36 as a triangular number



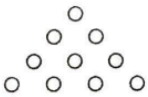
36 as a square number



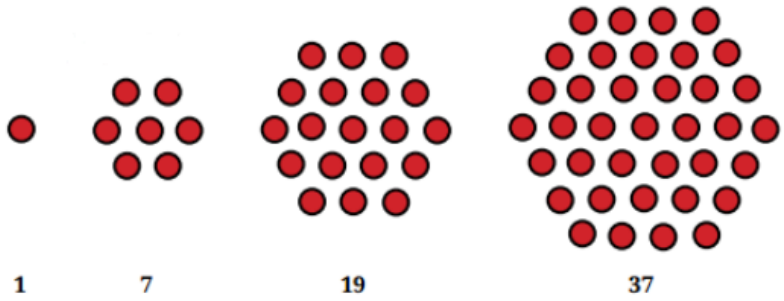
10 as even number



10 as triangular number

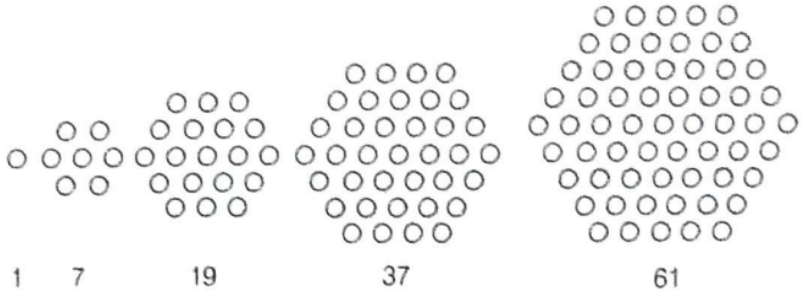


48. What would you call the following sequence of numbers?

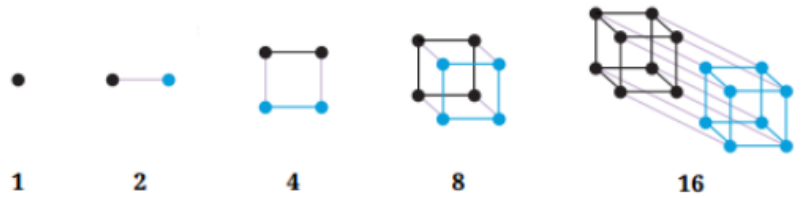


That's right, they are called hexagonal numbers! Draw these in your notebook. What is the next number is the sequence?

Ans. :



49. Can you think of pictorial ways to visualise the sequence of Powers of 2? Powers of 3? Here, is one possible way of thinking about Powers of 2.



Ans. : Yes

• **Power of 2** We can visualize the powers of 2 as squares where each subsequent square has twice the number of smaller squares as the previous one.

• **Power of 3** We can visualize the powers of 3 as cubes, where each subsequent cube has three times the number of smaller cubes as the previous one.

50. Can you find a similar pictorial explanation for why adding counting numbers up and down, i.e., 1, 1 + 2 + 1, 1 + 2 + 3 + 2 + 1 ,..., gives square numbers?

Ans. : Yes,

Adding up odd numbers -

$1 = 1$

$1 + 3 = 4$

$1 + 3 + 5 = 9$

$1 + 3 + 5 + 7 = 16$

$1 + 3 + 5 + 7 + 9 = 25$

$1 + 3 + 5 + 7 + 9 + 11 = 36$

$\vdots$

Thus, we see that adding up odd numbers gives square numbers.

51. Which sequence do you get when you start to add the Counting numbers up? Can you give a smaller pictorial explanation?

Ans. : Adding counting numbers

$1 = 1$

$1 + 2 = 3$

$1 + 2 + 3 = 6$

$1 + 2 + 3 + 4 = 10$

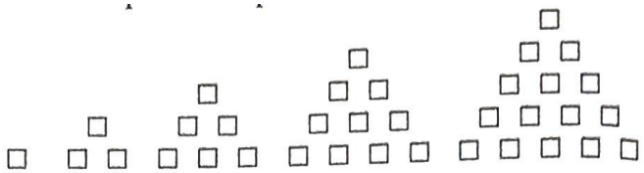
$1 + 2 + 3 + 4 + 5 = 15$

$\vdots$

and so on.

Here, we get sequence of triangular numbers.

A smaller pictorial explanation is



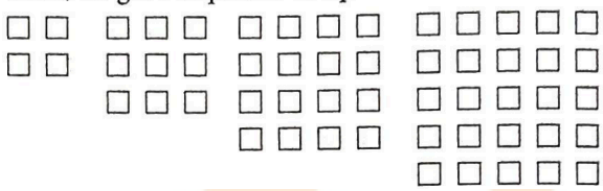
52. What happens when you add up pairs of consecutive triangular numbers? That is, take 1 + 3, 3 + 6, 6 + 10, 10 + 15,.....? Which sequence do you get? Why? Can you explain it with a picture?

Ans. : Adding up pairs of consecutive triangular numbers.

$$1+3=4$$
$$3+6=9$$
$$6+10=16$$
$$10+15=25$$
$$\vdots$$

and so on.

Here, we get a sequence of squares.



53. What happens when you start to add up powers of 2 starting with 1, i.e. take 1,1+2,1+2 +4,1+2+4+8,...? Now add 1 to each of these numbers-what numbers do you get? Why does this happen?

Ans. : Adding up powers of 2 starting with 1.

$$1=1$$
$$1+2=3$$
$$1+2+4=7$$
$$1+2+4+8=15$$
$$1+2+4+8+16=31$$
$$\vdots$$

and so on.

Adding 1 to each of the obtained numbers

$$1+1=2$$
$$3+1=4$$
$$7+1=8$$
$$15+1=16$$
$$31+1=32$$
$$\vdots$$

and so on.

Here, we get a sequence in which next term is obtained by multiplying previous term by 2 or next term is double of the previous term.

54. What happens when you multiply the triangular numbers by 6 and add 1? Which sequence do you get? Can you explain it with a picture?

Ans. : We have, triangular numbers.

1, 3, 6, 10, 15, ...

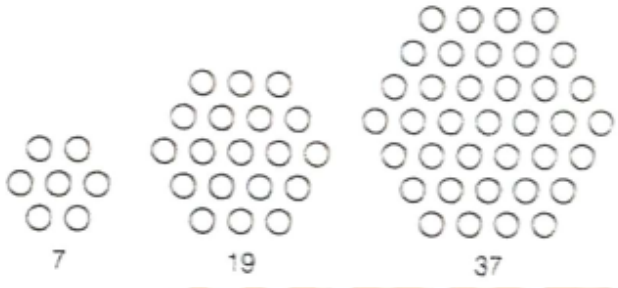
On multiplying triangular numbers by 6 and add 1 to it. we get

$$1\times 6+1=7$$
$$3\times 6+1=19$$
$$6\times 6+1=37$$
$$10\times 6+1=61$$
$$15\times 6+1=91$$
$$\vdots$$

and so on.

Hence, we get a sequence of hexagonal numbers.

The pictorial explanation of hexagonal numbers is given below.



55. What happens when you start to add up hexagonal numbers, i.e., take 1, 1 + 7, 1 + 7 + 19, 1 + 7 + 19 + 37,.....? Which sequence do you get? Can you explain it using

a picture of a cube?

Ans. :

Adding up hexagonal numbers

$1 = 1$

$1 + 7 = 8$

$1 + 7 + 19 = 27$

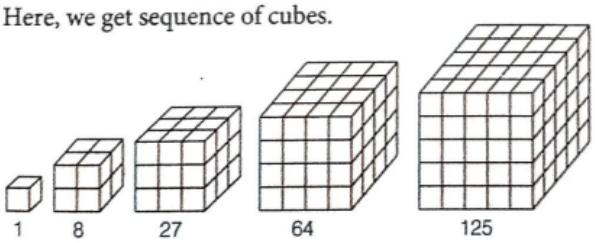
$1 + 7 + 19 + 37 = 64$

$1 + 7 + 19 + 37 + 61 = 125$

⋮

and so on.

Here, we get sequence of cubes.



56. Count the number of sides in each shape in the sequence of Regular Polygons. Which number sequence do you get? What about the number of corners in each shape in the sequence of Regular Polygons? Do you get the same number sequence? Can you explain why this happens?

Ans. :

Shape	Number of sides	Number of corners
Triangle	3	3
Quadrilateral (Square)	4	4
Pentagon	5	5
Hexagon	6	6
Heptagon	7	7
Octagon	8	8
Nonagon	9	9
Decagon	10	10

Sequence - 3, 4, 5, 6, 7, 8, 9, 10

We get, a sequence of counting numbers

Also, the number of corners in the shapes is same as the number of sides.

57. Count the number of lines in each shape in the sequence of Complete Graphs. Which number sequence do you get? Can you explain why?

Ans. : There are 1, 3, 6, 10, 15 lines respectively in each shape in the sequence of complete graphs.

We get a sequence of triangular numbers.

58. How many little squares are there in each shape of the sequence of Stacked Squares? Which number sequence does this give? Can you explain why?

Ans. : There are 1, 4, 9, 16, 25 little squares, respectively in each of the sequence of stacked squares.

This gives a sequence of squares.

Reason

$1 = 1$

$1 + 2 + 1 = 4$

$1 + 2 + 3 + 2 + 1 = 9$

$1 + 2 + 3 + 4 + 3 + 2 + 1 = 16$

$\vdots$

and so on.

59. How many little triangles are there in each shape of the sequence of Stacked Triangles? Which number sequence does this give? Can you explain why? (Hint: In each shape in the sequence, how many triangles are there in each row?)

Ans. : There are 1, 4, 9, 16, 25, little triangles, respectively in each shape of the sequence of stacked triangles.

This gives a sequence of squares.

Reason In each shape, add the number of little triangles in each row

$1 = 1$

$1 + 3 = 4$

$1 + 3 + 5 = 9$

$1 + 3 + 5 + 7 = 16$

$\vdots$

and so on.

60. To get from one shape to the next shape in the Koch Snowflake sequence, one replaces each line segment '—' with a 'speed bump' __/__. As one does this more and more times, the changes become tinier and tinier with very very small line segments. How many total line segments are there in each shape of the Koch Snowflake? What is the corresponding number sequence? (The answer is 3, 12, 48,....., i.e. 3 times Powers of 4; this sequence is not shown in Table 1)

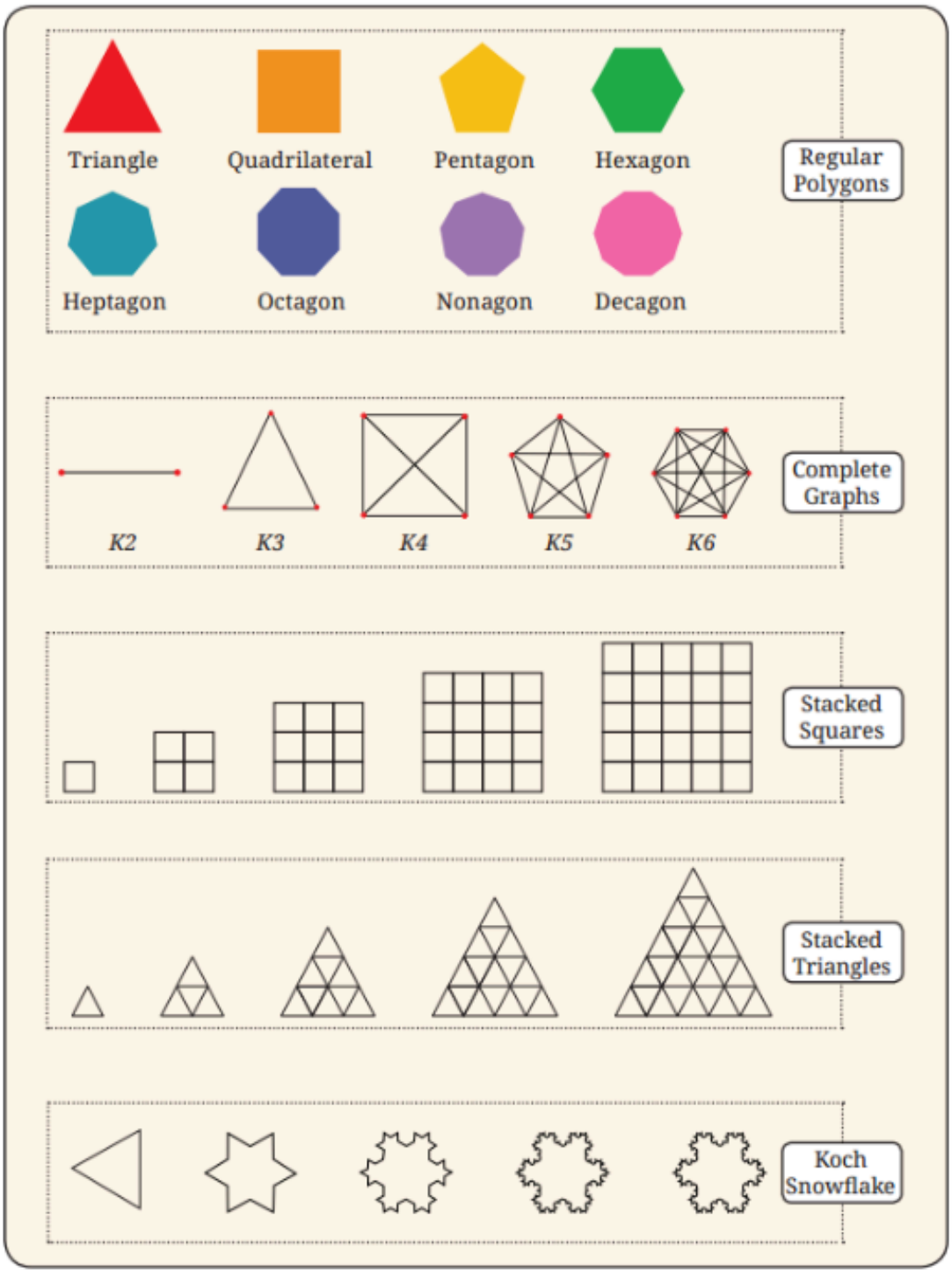
Ans. : There are 3, 12, 48, 192, 768 line segments in each shape of the Koch Snowflake.

The corresponding number sequence is 3, 12, 48, ...

i.e. 3 times the powers of 4.

*** Questions With Calculation.[3 Marks Each]** **[6]**

61.



Can you recognize the pattern in each of the sequences in Table ?

Ans. : (a) Regular Polygons: Triangle, quadrilateral, pentagon, hexagon, (the number of sides increases by 1 at a time). Hence it is a continuous number sequence starting from 3.

K_2	K_3	K_4	K_5	K_6	Complete Graphs
					
1	3	6	10	15	

Here number of lines is as follows:

$K_2 = 1$

$K_3 = 3$

$K_4 = 6$

$K_5 = 10$

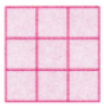
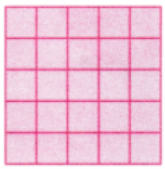
$K_6 = 15$

The series formed is 1, 3, 6, 10, 15,.....

Hence it is a triangular number sequence.

(c) Stacked Squares:

The number of small squares in each:

					Stacked Squares
					
1 $1\times1=1^2$	4 $2\times2=2^2$	9 $3\times3=3^2$	16 $4\times4=4^2$	25 $5\times5=5^2$	

The series formed is 1, 4, 9, 16, 25,.....

Hence it is a presentation of squares numbers sequence.

(d) Stacked Triangles

The number of small triangles in each:

					Stacked Triangles
					
1 1×1	4 2×2	9 3×3	16 4×4	25 5×5	

Hence it is also a square number sequence shown by triangles.

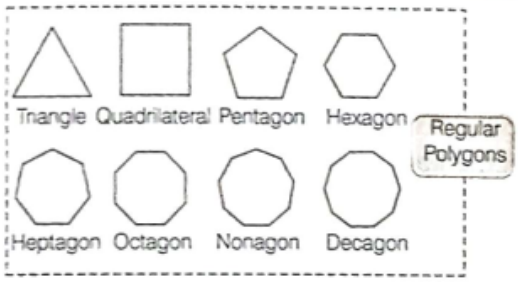
(e) Koch Snowflake

Number of sides in each becomes 4 times.

					Koch Snowflake
3	3 × 4 = 12	12 × 4 = 48	48 × 4 = 192	192 × 4 =768	

62. Try and redraw each sequence in Table 3 in your notebook. Can you draw the next shape in each sequence? Why or why not? After each sequence, describe in your own words what is the rule or pattern for forming the shapes in the sequence.

Ans. : → Regular Polygons - This sequence shows polygons that have equal sides and starts with a triangle having 3 sides and in each step in the sequence adds one more side to the previous shape.

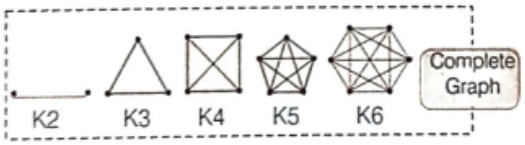



11 sided polygon

Rule $n-$ number of sides, $n \in N$

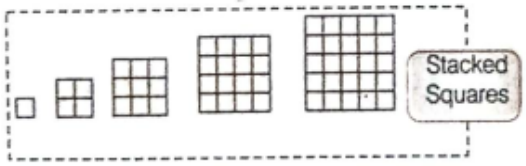
$n+1 =$ number of sides in the next shape

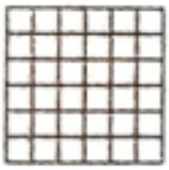
→ **Complete Graphs -** This sequence shows that each point is connected to every other point and starts with two points connected by a line, three points form a triangle, four points form a square and so on. In each step, the number of lines increases.



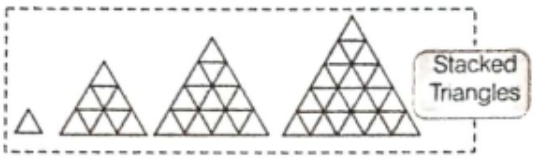

K7

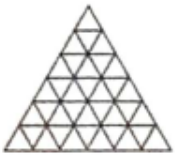
→ **Stacked Squares -** In this sequence, squares are stacked on each other to get the large square. In each steps of the sequence (starting with one square), the number of squares increases in a pattern.



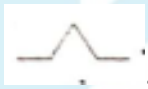


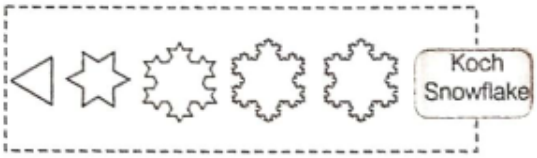
→ **Stacked Triangle** In this sequence, triangles are stacke to form a large triangle. In each step of the sequence starting with one triangle add more number of triangles to form a large triangle.





→ **Koch Snowflakes** In this sequence, starts with the triangle every side of the snowflake is replaced with 4 new sides. Each of these sides is a third of the length of the side, it is replacing or in this sequence, starts with triangle and in next step the

line segment is replaced by a 'speed bump'  . In each step, the chances become tinier and tinier with very very small line.



*** Match the following.** **[4]**

63.

Column A	Column B
(i) 1, 3, 9, 27, 81, ...	(a) Triangular: Numbers
(ii) 1, 2, 3, 5, 8, 13, ...	(b) Odd Numbers
(iii) 1, 3, 6, 10, 15, 21, ...	(c) Powers of 3
(iv) 1, 3, 5, 7, 9, 11, 13, ...	(d) Virahanka Numbers

Ans. :

Column A	Column B

(i) 1,3,9, 27,81,...	(c) Powers of 3
(ii) 1,2, 3, 5, 8, 13,...	(d) Virahanka Numbers
(iii) 1,3, 6, 10, 15,21,...	(a) Triangular: Numbers
(iv) 1,3,5,7,9,11,13,...	(b) Odd Numbers

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