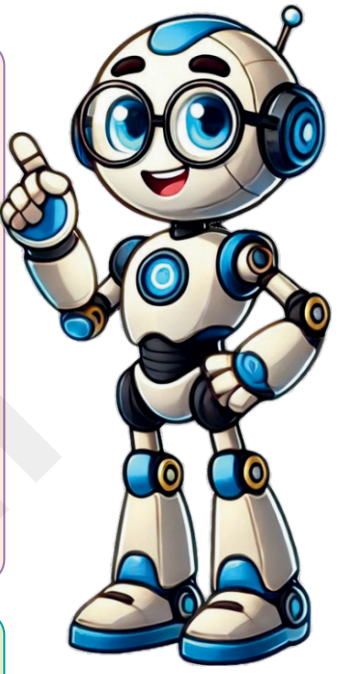
14

Patterns

We'll cover the following key points:

- → Pattern
- → Number Patterns
- → Pattern in the Formation of 2-digit Numbers
- → Pattern Formation by Addition of Consecutive Numbers
- → Pattern of Addition in Even Numbers
- → Pattern of Addition in Odd Numberg
- → Pattern from Difference to Sum
- → Pattern in Multiplication
- → Pattern in Division
- → Number Towers
- → Coding and Decoding
- → Tiling Patterns



Hi, I'm EeeBee

Do you Remember fundamental concept in previous class:
In class 3rd we learnt

- → Number Patterns
- → Patterns in Geometrical Shapes
- → Even and Odd Numbers

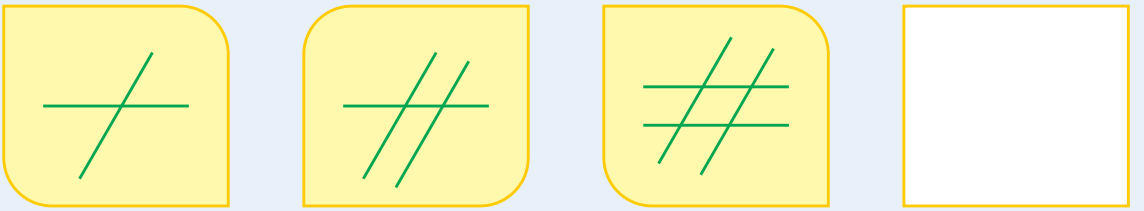
Still curious? Talk to me by scanning the QR code.

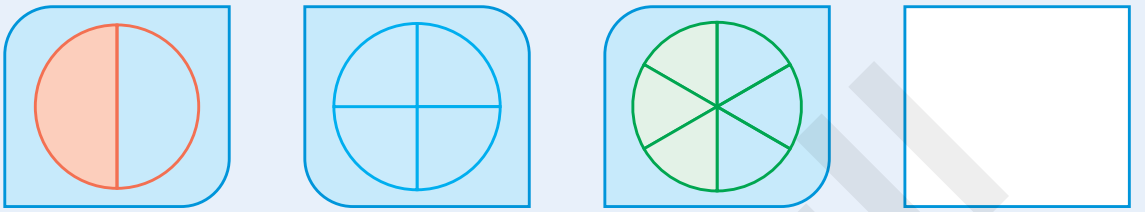
Learning Outcomes

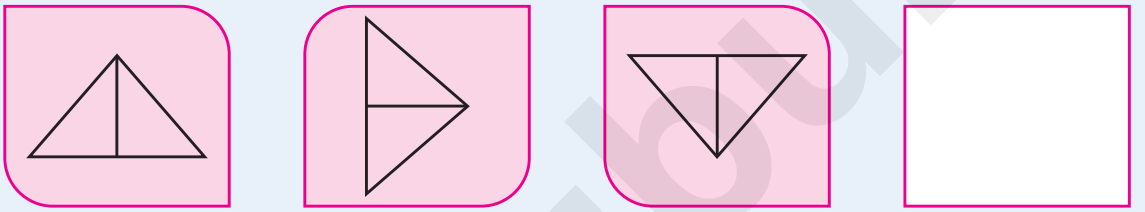
By the end of this chapter, students will be able to:

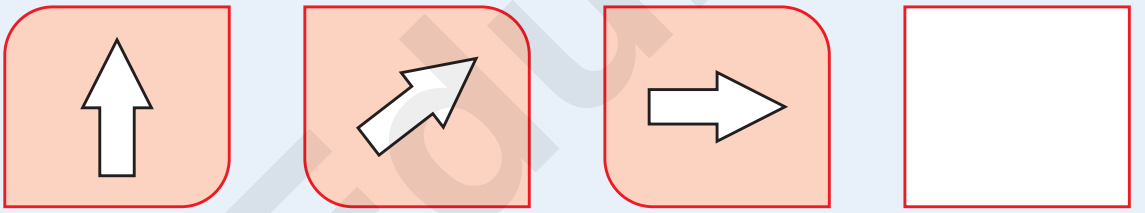
- Identify and name different 2D shapes such as squares, triangles, circles, and rectangles.
- Understand and describe the properties of 2D shapes (e.g., a rectangle has 4 right angles).
- Recognize and name common 3D shapes like cubes, spheres, cones, and cylinders.
- Identify and draw symmetrical shapes (e.g., shapes that can be divided into two equal halves).
- Create and extend patterns using shapes, colors, and numbers (e.g., red, blue, red, blue).
- Identify repeating patterns in everyday objects and surroundings (e.g., patterns in tiles or clothing).
- Understand and complete number patterns (e.g., 2, 4, 6, 8, ... or 1, 3, 5, 7, ...).

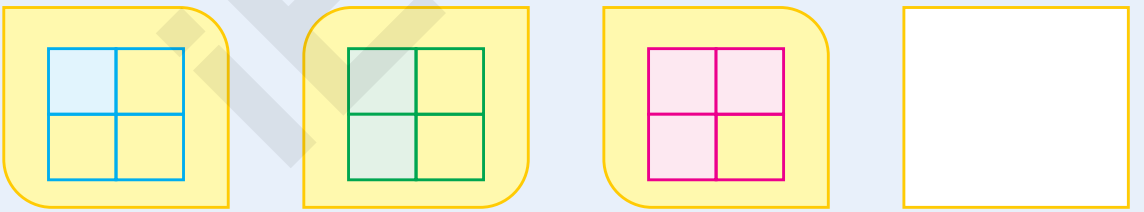
Draw the last figure in each case:

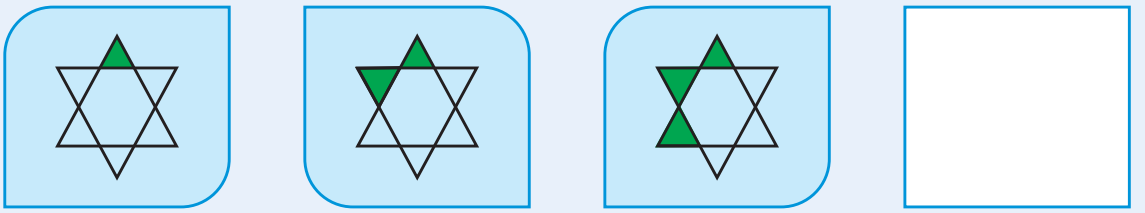
1. 

2. 

3. 

4. 

5. 

6. 

Pattern

There are different patterns spread around us. Knowingly or unknowingly, we use these patterns.

Pattern means a symmetry, a similarity or a relationship among pictures, designs and numbers.

You see kites following a pattern. Similarly, a craftman makes pattern on the clothes. using a wooden block. The outline of a cloud, the cracks in a rock, the weaves on the sea-shores are some fractal pattern.

Steps

A craftsman dips the wooden block in different colours, to form different patterns. This art is known as block printing.

Number Patterns

Patterns are very useful as sometimes without calculating, you can find solutions with their help.

For Example : $1+2+3+4+$ _____ $+10 = 55$

$11+12+13+14+$ _____ $+20 = 155$

:

:

:

:

:

$91+92+93+94+$ _____ $+100 = 955$

Pattern in the Formation of 2–digit Numbers

$1\times10+0=10$	$2\times10+0=20$	$3\times10+10=30$
$1\times10+1=11$	$2\times10+1=21$	$3\times10+1=31$
$1\times10+2=12$	$2\times10+2=22$	$3\times10+2=32$
$1\times10+3=13$	$2\times10+3=23$	$3\times10+1=33$
:	:	:
:	:	:
$1\times10+89=99$	$2\times10+79=99$	$3\times10+69=99$

In the similar pattern, 3-digit numbers, 4-digit numbers, 5-digit numbers etc., can be formed.

Pattern Formation by Addition of Consecutive Numbers

Two Consecutive Numbers	Three Consecutive Numbers	Four Consecutive Numbers
1 + 2 = 3	1 + 2 + 3 = 6	1 + 2 + 3 + 4 = 10
2 + 3 = 5	2 + 3 + 4 = 9	2 + 3 + 4 + 5 = 14
3 + 4 = 7	3 + 4 + 5 = 12	3 + 4 + 5 + 6 = 18
4 + 5 = 9	4 + 5 + 6 = 15	4 + 5 + 6 + 7 = 22
:	:	:
:	:	:
8 + 9 = 17	7 + 8 + 9 + 24	8 + 9 + 10 + 11 = 38
The sums are odd numbers.	The sums are multiples of 3. The sum is thrice the middle term.	The sums are even numbers and increase in 4's.

Ten Consecutive Numbers

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55

11 + 12 + 13 + 14 + 15 + 16 + 17 + 18 + 19 + 20 = 155

21 + 22 + 23 + 24 + 25 + 26 + 27 + 28 + 29 + 30 = 255

31 + 32 + 33 + 34 + 35 + 36 + 37 + 38 + 39 + 40 = 355

41 + 42 + 43 + 44 + 45 + 46 + 47 + 48 + 49 + 50 = 455

: :

: :

91 + 92 + 93 + 94 + 95 + 96 + 97 + 98 + 99 + 100 = 955

Pattern of Addition in Even Numbers

Study the pattern

2 + 4 = 6 (2 × 3)

2 + 4 + 6 = 12 (2 × 6)

2 + 4 + 6 + 8 = 20 (2 × 10)

2 + 4 + 6 + 8 + 10 = 30 (2 × 15)

2 + 4 + 6 + 8 + 10 + 12 = 42 (2 × 21) and so on.

Pattern of Addition in Odd Numbers

Study the pattern

$1 + 3 = 4 \quad (2 \times 2)$

$1 + 3 + 5 = 9 \quad (3 \times 3)$

$1 + 3 + 5 + 7 = 16 \quad (4 \times 4)$

$1 + 3 + 5 + 7 + 9 = 25 \quad (5 \times 5)$

$1 + 3 + 5 + 7 + 9 + 11 = 36 \quad (6 \times 6)$ and so on.

Pattern from Difference to Sum

Study the pattern

$(2 \times 2) - (1 \times 1) = 2 + 1$

$(3 \times 3) - (2 \times 2) = 3 + 2$

$(4 \times 4) - (3 \times 3) = 4 + 1$

$(5 \times 5) - (4 \times 4) = 5 + 4$

$(6 \times 6) - (5 \times 5) = 6 + 5$

:

:

$(9 \times 9) - (8 \times 8) = 9 + 8$

This can be extended to more digits.

$(10 \times 10) - (9 \times 9) = 10 + 9$

$(11 \times 11) - (10 \times 10) = 11 + 10$

:

:

$(99 \times 99) - (98 \times 98) = 99 + 98$

Pattern in Multiplication

15 × 15 = 225	25 × 25 = 625	35 × 35 = 1225	115 × 115 = 13225	125 × 125 = 15625	135 × 135 = 18225
↑	↑	↑	↑	↑	↑
1 × 2	2 × 3	3 × 4	11 × 12	12 × 13	13 × 14

In each product, 25 is obtained on multiplying the 5 in the one's place. The number to the left of 25 in the product can be obtained by multiplying the other digits with their successors.

Study the following patterns :

$$1 \times 1 = 1$$
$$11 \times 11 = 121$$
$$111 \times 111 = 12321$$
$$1111 \times 1111 = 1234321$$
$$11111 \times 11111 = 123454321 \text{ and so on.}$$

In the above multiplication, the digits read the same whether backward or forward. These numbers are called palindromic numbers.

a. If the 2-digit number 11 is multiplied by itself, then the middle digit in the product is 2.

b. If the 3-digit number 111 is multiplied by itself, then the middle in the product is 3.

c. If the 4-digit number is multiplied by itself, then the middle digit in the product is 4 and so on.

Pattern in Division

Find the pattern in divisions as given below :

$$216 \div 4 = 54$$
$$432 \div 8 = 54$$
$$648 \div 12 = 54$$

You can see, in each case the division is multiplied by the quotient and got dividend.

Mental Math

Critical Thinking

Can you make two pattern series of your own using different shapes? If yes, then go on.

Exercise 14.1

Knowledge Application

1. Study the patterns and fill in the blanks.

	$(4 \times 4) - (3 \times 3)$	=	4	+	3	=	7
	$(6 \times 6) - (5 \times 5)$	=	6	+	5	=	11
(a)	$(7 \times 7) - (6 \times 6)$	=	_____	+	_____	=	_____
(b)	$(8 \times 8) - (7 \times 7)$	=	_____	+	_____	=	_____
(c)	$(9 \times 9) - (8 \times 8)$	=	_____	+	_____	=	_____
(d)	$(10 \times 10) - (9 \times 9)$	=	_____	+	_____	=	_____

2. Carefully observe the patterns given below and write the number against each one.

11 = 2 _____ 12 = 3 _____ Hint: 11 = 1 + 1 = 2

38 = 11 = 2 _____ 86 = 14 = 5 _____ 12 = 1 + 2 = 3, etc.

142 = 7 _____

(a) 25 = _____ (b) 89 = _____ (c) 135 = _____

(d) 458 = _____ (e) 635 = _____

3. For each of the given number sequences, find the rule to generate the sequence. Describe the rule in words and write down the next four terms with the help of this rule.

(a) 1, 4, 7, 10, 13, 16, _____, _____, _____, _____

(b) 2, 6, 10, 14, 18, 22, _____, _____, _____, _____

(c) 8, 9, 11, 14, 18, 23, _____, _____, _____, _____

(d) 4, 8, 12, 16, 20, 24, _____, _____, _____, _____

4. Study the following patterns and fill in the blanks :

(a) $65 \times 65 = 4225$ (b) $105 \times 105 = 11025$

(c) $345 \times 345 =$ _____ (d) $505 \times 505 =$ _____

(e) $165 \times 165 =$ _____ (f) $195 \times 195 =$ _____

5. Observe the following patterns and extend it for two more steps :

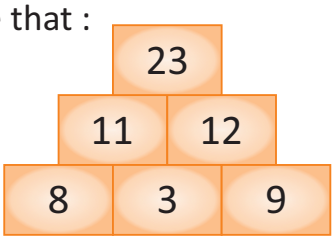
(a)
$1 \times 9 + 2 = 11$
$12 \times 9 + 3 = 111$
$123 \times 9 + 4 = 1111$
_____ = _____
_____ = _____

(b)
$111 \div 3 = 37$
$222 \div 6 = 37$
$333 \div 9 = 37$
_____ = _____
_____ = _____

Number Towers

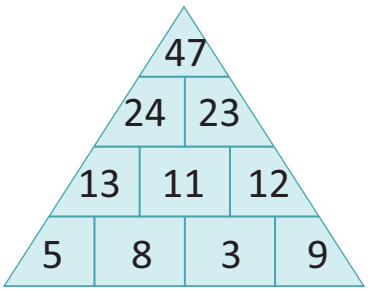
Consider a few examples :

1. Starting from the row of the bottom, you observe that :
   8 + 3 = 11 3 + 9 = 12
   In the second row : 11 + 12 = 23
2. The numbers have been arranged as pyramid.
   Now, you will observe that :
   Step 1: 5 + 8 = 13, 8 + 3 = 11,
   and 3 + 9 = 12



Step 2: 13 + 11 = 24 and
11 + 12 = 23

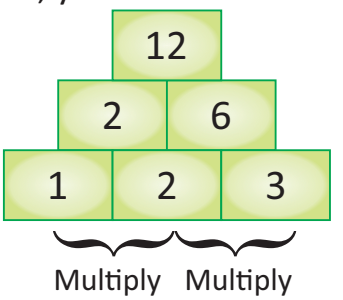
Step 3: 24 + 23 = 47



3. Starting from the row of the bottom, you observe that:

$1 \times 2 = 2$, $2 \times 3 = 6$

Finally, $2 \times 6 = 12$



REMEMBER

In a Fibonacci sequence, from third term onwards, each term is obtained by adding the previous two terms, i.e. 0, 1, 1, 2, 3, 5, 8, 13, 21,...

Coding and Decoding

We can use some codes to send and recieve some secret messages. In this coding, each letter is assigned a number.

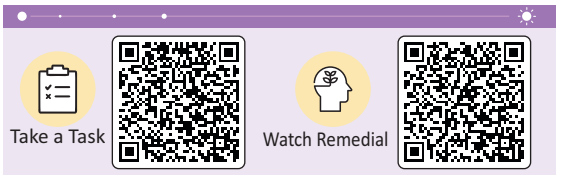
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Using this coding, we can write messages.

HAVE FUN is written as 8 1 22 5 6 21 14

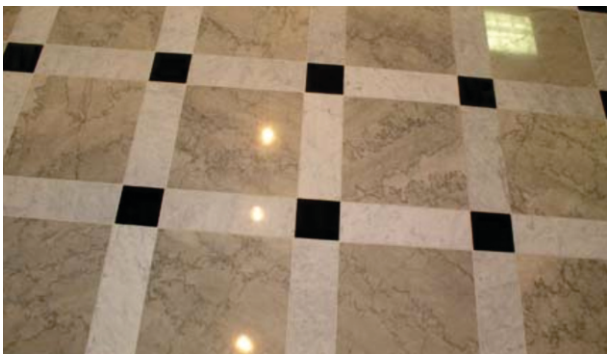
MATHEMATICS is written as 13 1 20 8 5 13 1 20 9 3 19

Tiling Patterns



Look around you at the floor and the walls.

These designs are made by tiles that fit into each other without any gaps or overlapping. These tiling patterns are called tessallations.



A floor design

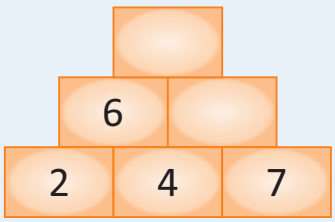
A wall design

Exercise 14.2

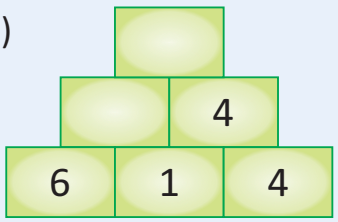
Knowledge Application

1. Look at the pattern and complete the number towers.

(a)



(b)



2. Write the following words using the codes :

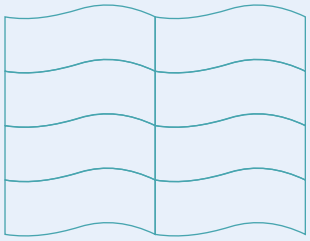
(a) COME AGAIN _____

(b) SAVE WATER _____

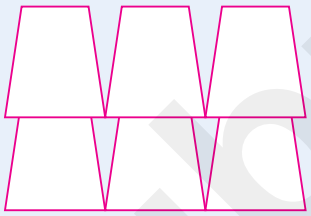
(c) BEST OF LUCK _____

3. Tick (✓) the patterns that tessalate.

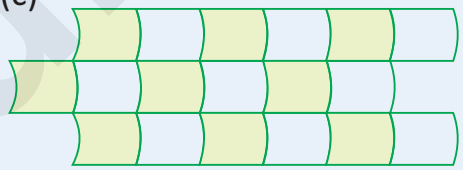
(a)



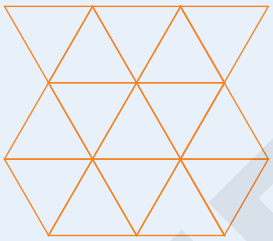
(b)



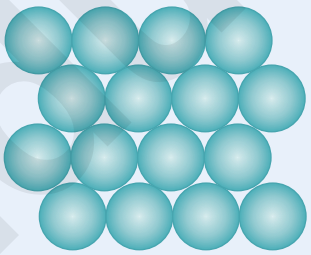
(c)



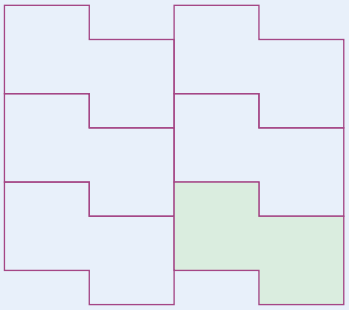
(d)



(e)



(f)



LET US SUMMARIZE

- Pattern means a symmetry, a similarity or a relation among pictures, designs and number.
- Outline of a cloud is an example of fractal pattern.
- There is also a pattern in multiplication and division.
- Number towers follow a pattern.
- Sending and receiving messages becomes easy with the help of coding.
- Tiles also follow a specific pattern.

Think Tank

Gap Analyzer™

1. Tick (✓) the correct answer:

(a) Outline of a cloud is an example of _____ .

(i) Fractal pattern ☐ (ii) Tile pattern ☐

(iii) Coding ☐ (iv) Number towers ☐

(b) Look at the coding.

8 1 22 5 6 21 14

Which one is the decoding of the following?

(i) HAVE FUN ☐ (ii) GOOD ☐

(iii) HELLO ☐ (iv) SURPRISE ☐

(c) The middle term in the pattern 111 x 111 is _____ .

(i) 4 ☐ (ii) 3 ☐ (iii) 2 ☐ (iv) 5 ☐

(d) Look at the pattern. 1 + 2 = 3; 2 + 3 = 5; 3 + 4 = 7

Which one is the next term?

(i) 12 ☐ (ii) 15 ☐ (iii) 9 ☐ (iv) 17 ☐

2. Fill in the blanks:

(a) 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = _____

(b) 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = _____

(c) 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = _____

(d) 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 = _____

(e) 1 + 2 + 3 + 4 + 5 + 6 + 99 + 100 = _____

Custom Learning Path

Scan to Create Your Own Learning Path

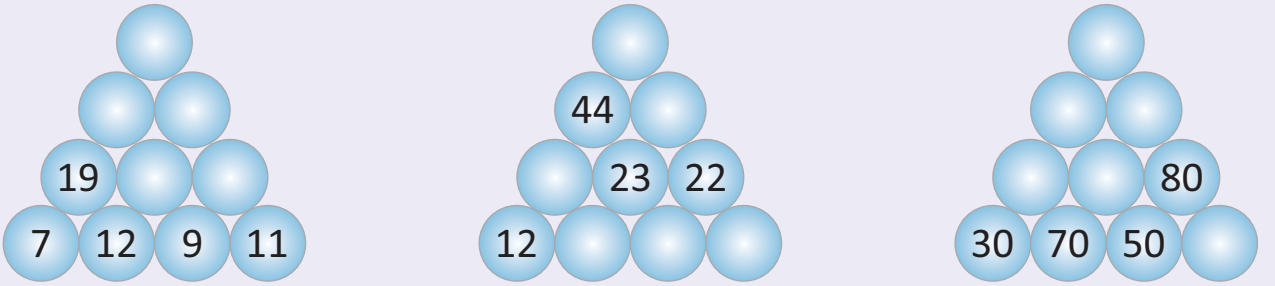
3. Match the following:

(a)	12345679 × 9	(i)	222222222
(b)	12345679 × 18	(ii)	444444444
(c)	12345679 × 27	(iii)	999999999
(d)	12345679 × 36	(iv)	111111111
(e)	12345679 × 45	(v)	333333333

Puzzle

Experiential Learning

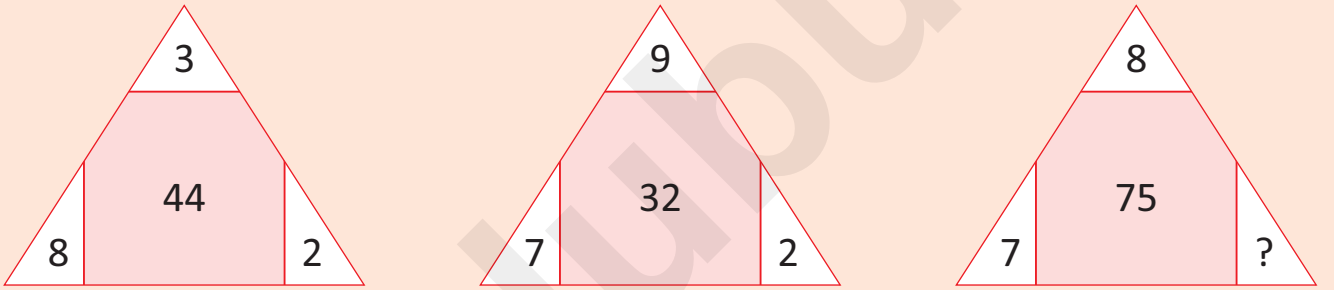
Solve the puzzle:



Mental Math

Conceptual Understanding

Solve the problem. What number should replace the question mark?



Maths Lab Activity

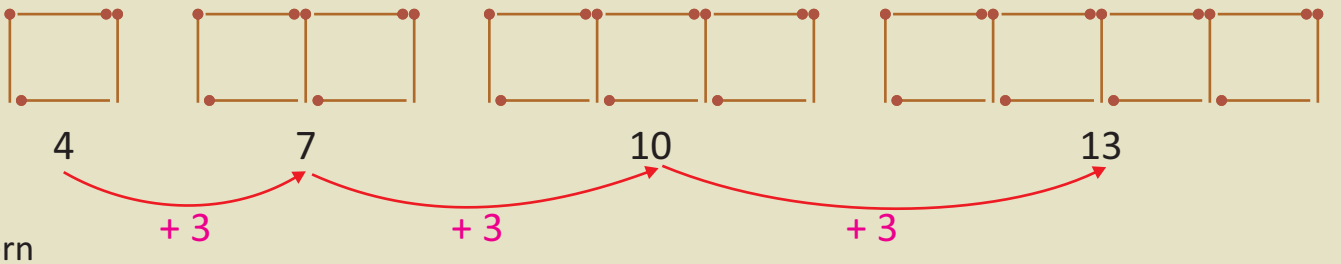
Collaboration

Objective : Finding the number pattern.

Materials required : Matchsticks

Procedure :

1. We can find the number of matchsticks being used to from 1 square, 2 squares, 3 squares, 4 squares, etc.



Pattern