CHAPTER

18

PATTERN

A **pattern** is a set of rule within the numeral and number series, hence refers to certain mathematical operations likewise addition, subtraction, division and multiplication from one term to another term.
It can be classified in two ways :

Grid Pattern

It contains more than one numeral within the square rectangle applying certain rule.

e.g.,

6	11	16
9	14	19
13	18	23

Second and third term in each row is exceeding by 5 and 10 of the first term of each row

i.e. Ist row, $6 + 5 = 11$ and $6 + 10 = 16$

IInd row, $9 + 5 = 14$ and $9 + 10 = 19$

IIIrd row, $13 + 5 = 18$ and $13 + 10 = 23$

Example **1.** Identify the value of question mark (?).

18	21	24
28	31	34
38	41	44
?	?	?

(1) 48, 51, 53
(2) 48, 51, 54
(3) 46, 49, 52
(4) 51, 54, 57

Sol. (2) Required pattern,

$$\begin{array}{lll} 18 & 18+3=21 & 21+3=24 \\ \downarrow +10 & & \\ 28 & 28+3=31 & 31+3=34 \\ \downarrow +10 & & \\ 38 & 38+3=41 & 41+3=44 \\ \downarrow +10 & & \\ \boxed{48} & \boxed{48}+3=\boxed{51} & 51+3=\boxed{54} \end{array}$$

Example **2.** If sum of each row, column and diagonals are equal, then the value of P, Q and R respectively is

P	15	22
21	19	Q
R	23	18

(1) 20, 16, 17 (2) 20, 17, 16
(3) 17, 20, 16 (4) 16, 20, 17

Sol. (2) $\because$ Sum of all column are equal.

$\therefore \quad 15+19+23 = 22+Q+18$

$\Rightarrow \quad 57 = 40+Q \Rightarrow Q = \boxed{17}$

Again, sum of all row are equal.

$\therefore P+15+22 = 21+19+Q = R+23+18$

$\Rightarrow \quad P+37 = 40+Q = R+41$

$\Rightarrow \quad P+37 = 40+17 \Rightarrow P = \boxed{20}$

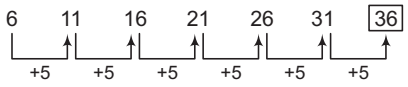
and $\quad R+41 = 40+17 \;\; R = \boxed{16}$

Series Based Pattern

Such type of questions mainly deals with the pattern of increasing or decreasing of numerals, hence may be operated by the mathematical operations such as addition, subtraction, multiplication and division.

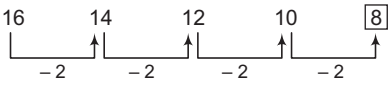
- If the next term is increasing in constant manner, then pattern of addition must take place.
- If the next term is decreasing in constant manner, then patter of subtraction must take place.
- If the next term is increasing rapidly, then pattern of multiplication must take place.
- If the next term is decreasing rapidly, then pattern of division must take place.

e.g., (i)



Here, next term is increasing in constant manner.

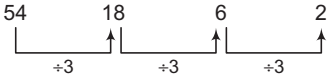
(ii)



(iii)

Here, next term is obtained by multiplying the previous number by 2.

(iv)



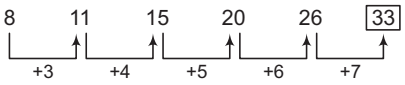
Here, next term is obtained by dividing the previous number by 3.

Example **3.** Find the next term of the given series

8, 11, 15, 20, 26, ?

(1) 30
(2) 32
(3) 33
(4) 34

Sol. (3)



The series is increasing by ascending series by 1.

Example **4.** Identify the pattern of the question and determine the next term.

$$\underset{\times 2}{\underline{2}} \quad \underset{\times 5}{\underline{5}} \quad \underset{\times 8}{\underline{8}} \quad \underset{\times 11}{\underline{11}} \quad ?$$
$$\underline{4} \quad \underline{25} \quad \underline{64} \quad \underline{121}$$

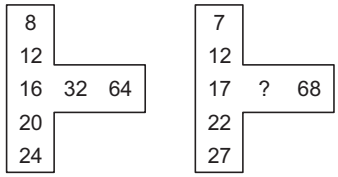
(1) $\begin{array}{r} 15 \\ \times\ 15 \\ \hline 225 \end{array}$ (2) $\begin{array}{r} 14 \\ \times\ 14 \\ \hline 196 \end{array}$

(3) $\begin{array}{r} 16 \\ \times\ 16 \\ \hline 256 \end{array}$ (4) $\begin{array}{r} 18 \\ \times\ 18 \\ \hline 324 \end{array}$

Sol. (2) Every next term is increasing by 3 from the previous one, so the next term will be 14 (11 + 3).

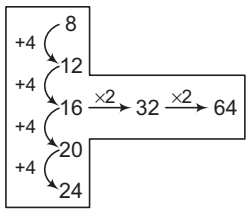
$$\begin{array}{r} 14 \\ \times 14 \\ \hline 196 \end{array}$$

Example **5.** Identify the pattern and find the value of question mark (?).

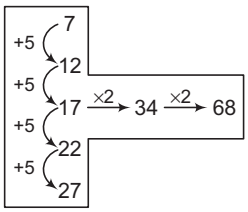


(1) 35 (2) 40 (3) 34 (4) 45

Sol. (3) As,



Similarly,



$\therefore$ $? = 34$

Entrance Corner

1. What is the next term in the given series?
9, 13, 17, 21, 25, ? **[JNV 2018]**
(1) 26 (2) 27 (3) 29 (4) 33

2. Next term of 258, 130, 66, 34, 18, ... is **[JNV 2017]**
(1) 12 (2) 10 (3) 8 (4) 13

3. Find the next term of the series
3, 4, 6, 9, 13, ... **[JNV 2016]**
(1) 18 (2) 17 (3) 14 (4) 19

4. The next term of the series 1, 2, 4, 8, ... is **[JNV 2015]**
(1) 12 (2) 16 (3) 10 (4) 11

5. Next term of 80, 10, 70, 15, 60, ... is **[JNV 2014]**
(1) 20 (2) 25 (3) 30 (4) 50

6. If sum of each row, column and diagonals are equal, then the value of x, y, z and w respectively, is **[JNV 2014]**

8	x	z
y	5	w
4	9	2

(1) 4, 6, 8, 7 (2) 1, 3, 6, 7
(3) 1, 6, 3, 7 (4) 3, 6, 7, 1

7. Numbers in the next line is **[JNV 2013]**

40	45	50
55	60	65
70	75	80
-	-	-

(1) 75, 80, 85 (2) 85, 90, 95
(3) 90, 95, 100 (4) 70, 75, 85

8. If the sum of each row, column and diagonals are same, then the value of x, y, t and z is **[JNV 2013]**

x	1	y
3	5	z
t	9	2

(1) 8, 6, 4, 7 (2) 6, 8, 4, 7
(3) 7, 8, 6, 4 (4) 4, 6, 7, 8

9. The next number in the series 2, 5, 8, 11, ... is **[JNV 2012]**
(1) 12 (2) 10
(3) 14 (4) 15

10. 11, 13, 17, 19, 23, 29, 31, 37, 41, ...is **[JNV 2011]**
(1) 42 (2) 43
(3) 44 (4) 45

11. Study the following pattern find out the next term. **[JNV 2010]**

$5 \times 5 = 25$, $15 \times 15 = 225$, $25 \times 25 = 625$, $35 \times 35 = 1225$, $45 \times 45 = 2025$

(1) $55 \times 55 = 2825$
(2) $55 \times 55 = 3225$
(3) $55 \times 55 = 3025$
(4) $55 \times 55 = 3225$

12. Which group of number will come in the next row? **[JNV 2007]**

6	24	624
7	28	728
8	32	832
?	?	?

(1) 9, 36, 936, (2) 9, 36, 972
(3) 9, 81, 981, (4) 9, 63, 963

13. What will be the next row of numbers in the following pattern? **[JNV 2005]**

4	16	64
6	36	216
8	64	512
?	?	?

(1) 8, 68, 518 (2) 10, 100, 1000
(3) 10, 200, 2000 (4) 10, 500, 5000

14. The next two terms in the series 123, 234, 345, ..., are **[JNV 2004]**
(1) 456, 457 (2) 346, 347
(3) 456, 567 (4) 456, 678

Answers

1. (3)	**2.** (2)	**3.** (1)	**4.** (2)	**5.** (1)	**6.** (2)	**7.** (2)	**8.** (1)	**9.** (3)	**10.** (2)
11. (3)	**12.** (1)	**13.** (2)	**14.** (3)						

Hints and Solutions

1. The series follows the pattern as

$$9+4=13$$
$$13+4=17$$
$$17+4=21$$
$$21+4=25$$
$$25+4=\boxed{29}$$

Therefore, 29 is the next term in the given series.

2. 258, 130, 66, 34, 18, $\boxed{10}$

÷2+1, ÷2+1, ÷2+1, ÷2+1, ÷2+1

3. 3, 4, 6, 9, 13, $\boxed{18}$

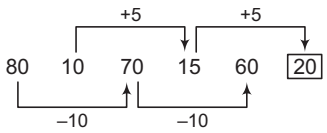
+1, +2, +3, +4, +5

It is clear that next term of series is 18.

4. 1, 2, 4, 8, $\boxed{16}$

×2, ×2, ×2, ×2

5.



Hence, 20 is the missing term.

6. Since, the sum of last row

$$=4+9+2=15$$

Now, sum of diagonal

$$4+5+z=15$$
$$z=15-9$$
$$=6$$

Now, sum of first column

$$8+y+4=15$$
$$y=15-12$$
$$=3$$

Also, $y+5+w=15$

$$3+5+w=15$$
$$w=15-8$$
$$=7$$

Now, $8+x+z=15$

$$8+x+6=15$$
$$x=15-14=1$$

Hence, x, y, z and w are 1, 3, 6 and 7.

7. $40 \xrightarrow{+15} 55 \xrightarrow{+15} 70 \xrightarrow{+15} \boxed{85}$ (in first column)

$45 \xrightarrow{+15} 60 \xrightarrow{+15} 75 \xrightarrow{+15} \boxed{90}$ (in second column)

$50 \xrightarrow{+15} 65 \xrightarrow{+15} 80 \xrightarrow{+15} \boxed{95}$ (in third column)

8.

x	1	y
3	5	z
t	9	2

If we put $x=8$, $y=6$, $t=4$, $z=7$

Then,

8	1	6	= 15
3	5	7	= 15
4	9	2	= 15
15	15	15	

9. The pattern of series is

2, 5, 8, 11, $\boxed{14}$

+3, +3, +3, +3

10. The series consists of prime numbers.

$\therefore$ The missing number is the next prime number which is 43.

11. $55 \times 55 = 3025$

12. 6 and 24 becomes 624.

Where, $6 \times 4 = 24$

Hence, 9 and $9 \times 4 = 36$ becomes 936

$\therefore$ Next group will be 9, 36, 936.

13. Second and third columns are square and cube of the first column.

Hence, 10

$$(10)^2 = 100$$
$$(10)^3 = 1000$$

14.

1	2	3				
×	2	3	4			
	×	3	4	5		
		×	4	5	6	
			×	5	6	7

In the series, left most digit in each term is omitting and the succeeding of the right most digit is appearing.

Practice Exercise

1. Identify the pattern and find the value of question mark?

4	9	14	
+ 8	+ 13	+ 18	?
12	22	32	

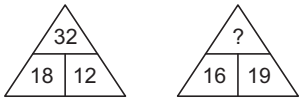
(1) 19 + 23 = 42

(2) 18 + 22 = 40

(3) 17 + 21 = 38

(4) 20 + 24 = 44

2. In the following figures, identify the pattern and find the value of question mark(?).



(1) 34 (2) 37

(3) 35 (4) 38

3. Identify the pattern and find the value of question mark(?).

6 × 6 + 2	
14	15
8 × 8 + 2	
18	19
+ 2	
12	13

(1) 4 × 4 (2) 7 × 7

(3) 5 × 5 (4) 9 × 9

4. If sum of each row, column and diagonals are equal, then the value of *a*, *b*, *c* and *d* respectively, is

a	7	14
b	11	*d*
8	15	*c*

(1) 12, 13, 10, 9 (2) 13, 12, 9, 10

(3) 12, 9, 13, 10 (4) 12, 13, 9, 10

5. If the sum of each row, column and diagonals are equal, then the value of *p*, *q*, *r* and *s* respectively, is

19	*q*	21
p	18	16
15	*s*	*r*

(1) 20, 17, 14, 22 (2) 17, 20, 14, 22

(3) 14, 17, 20, 22 (4) 20, 14, 17, 22

Directions (Q. Nos. 6-12) *Find the value of question mark(?).*

6. 2, 3, 5, 8, 13, 21, ?

(1) 30 (2) 34

(3) 35 (4) 39

7. 8, 20, 32, 44, 56, ?

(1) 65 (2) 68

(3) 60 (4) 69

8. 4, 5, 9, 18, 34, ?

(1) 50 (2) 58

(3) 57 (4) 59

9. 2, 3, 5, 7, ?

(1) 9 (2) 13

(3) 11 (4) 10

10. 122, 248, 326, 414, ?

(1) 177 (2) 521

(3) 817 (4) 432

11.

8	4	9
2	8	4
3	7	8
14	60	?

(1) 40 (2) 41 (3) 38 (4) 49

12.

3	6	1	18
7	2	4	56
8	4	3	96
?	4	3	48

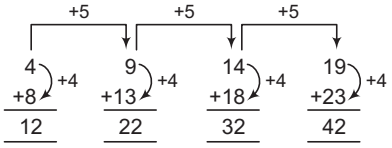
(1) 5 (2) 8 (3)18 (4) 4

Answers

1. (1)	**2.** (2)	**3.** (3)	**4.** (1)	**5.** (4)	**6.** (2)	**7.** (2)	**8.** (4)	**9.** (3)	**10.** (1)
11. (2)	**12.** (4)								

Hints and Solutions

1.



2. As, $18 + 12 + 2 = 32$

Same as, $16 + 19 + 2 = 37$

3. As, $6 \times 6 + 2 \Rightarrow 6 + 6 + 2 = 14 \xrightarrow{+1} 15$

and $8 \times 8 + 2 \Rightarrow 8 + 8 + 2 = 18 \xrightarrow{+1} 19$

Same as, $5 \times 5 + 2 \Rightarrow 5 + 5 + 2 = 12 \xrightarrow{+1} 13$

4. Now, sum of second column $= 7 + 11 + 15 = 33$

Then,

$a = 33 - (7 + 14) = 12$

$b = 33 - (8 + a) = 33 - (8 + 12) = 13$

$c = 33 - (8 + 15) = 10$

$d = 33 - (14 + c)$

$\Rightarrow \quad 33 - (14 + 10) = 9$

$\therefore \quad a = 12,\ b = 13,\ c = 10$ and $d = 9$

5. Now, sum of diagonal $= 15 + 18 + 21 = 54$

then, $p = 54 - (18 + 16) = 20$

$q = 54 - (19 + 21) = 14$

$r = 54 - (21 + 16) = 17$

and $s = 54 - (15 + r) = 54 - (15 + 17) = 22$

6. Pattern of the series is as follow :

$2 + 3 = 5$

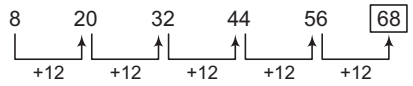
$5 + 3 = 8$

$8 + 5 = 13$

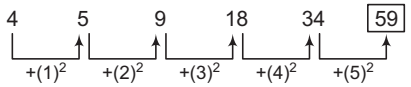
$13 + 8 = 21$

$21 + 13 = \boxed{34}$

7. Pattern of the series is as follow :



8. Pattern of the series is as follow :



9. Pattern of the series is as follow :

2, 3, 5, 7, $\boxed{11}$

Series is containing the prime numbers. Hence, next value after 7 is 11.

10. Pattern of the series is as follow :

As $\quad 122 \Rightarrow 1 \times 2 = 2$

$248 \Rightarrow 2 \times 4 = 8$

$326 \Rightarrow 3 \times 2 = 6$

and $\quad 414 \Rightarrow 4 \times 1 = 4$

Same as, $\quad 177 \Rightarrow 1 \times 7 = 7$

11. Pattern of the series is as follow :

As, $\quad 8 + (2 \times 3) = 14$

$4 + (8 \times 7) = 60$

Similarly,

$9 + (4 \times 8) = 41$

12. Pattern of the series is as follow :

As, $\quad 3 \times 6 \times 1 = 18$

$7 \times 2 \times 4 = 56$

$8 \times 4 \times 3 = 96$

Similarly, $\quad x \times 4 \times 3 = 48$

$$x = \frac{48}{4 \times 3} = 4$$

Self Practice

1. If sum of each row, column and diagonals are equal, then the sum of A and B is

A	3	10
9	7	B
4	11	6

(1) 12 (2) 13 (3) 14 (4) 18

2. Find the value of question mark (?).

8	11	6
15	10	13
12	15	10
19	14	?

(1) 17 (2) 15 (3) 14 (4) 21

3. If the sum of each row, column and diagonal is 24, then find the multiple of x and y.

9	y	11
10	8	6
5	x	7

(1) 32 (2) 40 (3) 44 (4) 48

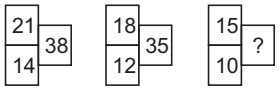
4. Next term of 69, 55, 26, 13, ... is

(1) 5 (2) 4 (3) 6 (4) 8

5. Next term of 86, 48, 32, ... is

(1) 12 (2) 10 (3) 6 (4) 27

6. Identify the pattern and find the value of question mark (?).



(1) 40 (2) 30 (3) 32 (4) 36

7. Identify the pattern and find the value of question mark (?).

(1) 72 (2) 68 (3) 65 (4) 81

Answers

1. (2)	**2.** (1)	**3.** (4)	**4.** (2)	**5.** (3)	**6.** (3)	**7.** (1)	