NCERT QUESTIONS WITH SOLUTIONS

FIGURE IT OUT-01

1. Write formulas for the perimeter of –

(a) triangle with all sides equal.

(b) a regular pentagon (as we have learnt last year, we use the word regular to say that all side lengths and angle measures are equal)

(c) a regular hexagon

Sol. (a) Let side length of each side of triangle = a

So, perimeter of triangle with all sides equal = 3a.

(b) Let side length of a regular pentagon = a

So, perimeter of the regular pentagon = 5a

(c) Let side length of a regular hexagon = a

So, perimeter of the regular hexagon = 6a

2. Munirathna has a 20 m long pipe. However, he wants a longer watering pipe for his garden. He joins another pipe of some length to this one. Give the expression for the combined length of the pipe. Use the letter-number 'k to denote the length in meters Of the Other pipe.

Sol. Length of pipe Munirathna has = 20 m

Length of another pipe he wants to join in meters = k

The combined length of the pipe = (20 + k) m

3. What is the total amount Krithika has, if she has the following numbers of notes of ₹100, ₹20 and ₹5? Complete the following table?

No. of ₹100 notes	No. of ₹20 notes	No. of ₹5 notes	Expression and total amount
3	5	6	
			6 × 100 + 4 × 20 + 3 × 5 = 695
8	4	z	
x	y	z	

Sol.

No. of ₹100 notes	No. of ₹20 notes	No. of ₹5 notes	Expression and total amount
3	5	6	3 × 100 + 5 × 20 + 6 × 5 = 430
6	4	3	6 × 100 + 4 × 20 + 3 × 5 = 695
8	4	z	8 × 100 + 4 × 20 + z × 5 = 880 + 5z
x	y	z	x × 100 + y × 20 + z × 5 = 100x + 20y + 5z

4. Venkatalakshmi owns a flour mill. It takes 10 seconds for the roller mill to Start running. Once it is running, each kg of grain takes 8 seconds to grind into powder. Which of the expressions below describes the time taken to complete grind 'y' kg of grain, assuming the machine is off initially?

(a) 10 + 8 + Y (b) (10 + 8) × y (c) 10 × 8 × y

(d) 10 + 8 × y (e) 10 × y + 8

Sol. Time taken by the roller mill to start running 10 seconds

Time taken by the roller mill to grind each kg of grain to powder = 8 seconds

Therefore, expression for the time taken to complete grind y kg of grain = 10 + 8 × y

Thus, expression (d) 10 + 8 × y describes the given condition.

5. Write algebraic expressions using letters of your choice.

(a) 5 more than a number

(b) 4 less than a n umber

(c) 2 less than 13 times a number

(d) 13 less than 2 times a number

Sol. Let letter 'n' represents the number, then

(a) n + 5 (b) n – 4 (c) 13 × n – 2 (d) 2 × n – 13

6. Describe situations corresponding to the following algebraic expressions:

(a) 8 × x + 3 × y (b) 15 × j – 2 × k

Sol. (a) Kritika bought x number of notebooks and y number of pencils. What is the. total amount she has to pay to the shopkeeper, if the cost of each notebook is ₹8 and cost of each pencil is ₹3?

(b) Rohan earns ₹15 per glass by selling lemonade in his school fete. To maintain the cleanliness he further announced ₹2 discount on each glass, the customer return to him. If he sold j number of glasses and k number of glasses were returned to him, what is the total earnings at the end of the day?

7. In a calendar month, if any 2 × 3 grid full of dates is chosen as shown in the picture, write expressions for the dates in the blank cells if the bottom middle cell has date 'W'.

November 2024

Mon	Tue	Wed	Thu	Fri	Sat	Sun
					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	27	28	29	30

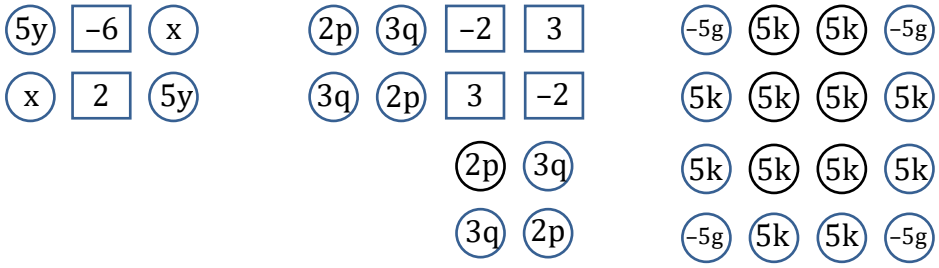
W – 1	W	

Sol.

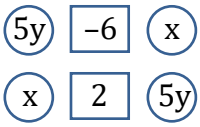
W–8	W-7	W–6
W – 1	W	W+1

FIGURE IT OUT-02

1. Add the numbers in each picture below. Write their corresponding expression and simplify them. Try adding the numbers in each picture in a couple different ways and see that you get the same thing.



Sol.



Way-1

5y + −6 + x + x + 2 + 5y

= 5y + 5y + x + x + − 6 + 2

= 10y + 2x −4

Way-2

(2×5y) + (2×x) + (−6+ 2)

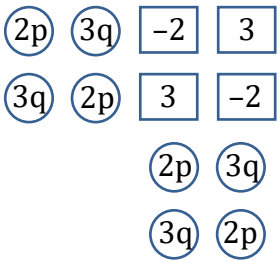
= 2(5y)+(2x)+(−4)

=10y + 2x − 4

Way-3

2(5y+x)+(−6+2)

=10y+2x−4



Way-1

2p+3q+−2+3+3q+2p+3+−2+2p+3q+3q+2p

=2p+2p+2p+2p+3q+3q+3q+3q+−2+−2+3+3

= 8p+12q+2

Way-2

4(2q)+4(3q)+2×(−2)+2×(3)

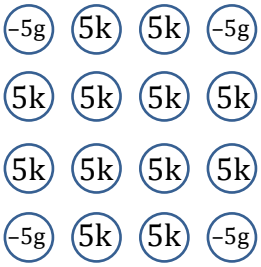
= 8p+12q−4+6

= 8p+12q + 2

Way-3

$4\times(2p + 3q) + 2\times(-2 + 3)$

$= 8p + 12q + 2$



Way-1

$-5g+5k+5k+-5g+5k+5k+5k+5k+5k+5k+5k+-5g+ 5k+5k+5g$

$= -5g + -5g+ -5g +-5g + 5k+5k+5k+5k+5k+5k+5k+5k+5k+5k+k5k+5k+5k+5k+60k$

Way-2

$4 \times (-5g) + 12 \times (5k)$

$= -4 \times 5g + 12 \times 5k$

$= -20g + 60k$

Way-3

$2 \times (-5g) + 2 \times (5k) + 8 \times (5k) + 2 (-g) + 12 (5k)$

$= 4 \times (-5g) + 12 \times (5k)$

$= -20g + 60k$

2. Simplify each of the following expressions

(a) $p + p + p + p, p + p + p + q, p + q + p - q,$

(b) $p - q + p - q, p + q - p + q,$

(c) $p + q - (p + q), p - q - p - q$

(d) $2d - d - d - d, 2d - d - d - c,$

(e) $2d - d - (d - c), 2d - (d - d) - c,$

(f) $2d - d - c - c$

Sol. (a) $p + p + p + p = 4p$

$p + p + p + q = 3p + q$

$p + q + p - q = 2p$

(b) $p - q + p - q = 2p - 2q$

$p + q - p + q = 2q$

(c) $p + q - (p + q) = 0$

$p - q - p - q = -2q$

(d) $2d - d - d - d = -d$

$2d - d - d - c = -c$

(e) $2d - d - (d - c) = c$

$2d - (d - d) - c = 2d - c$

(f) $2d - d - c - c = d - 2c$

FIGURE IT OUT-03

For the problems asking you to find suitable expression(s), first try to understand the relationship between the different quantities in the situation described. If required, assume some values for the unknowns and try to find the relationship.

1. One plate of Jowar roti costs ₹30 and one plate of Pulao costs ₹20. If x plates of Jowar roti and y plates of pulao were ordered in a day, which expression(s) describe the total amount in rupees earned that day?

(a) 30x + 20y
(b) (30 + 20) × (x + y)
(c) 20x + 30y
(d) (30 + 20) × x + y
(e) 30x – 20y

Sol. Cost of one plate of Jowar roti = ₹ 30

∴ Cost of x plate of Jowar roti = 30x

Cost of one plate of Pulao = ₹ 20

∴ Cost of y plate of Pulao = 20y

So, the expression for the total amount earned that day = 30x + 20y

2. Pushpita sells two types of flowers on Independence day: champak and marigold. 'p' customers only bought champak, 'q' customers only bought marigold, and 'r' customers bought both. On the same day, she gave away a tiny national flag to every customer. How many flags did she give away that day?

(a) p + q + r
(b) p + q + 2r
(c) 2 × (p + q + r)
(d) p + q + r + 2
(e) p + q + r + 1
(f) 2 × (p + q)

Sol. Number of customers who bought only champak = p

Number of customers who bought only marigold = q

Number of customers who bought both = r

As Pushpita gave away a tiny national flag to every customer.

So, the number of flags she gives away that day = p + q + r.

3. A snail is trying to climb along the wall of a deep well. During the day it climbs up 'u' cm and during the night it slowly slips down 'd' cm. This happens for 10 days and 10 nights.

(a) Write an expression describing how far away the snail is from its starting position.

(b) What can we say about the snail's movement if d > u?

Sol. (a) During the day, the snail climbs up 'u' cm.

During the night snail slips down d cm.

So, the net distance covered in one day is u-d.

So, in 10 days and 10 nights, the net distance covered by the snail = 10(u-d).

Hence, the expression describing how far away the snail is from it starting position is 10(u – d) cm.

(b) If d > u, the snail slips down more than it climbs.

It means the snail will never reach the top.

4. Radha is preparing for a cycling race and practices daily. The first week she cycles 5 km every day. Every week she increases the daily distance cycled by 'z' km. How many kilometers would Radha have cycled after 3 weeks?

Sol. In the first week, Radha cycled 5 km every day.

So, she cycled 5 × 7 = 35 km in the first week.

In the second week, Radha cycles (5 + z) km every day.

So, she cycled (5 + z) × 7 = (35 + 7z) km in second week.

In the third week, she cycles (5 + z + z = 5 + 2z) km every day.

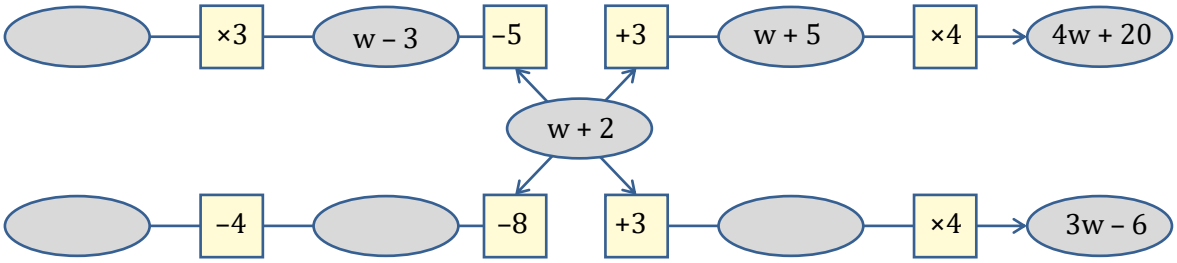
So, she cycled (5 + 2z) × 7 = (35 + 14z) km in third week.

So, number of kilometres Radha cycled in 3 weeks = 35 + (35 + 7z) + (35 + 14z)

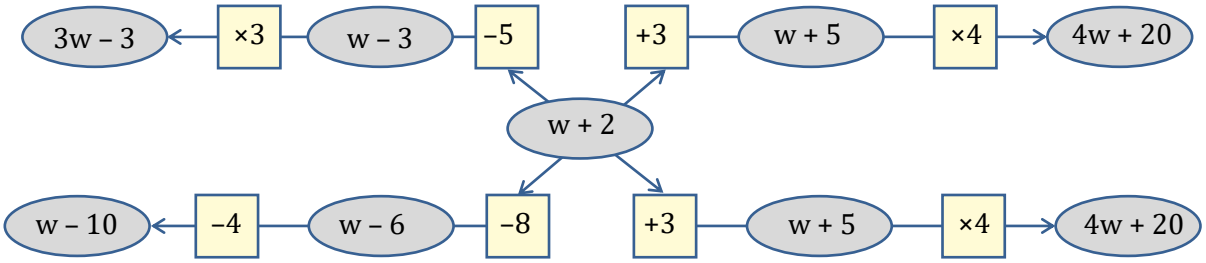
= (35 + 35 + 35) + (7z + 14z)

= 105 + 21z km

5. In the following figure, observe how the expression w + 2 becomes 4w + 20 along one path. Fill in the missing blank on the remaining paths. The ovals contain expressions, and the boxed contain operations.



Sol.



6. A local train from Yahapur to Vahapur stops at three stations at equal distances along the way. The time taken in minutes to travel from one station to the next station is the same and is denoted by t. The train stops for 2 minutes at each of the three stations.

(a) If t = 4, what is the time taken to travel from Yahapur to Vahapur?

(b) What is the algebraic expression for the time taken to travel from Yahapur to Vahapur?

[Hint: Draw a rough diagram to visualise the situation]

Sol. (a) The train from Yahapur to Vahapur stops at 3 stations, and stops for 2 minutes at every station.

Time taken in travelling = 4t

At t = 4, time taken in travelling = 4 × 4 = 16 minutes

Time taken during stoppages = 3 × 2 = 6 minutes

So, the time taken to travel from Yahapur to Vahapur = 16 + 6 = 22 minutes.

(b)

Let the time taken to travel from one station to another station = t

So, time taken to travel from Yahanpur to Vahapur = 4t

As there are three stoppages between these two stations, and the train stops for 2 minutes at each stoppage,

Therefore, total time taken during stoppages = 2 × 3 = 6 minutes

So, the algebraic expression for total time taken is 4t + 6.

7. Simplify the following expressions:

(a) 3a + 9b – 6 + 8a – 4b – 7a + 16

(b) 3(3a – 3b) – 8a – 4b – 16

(c) 2(2x – 3) + 8x + 12

(d) 8x – (2x – 3) + 12

(e) 8h – (5 + 7h) + 9

(f) 23 + 4(6m – 3n) – 8n – 3m – 18

Sol. (a) 3a + 9b – 6 + 8a – 4b – 7a + 16

= (3a + 8a – 7a) + (9b – 4b) + (-6 + 16)

= 4a + 5b + 10

(b) 3(3a – 3b) – 8a – 4b – 16

= 9a – 9b – 8a – 4b – 16

= (9a – 8a) + (–9b – 4b) – 16

= a – 13b – 16

(c) 2(2x – 3) + 8x + 12

= 4x – 6 + 8x + 12

= (4x + 8x) + (-6 + 12)

= 12x + 6

(d) 8x – (2x – 3) + 12

= 8x – 2x + 3 + 12

= 6x + 15

(e) 8h – (5 + 7h) + 9

= 8b – 5 – 7b + 9

= (8b – 7b) + (-5 + 9)

= b + 4

(f) $23 + 4(6m - 3n) - 8n - 3m - 18$

$= 23 + 24m - 12n - 8n - 3m - 18$

$= (23 - 18) + (24m - 3m) + (-12n - 8n)$

$= 5 + 21m - 20n$

8. Add the expressions given below:

(a) $4d - 7c + 9$ and $8c - 11 + 9d$

(b) $-6f + 19 - 8s$ and $-23 + 13f + 12s$

(c) $8d - 14c + 9$ and $16c - (11 + 9d)$

(d) $6f - 20 + 8s$ and $23 - 13f - 12s$

(e) $13m - 12n$ and $12n - 13m$

(f) $-26m + 24n$ and $26m - 24n$

Sol. (a) $4d - 7c + 9$ and $8c - 11 + 9d$

$= 4d - 7c + 9 + 8c - 11 + 9d$

$= (4d + 9d) + (-7c + 8c) + (9 - 11)$

$= 13d + c - 2$

(b) $-6f + 19 - 8s$ and $-23 + 13f + 12s$

$= -6f + 19 - 8s + -23 + 13f + 12s$

$= (-6f + 13f) + (-8s + 12s) + (19 - 23)$

$= 7f + 4s - 4$

(c) $8d - 14c + 9$ and $16c - (11 + 9d)$

$= 8d - 14c + 9 + 16c - 11 - 9d$

$= 8d - 9d - 14c + 16c + 9 - 11$

$= -d + 2c - 2$

$= 2c - d - 2$

(d) $6f - 20 + 8s$ and $23 - 13f - 12s$

$= 6f - 20 + 85 + 23 - 13f - 125$

$= (6f - 13f) + (8s - 12s) + (-20 + 23)$

$= -7f - 4s + 3$

(e) $13m - 12n$ and $12n - 13m$

$= 13m - 12n + 12n - 13m$

$= (13m - 13m) + (-12n + 12n)$

$= 0$

(f) $-26m + 24n$ and $26m - 24n$

$= -26m + 24n + 26m - 24n$

$= (-26m + 26m) + (24n - 24n)$

$= 0$

9. Subtract the expressions given below:

(a) 9a – 6b + 14 from 6a + 9b – 18

(b) –15x + 13 – 9y from 7y – 10 + 3x

(c) 17g + 9 – 7h from 11 – 10g + 3h

(d) 9a – 6b + 14 from 6a – (9b + 18)

(e) 10x + 2 + 10y from -3y + 8 – 3x

(f) 8g + 4h – 10 from 7h – 8g + 20

Sol. (a) (6a + 9b – 18) – (9a – 6b + 14)

= 6a + 9b – 18 – 9a + 6b – 14

= (6a – 9a) + (9b + 6b) + (–18 – 14)

= –3a + 15b – 32

(b) (7y – 10 + 3x) – (–15x + 13 – 9y)

= 7y – 10 + 3x + 15x – 13 + 9y

= (7y + 9y) + (3x + 15x) + (–10 – 13)

= 16y + 18x – 23

(c) (11 – 10g + 3h) – (17g + 9 – 7h)

= 11 – 10g + 3h – 17g – 9 + 7h

= (11 – 9) + (–10g – 17g) + (3h + 7h)

= 2 – 27g + 10h

= 10h – 27g + 2

(d) 6a – (9b + 18) – (9a – 6b + 14)

= 6a – 9b – 18 – 9a + 6b – 14

= (6a – 9a) + (–9b + 6b) + (–18 – 14)

= –3a – 3b – 32

= –(3a + 3b + 32)

(e) (–3y + 8 – 3x) – (10x + 2 + 10y)

= –3y + 8 – 3x – 10x – 2 – 10y

= (–3y – 10y) + (–3x – 10x) + (8 – 2)

= –13y – 13x + 6

(f) (7h – 8g + 20) – (8g + 4h – 10)

= 7h – 8g + 20 – 8g – 4h + 10

= (7h – 4h) + (–8g – 8g) + (20 + 10)

= 3h – 16g + 30

10. Describe situations corresponding to the following algebraic expressions:

(a) 8x + 3y

(b) 15x – 2x

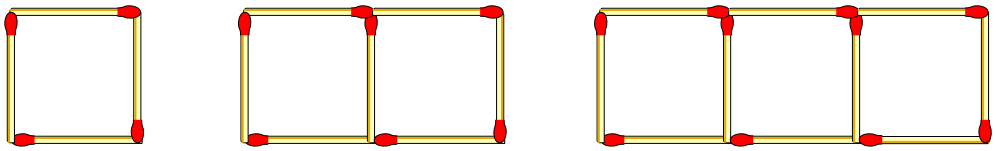
Sol. (a) A notebook costs ₹ 8 and a pen costs ₹ 3. If you buy x notebooks and y pens. Then the total cost bear by you is ₹ (8x + 3y).

(b) A fruit seller has 15 boxes of apples, each box containing x apples. Before selling them, he found that 2 boxes of apples were rotten. The number of fresh apples left is 15x – 2x.

11. Imagine a straight rope. If it is cut once as shown in the picture, we get 2 pieces. If the rope is folded once and then cut as shown, we get 3 pieces. Observe the pattern and find the number of pieces if the rope is folded 10 times and cut. What is the expression for the number of pieces when the rope is folded r times and cut?

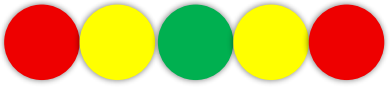
Sol. Step 1 (0 fold): We get 0 + 2 = 2 pieces
Step 2 (1 fold): We get 1 + 2 = 3 pieces
Step 3 (2 folds): We get 2 + 2 = 4 pieces
In the same way, if the rope is folded 10 times and cut, we get 10 + 2 = 12 pieces.
In the same way, when the rope is folded r times and cut, we get r + 2 pieces.

12. Look at the matchstick pattern below. Observe and identify the pattern. How many matchsticks are required to make 10 such squares? How many are required to make w squares?



Sol. Step 1: To make 1 square, we need 4 matchsticks.
Step 2: To make 2 squares, we need 4 + 3 = 7 matchsticks
Step 3: To make 3 squares, we need 4 + 3 + 3 = 10 matchsticks.
And to make w squares we need = 4 + (w – 1) × 3
= 4 + 3(w – 1)
= (4 + 3w – 3)
= 3w + 1 matchsticks.
To make 10 squares, substitute 10 for w:
3(10) + 1 = 30 + 1 = 31 matchsticks

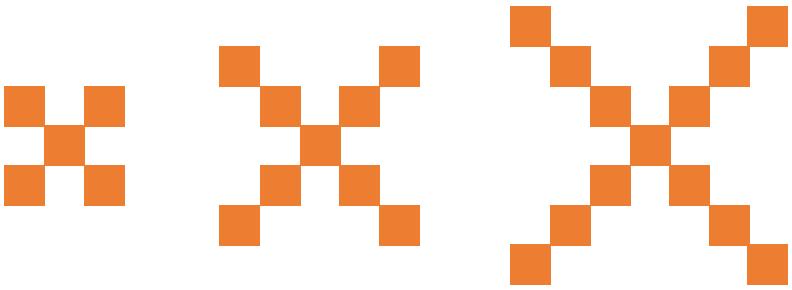
13. Have you noticed how the colours change in a traffic signal? The sequence of colour changes is shown below. Find the colour at positions 90, 190, and 343. Write expressions to describe the positions for each colour.



1 2 3 4 5 .....

Sol. The sequence of red light: 1, 5, 9, ...
In general, 4n – 3 positions
The sequence of green light: 3, 7, 11,.....
In general; 4n – 1 positions
The sequence of yellow light: 2, 4, 6, ...
In general, 2n positions
Since 90 and 190 are even numbers, it will be 2n positions.
Now, 343 ÷ 4 = 85 quotient + 3 remainder.
So, it matches a 4n-1 position.
So, colour at positions 90, 190, and 343 are yellow, yellow, and green, respectively.

14. Observe the pattern below. How many squares will be there in Step 4, Step 10, Step 50? Write a general formula. How would the formula change if we want to count the number of vertices of all the squares?



Sol. Number of squares in step 1 = 5
Number of squares in step 2 = 5 + 4 = 9
Number of squares in step 3 = 5 + 4 + 4 = 5 + 2 × 4 = 13
So, number of squares in step 4 = 5 + 4 + 4 + 4 = 5 + 3 × 4 = 17
So, number of squares in step 10 = 5 + 9 × 4 = 41
And, number of squares in step 50 = 5 + 49 × 4 = 201
So, the general formula = 5 + (n – 1) × 4 = 5 + 4(n – 1) = 5 + 4n – 4 = 4n + 1.
Since 1 square has 4 vertices, the number of vertices (4n + 1) squares have 4(4n + 1) = 16n + 4.

15. Numbers are written in a particular sequence in this endless 4-column grid.

1	2	3	4
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

(a) Give expressions to generate all the numbers in a given column (1, 2, 3, 4).
(b) In which row and column will the following numbers appear:
(i) 124 (ii) 147 (iii) 201
(c) What number appears in row r and column c?
(d) Observe the positions of multiples of 3.
Do you see any pattern in it? List other patterns that you see.

Sol. (a) Expression to generate all the numbers in a given column (1, 2, 3, 4)

Let r be the row number.

Column 1: 1, 5, 9, 13,..... which starts at 1 and adds 4 each row.

So, number in the r^{th} row of column 1 = $4 \times (r - 1) + 1$

Column 2: $4 \times (r - 1) + 2$

Column 3: $4 \times (r - 1) + 3$

Column 4: $4 \times (r - 1) + 4$

If c is the column number, then the general formula to generate all numbers is $4 \times (r - 1) + c$.

(b) (i) We divide each number by 4 to find its row and column

$124 \div 4 \Rightarrow$ Quotient = 31 and remainder is 0

$\therefore$ $124 = 4 \times 31 + 0$ or $4 \times 30 + 4$

Comparing it with $4 \times (r - 1) + c$, we get

$r - 1 = 30, c = 4$

So, $r = 31$ and $c = 4$

So, row is 31 and column is 4

(ii) $147 \div 4 \Rightarrow$ Quotient = 36 and remainder is 3

$\therefore$ $147 = 4 \times 36 + 3$

Comparing it with $4 \times (r - 1) + c$, we get

$r - 1 = 36, c = 3$

So, 147 will appear at row 36 + 1 = 37 and column 3

(iii) $201 \div 4 \Rightarrow$ Quotient = 50 and remainder is 1

$\therefore$ $201 = 4 \times 50 + 1$

Comparing it with $4 \times (r - 1) + c$, we get

$r - 1 = 50, c = 1$

So, 201 will appear at row 51 and column 1.

(c) The number that appears in row r and column c is $4(r - 1) + c$.

(d) Every third number is a multiple of 3.

We can observe that even numbers always appear in column 2 and column 4.

Odd numbers always appear in column 1 and column 3.

Every row has 2 odd and 2 even numbers.

The sum of each row increases by 16.

(e.g., Row 1: 1 + 2 + 3 + 4 = 10, Row 2: 5 + 6 + 7 + 8 = 26, Row 3: 9 + 10 + 11 + 12 = 42)