Mathematics - 8

1. A Square and A Cube

Class Work 1.1

1. (a) Prime factors of 324

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

Since no factor is left over.

Therefore 324 is a perfect square

2	324
2	162
3	81
3	27
3	9
3	3
	1

(b) Prime factors of 5488

$= 2 \times 2 \times 2 \times 2 \times 7 \times 7 \times 7$

If can be expressed as :

$5488 = (2 \times 2) \times (2 \times 2) \times (7 \times 7) \times 7$

Since 7 is left unpowered, therefore 5488 is not a perfect square number.

2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

(c) Prime factors of 14641

$= 11 \times 11 \times 11 \times 11$

It can be expressed as :

$14641 = (11 \times 11) \times (11 \times 11)$

Since No factor is left over therefore 14641 is a perfect square.

11	14641
11	1331
11	121
11	11
	1

(d) Prime factor of 7688

$= 2 \times 2 \times 2 \times 31 \times 31$

It can be expressed as 7688

$= (2 \times 2) \times (2) \times (31 \times 31)$

Since 2 is left unpaired. Therefore 7688 is not a perfect square.

2	7688
2	3844
2	1922
31	961
31	31
	1

2. (a) Prime factors of 2304

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

Since no prime factor is left over, therefore 2304 is a perfect square number.

also, $2304 = 2^2 \times 2^2 \times 2^2 \times 2^2 \times 3^2$

$= (2 \times 2 \times 2 \times 2 \times 3)^2$

$= (48)^2$

Thus 48 is the number whose square is 2304.

2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

(b) Prime factors of 1764

$= 2 \times 2 \times 3 \times 3 \times 7 \times 7$

It can be expressed as 1764

$= (2 \times 2) \times (3 \times 3) \times (7 \times 7)$

Since no prime factor is left over, therefore 1764 is a perfect square number, also

$1764 = (2 \times 2) \times (3 \times 3) \times (7 \times 7)$

$= 2^2 \times 3^2 \times 7^2$

$= (2 \times 3 \times 7)^2$

$1764 = (42)^2$

Thus 42 is the number whose square is 1764.

2	1764
2	882
3	442
3	147
7	49
7	7
	1

(c) Prime factors of 3025 = 5 × 5 × 11 × 11

It can be expressed as 3025

= (5 × 5) × (11 × 11)

Since no prime factor is left over, therefore 3025 is a perfect square number also

$3025 = 5^2 \times 11^2$

$= (5 \times 11)^2$

$= (55)^2$

5	3025
5	605
11	121
11	11
	1

Thus 55 is the number whose square is 3025

(d) Prime factors of 3136

= (2 × 2) × (2 × 2) × (2 × 2) × (7 × 7)

Since no prime factor is left over, therefore 3136 is a perfect square number again

$3136 = 2^2 \times 2^2 \times 2^2 \times 7^2$

$= (2 \times 2 \times 2 \times 7)^2$

$= (56)^2$

So 56 is the number whose square is 3136

2	3136
2	1568
2	784
2	392
2	196
2	98
7	49
7	7
	1

3. (a) Prime factors of 3675

= 3 × 5 × 5 × 7 × 7

It can be written as :

(3) × (5 × 5) × (7 × 7)

Since 3 is left unpaired, therefore number 3675 is not a perfect square number.

To make is perfect square, digit 3 should be paired. Thus, the smallest number by which 3675 should be multiplied to make it perfect square is 3

3	3675
5	1225
5	245
7	49
7	7
	1

So New number which is perfect square

= 3 × 3 × 5 × 5 × 7 × 7

= 11,025

Thus $11{,}025 = 3^2 \times 5^2 \times 7^2$

$= (3 \times 5 \times 7)^2$

$= (105)^2$

So 105 is the number whose square is 11,025 (New Number)

(b) Prime factors of 2156

= 2 × 2 × 7 × 7 × 11

It can be expressed as

= (2 × 2) × (7 × 7) × (11)

Since digit 11 is unpaired. Therefore 2156 is not a perfect square number

2	2156
2	1078
7	539
7	77
11	11
	1

To make 2156 a perfect square, digit 11 should be paired

Thus, the smallest number by which 2156 should be multiplied to make it perfect square is 11 and New number

= (2 × 2) × (7 × 7) × (11 × 11)

= 23,716

(a perfect square number)

Since $23716 = 2^2 \times 7^2 \times 11^2$

$= (2 \times 7 \times 11)^2$

$= (154)^2$

Thus 154 is the number whuse square is 23716.

(c) Prime factors of 3332

$= 2 \times 2 \times 7 \times 7 \times 17$

It can be expressed as 3332

$= (2 \times 2) \times (7 \times 7) \times (17)$

Since digit 17 is un paired. Therefore 3332 is not a perfect square number.

2	3332
2	1666
7	833
7	199
17	17
	1

To make it perfect square, digit 17 should be paired.

Thus digit 17 is the smallest number by which 3332 should be multiplied to get a new number as a perfect square number and

New Number

$= (2 \times 2) \times (7 \times 7) \times (17 \times 17)$

$= 56{,}644$ (pefect square number)

Now New number 56,644

$= 2^2 \times 72 \times 17^2$

$= (2 \times 7 \times 17)^2 = (238)^2$

Hence 238 is the number whose square is 56,644.

(d) Prime factors of 2925

$= 3 \times 3 \times 5 \times 5 \times 13$

It can be expressed as 2925

$= (3 \times 3) \times (5 \times 5) \times 13$

Since digit 13 is unpaired. Therefore 2925 is not a perfect square number.

3	2925
3	975
5	325
5	65
13	13
	1

To make 2925 a perfect square number, digit 13 should be paired.

Thus 13 is the smallest number by which 2925 should be multiplied to get new number as a perfect square number and

New Number

$= (3 \times 3) \times (5 \times 5) \times (13 \times 13)$

$= 38{,}025$ (perfect square number)

and $38{,}025 = 3^2 \times 5^2 \times 13^2$

$= (3 \times 5 \times 13)^2$

$= (195)^2$

hence 195 is the number whose square is 38,025.

4. (a) Prime factors of $1575 = 3 \times 3 \times 5 \times 5 \times 7$

It can be written as 1575

$= (3 \times 3) \times (5 \times 5) \times (7)$

Since digit 7 is unpaired. Therefore 1575 is not a perfect square number

3	1575
3	525
5	175
5	35
7	7
	1

To make 1575 a perfect square number, digit 7 should be eliminated

Thus the smallest number by which 1575 should be divided to make it perfect square is 7.

and new number is $= 1575 \div 7$

= 225 which is a perfect square number

also $225 = 3 \times 3 \times 5 \times 5$

$= 3^2 \times 5^2$

$= (3 \times 5)^2$

$= 15^2$

hence 15 is the number whose square is 225.

(b) Prime factors of 9075

$= 3 \times 5 \times 5 \times 11 \times 11$

It can be expressed as 9075

$= (3) \times (5 \times 5) \times (11 \times 11)$

Since digit 3 is unpaired hence 9075 is not a perfect square number.

3	9075
5	3025
5	605
11	121
11	11
	1

So to get a perfect square, 3 must be eliminated. Thus 3 is the smallest digit by which 9075 should be divided to get a New perfect square.

New Number = $\dfrac{9075}{3}$ = 3025

(perfect square Number)

also 3025 = 5 × 5 × 11 × 11

= $5^2 \times 11^2$

= $(5 \times 11)^2$

= 55^2

hence 55 is the number whose square is 3025

(c) Prime factors of 4851

= 3 × 3 × 7 × 7 × 11

It can be expressed as 4851

= (3 × 3) × (7 × 7) × (11)

Since digit 11 is unpaired hence 4851 is not a perfect square number

$$\begin{array}{r|r} 3 & 4851 \\ \hline 3 & 1617 \\ \hline 7 & 539 \\ \hline 7 & 77 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

So to get a perfect square digit 11 must be eliminated

Thus 11 is the smallest number by which given number 4851 should be divided to get a perfect square and

New Number = $\dfrac{4851}{11}$

= 441

(A perfect square Number)

also 441 = 3 × 3 × 7 × 7

= $3^2 \times 7^2$

= $(3 \times 7)^2$

= $(21)^2$

hence 21 is the number whose square is 441.

(d) Prime factors of 3380

= 2 × 2 × 5 × 13 × 13

It can be expressed as 3380

= (2 × 2) × (5) × (13 × 13)

$$\begin{array}{r|r} 2 & 3380 \\ \hline 2 & 1690 \\ \hline 5 & 845 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

Since digit 5 is unpaired hence 3380 is not a perfect square number

So to get a perfect square, digit 5 must be eliminated

Thus 5 is the least number by which 3380 should be divided to get a new perfect square number and

New Number = $\dfrac{3380}{5}$

= 678 (Perfect Square number)

also 676 = (2 × 2) × (13 × 13)

= $2^2 \times 13^2 = (2 \times 13)^2 = 26^2$

hence 26 is the number whose square is 676.

Class Work 1.2

1. 5 numbers that are not squares

= 2057, 138, 422, 307, 502

2. (b) 34^2

(c) 46^2

(d) 56^2

(e) 74^2

3. If a number contains 3 zeros at the end, its square will have 6 zeros at the end.

4. Parity of Number : if any number is either even or odd. This is called parity of number.

Square of an even number is also an even number e.g. 12 and square of an odd number is also an odd number e.g. 5

Class Work 1.3

$1^2 = 1$	$8^2 = 64$	$15^2 = 225$	$21^2 = 441$	$29^2 = 841$
$2^2 = 4$	$9^2 = 81$	$16^2 = 256$	$22^2 = 484$	$30^2 = 900$
$3^2 = 9$	$10^2 = 100$	$17^2 = 289$	$23^2 = 529$	$31^2 = 961$
$4^2 = 16$	$11^2 = 121$	$18^2 = 324$	$24^2 = 576$	$32^2 = 1024$
$5^2 = 25$	$12^2 = 144$	$19^2 = 361$	$25^2 = 625$	
$6^2 = 36$	$13^2 = 169$	$20^2 = 400$	$26^2 = 676$	
$7^2 = 49$	$14^2 = 196$		$27^2 = 729$	
			$28^2 = 784$	

Since 32^2 = 1024 is greater than 1000. Therefore longest square less than 1000 is 961.

NCERT Exercise 1.1

1. We know that a number having 2, 3, 7 or 8 at unit place is never a perfect square, So 2032, 1027 and 2048 are not a perfect square.

By Prime factorisation

$1089 = \underline{3 \times 3} \times \underline{11 \times 11}$

3	1089
3	363
11	121
11	11
	1

So 1089 is a perfect square.

2. We know that if the unit digit of number is 2 or 8 then the unit digit of the square of the number is 4. So, required numbers are 108^2 and 292^2.

3. Given, $125^2 = 15625$

$\therefore$ $126^2 = 15625 + 126^{th}$ odd number

$= 15625 + (2 \times 126 - 1)$

[$\because$ n^{th} odd number $= 2n - 1$]

$= 15625 + (252 - 1)$

$= 15625 + 251$Ans. (iv)

4. Area of square= Side^2

Given, Area of square = 441 m^2

$\therefore$ Side^2 = 441

$\Rightarrow$ side $= \sqrt{441}$

$= \sqrt{\underline{7 \times 7} \times \underline{3 \quad 3}}$

$= 7 \times 3 = 21$ m

7	441
7	63
3	9
3	3
	1

5. LCM of 4, 9 and 10

2	4, 9, 10
2	2, 9, 5
3	1, 9, 5
3	1, 3 , 5
5	1, 1, 5
	1, 1, 1

LCM of 4, 9 and 10

$= \underline{2 \times 2} \times \underline{3 \times 3} \times 5$

$= 180$

Here, prime factor 5 does not have any pair,

So, 180 is multiplied by 5 to make pair

$\therefore$ $180 \times 5 = 900$ is the required number.

6. By prime factorisation,

$9408 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times 3 \times \underline{7 \times 7}$ Prime factor 3 does not have any pair, so, 9408 should be multiply by 3.

Required number

$= 9408 \times 3$

$= 28224$

2	9408
2	4704
2	2352
2	1176
2	588
2	294
3	147
7	49
7	7
	1

$\sqrt{28224} = \sqrt{2^2 \times 2^2 \times 2^2 \times 3^2 \times 7^2}$

$= 2 \times 2 \times 2 \times 3 \times 7$

$= 168$

7. (i) 16 and 17

We know that total numbers lie between n^2 and $(n + 1)^2 = 2n$.

So, total numbers lie between 16 and 17 are

$2 \times 16 = 32$

(ii) 99 and 100

Required numbers are

$2 \times 99 = 198$

8. Here, 4^{th} term = third term + 1

3^{rd} term = Product of first two numbers

So, $4^2 + 5^2 + 20^2 = (20 + 1)^2 = (21)^2$

and $9^2 + 10^2 + (90)^2 = (91)^2$

9. Here, total number of large squares = 9×9 = 81, number of rows in one large square = 5

and number of columns in one large square = 5

$\therefore$ Total number of tiny squares in 81 large squares

$= 5 \times 5 = 25$

Now, total number of tiny squares in 81 large squares

$= 25 \times 81 = 2025$

Prime factorisation of 2025

$= 3 \times 3 \times 3 \times 5 \times 5$

3	2025
3	675
3	225
3	75
5	25
5	5
	1

Practice Exercise 1.1

1. (a) Prime factorisation of 625

$= 5 \times 5 \times 5 \times 5$

It can be expressed as 625

$= (5 \times 5) \times (5 \times 5)$

5	625
5	125
5	25
5	5
	1

Since no factor is left over therefore 625 is a perfect square number

(b) Prime factors of 729

$= 3 \times 3 \times 3 \times 3 \times 3 \times 3$

It can be expressed as 729

$= (3 \times 3) \times (3 \times 3) \times (3 \times 3)$

3	729
3	243
3	81
3	27
3	9
3	3
	1

Since no prime factors is left over therefore 729 is a perfect square number.

(c) Prime factors of 1176

$= 2 \times 2 \times 2 \times 3 \times 7 \times 7$

It can be expressed as 1176

$= (2 \times 2) \times (2) \times (3) \times (7 \times 7)$

2	1176
2	588
2	294
3	147
7	49
7	7
	1

Since digits 2 and 3 are unpaired therefore 1176 is not a perfect square number.

(d) Prime factors of 11025

$= 3 \times 3 \times 5 \times 5 \times 7 \times 7$

It can be expressed as

$11025 = (3 \times 3) \times (5 \times 5) \times (7 \times 7)$

5	11025
5	2205
3	441
3	147
7	49
7	7
	1

Since No factor is left over

Therefore 11025 is a perfect square number.

(e) Prime factors of 4225

$= 5 \times 5 \times 13 \times 13$

It can be expressed as

$4225 = (5 \times 5) \times (13 \times 13)$

5	4225
5	845
13	169
13	13
	1

Since all the factors of 4225 are in paired form

Therefore 4225 is perfect square number.

(f) Prime factors of 1089

$= 3 \times 3 \times 11 \times 11$

It can be expressed as 1089

$= (3 \times 3) \times (11 \times 11)$

3	1089
3	363
11	121
11	11
	1

Since all the prime factors of 1089 are listed in pair

Therefore 1089 isa perfect square.

(g) Prime factors of 5625

$= 3 \times 3 \times 5 \times 5 \times 5 \times 5$

If can be expressed as 5625

$= (3 \times 3) \times (5 \times 5) \times (5 \times 5)$

$$\begin{array}{r|r} 3 & 5625 \\ \hline 3 & 1875 \\ \hline 5 & 625 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

Since all the prime factors of 5625 are in pair

Therefore 5625 is a perfect square.

(h) Prime factors of 9075

$= 3 \times 5 \times 5 \times 11 \times 11$

It can be expressed as 9075

$= 3 \times (5 \times 5) \times (11 \times 11)$

$$\begin{array}{r|r} 3 & 9075 \\ \hline 5 & 3025 \\ \hline 5 & 605 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Since prime factor 3 does not have its pair therefore 9075 is not a perfect square.

2. (a) Prime factors 2601

$= 3 \times 3 \times 17 \times 17$

It can be expressed as 2601

$= (3 \times 3) \times (17 \times 17)$

$$\begin{array}{r|r} 3 & 2601 \\ \hline 3 & 867 \\ \hline 17 & 289 \\ \hline 17 & 17 \\ \hline & 1 \end{array}$$

Since all the prime factors are in pair

Therefore 2601 is a perfect square

$\sqrt{2601} = 3 \times 17$

$\therefore \sqrt{2601} = 51$

Thus the square root of 2601 is 51

(b) Prime factors of 7056

$= (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (7 \times 7)$

Prime factors of 7056 can be written in pair. Therefore 7056 is a perfect Square and

$\sqrt{7056} = 2 \times 2 \times 3 \times 7$

$\therefore \sqrt{7056} = 84$

$$\begin{array}{r|r} 2 & 7056 \\ \hline 2 & 3528 \\ \hline 2 & 1764 \\ \hline 2 & 882 \\ \hline 3 & 441 \\ \hline 3 & 147 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Thus the square root of 7056 is 84

(c) Prime factors of 8281

$= (7 \times 7) \times (13 \times 13)$

Since all prime factors of 8281 are in pairs. Therefore 8281 is a perfect square.

$$\begin{array}{r|r} 7 & 8281 \\ \hline 7 & 1183 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

Also $\sqrt{8281} = 7 \times 13$

$\therefore \sqrt{8281} = 91$

Thus square root of 8281 is 91.

(d) Prime factors of 5929

$= (7 \times 7) \times (11 \times 11)$

$$\begin{array}{r|r} 7 & 5929 \\ \hline 7 & 847 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Since all prime factors are in pair therefore 5929 is a perfect square number

Also $\sqrt{5929} = 7 \times 11$

$\therefore \sqrt{5929} = 77$

Thus square root of 5929 is 77.

3. (a) Prime factors of 9075

$= (3) \times (5 \times 5) \times (11 \times 11)$

as the prime factor 3 is not paired, so 9075 is not perfect square

To make 9075 perfect square. Prime number 3 should be paired

$$\begin{array}{r|r} 3 & 9075 \\ \hline 5 & 3025 \\ \hline 5 & 605 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

So 3 is the least number by which 9075 be multiplied to get a perfect square number

New Number = 9075 × 3

= 27,225

(Perfect Square Number)

Prime factors of 27,225

= (3 × 3) × (5 × 5) × (11 × 11)

also $\sqrt{27{,}225} = 3 \times 5 \times 11$

$\therefore \quad \sqrt{27{,}225} = 165$

Thus 3 is the least number by which given number should multiplied to get perfect square and 165 is the number whose square is 27,225.

(b) Prime factors of 7623

= (3 × 3) × (7) × (11 × 11)

as the prime factor 7 is not paired, so 7623 is not a perfect square number.

To make 7623 perfect square. Prime factor 7 should be paired

$$\begin{array}{r|r} 3 & 7623 \\ \hline 3 & 2541 \\ \hline 7 & 847 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

So 7 is the least number by which 7623 be multiplied to get a perfect square and

New Number = 7623 × 7

= 53,361

(perfect square number)

Prime factors of 56,361

= (3 × 3) × (7 × 7) × (11 × 11)

also 56,361 = $3^2 \times 7^2 \times 11^2$

= $(3 \times 7 \times 11)^2$

= $(231)^2$

thus 231 is the number whose square is 56,361

(c) Prime factors of 3380

= (2 × 2) × (5) × (13 × 13)

as prime factor 5 is not paired, so 3380 is not a perfect square.

To make 3380 a perfect square, we multiply it by 5

$$\begin{array}{r|r} 2 & 3380 \\ \hline 2 & 1690 \\ \hline 5 & 845 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

Thus, the required perfect square number is

3380 × 5 = 16,900

Also, 16,900

= (2 × 2) × (5 × 5) × (13 × 13)

= $2^2 \times 5^2 \times 13^2$

= $(2 \times 5 \times 13)^2$

= $(130)^2$

Thus, 5 is the least number by which 3380 be multiplied to get a perfect square and 130 is the number whose square is 16,900.

(d) Prime factors of 2475

= (3 × 3) × (5 × 5) × (11)

as prime factor 11 is not paired, so 2475 is not perfect square

$$\begin{array}{r|r} 3 & 2475 \\ \hline 3 & 825 \\ \hline 5 & 275 \\ \hline 5 & 55 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

To make 2475 perfect square, we multiply it by 11

Thus, the required perfect square number is

2475 × 11 = 27,225

also, 27,225

= (3 × 3) × (5 × 5) × (11 × 11)

= $3^2 \times 5^2 \times 11^2$

= $(3 \times 5 \times 11)^2$

= $(165)^2$

Thus, 11 is the least number by which 2475 be multiplied to get a perfect square and 165 is the number whose square is 27,225.

4. (a) Prime factors of 4056

= (2 × 2) × (2) × (3) × (13 × 13)

As the prime factors 2 and 3 have no pair, so 4056 is not perfect square

$$\begin{array}{r|r} 2 & 4056 \\ \hline 2 & 2028 \\ \hline 2 & 1014 \\ \hline 3 & 507 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

So, we must divide the number by 2 × 3 = 6. So that it be comes a perfect square and New Number so obtained is $\dfrac{4056}{6}$

$= 676$ (perfect square)

Now $676 = (2 \times 2) \times (13 \times 13)$

$= 2^2 \times 13^2$

$= (2 \times 13)^2$

$= 26^2$

Thus 26 is the number whose square is 676 and 6 is the least number by which number 4056 should be divided to get perfect square number.

(b) Prime factors of 4500

$= (2 \times 2) \times (3 \times 3) \times (5 \times 5) \times (5)$

as the prime number 5 is not paired hence 4500 is not perfect square number.

$$\begin{array}{r|r} 2 & 4500 \\ \hline 2 & 2250 \\ \hline 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

To make 4500 a perfect square, we must divide it by 5

Thus, the required perfect square number is 4500 ÷ 5 = 900

So, 5 is the least number by which 4500 should be divided to get perfect square.

(c) Prime factors of 8820

$= (2 \times 2) \times (3 \times 3) \times (5) \times (7 \times 7)$

as the prime number 5 is not paired. So 8820 is not a perfect square.

$$\begin{array}{r|r} 2 & 8820 \\ \hline 2 & 4410 \\ \hline 3 & 2205 \\ \hline 3 & 735 \\ \hline 5 & 245 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

So, we must divide the number by 5. So that it becomes a perfect square and the number so obtained is 8820 ÷ 5 = 1764

Thus 5 is the least number by which given number should be divided to get perfect square.

(d) Prime factors of 7776

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

as the prime factors 2 and 3 are not paired.

So 7776 is not perfect square.

$$\begin{array}{r|r} 2 & 7776 \\ \hline 2 & 3888 \\ \hline 2 & 1944 \\ \hline 2 & 972 \\ \hline 2 & 486 \\ \hline 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

So, we must divide the number by 2 × 3 = 6,

So that it be comes a perfect square and the perfect square so obtained is 7776 ÷ 6 = 1,296

Thus 6 is the least number by which given number should be divided to get a perfect square.

5. We know that square of an even number is also an even number

(a) So, 256 is the square of an even number

(c) 400 is the square of an even number

(d) 1024 is the square of an even number

(g) 196 is the square of an even number

(h) 900 is also the square of an even number

6. (a) Prime factors of 360

$= (2 \times 2) \times (2) \times (3 \times 3) \times (5)$

as prime factors 2 and 5 have no pair

So, number 360 is not a perfect square.

2	360
2	180
2	190
3	45
3	15
5	5
	1

OR

Since the given number 360 ends with odd number of zero. So it can not be a perfect square.

(b) Since given number 9468 ends with 8. So it can not be a perfect square.

(c) Since given number 8457 ends with 7. So it can not be a perfect square.

(d) Since given number 5372 ends with 2. So it can not be a perfect square.

(e) Since given number 6778 ends with 8. So it can not be a perfect square.

(g) Since given number 64000 ends with odd number of zeros. So it can not be perfect square.

(h) Since given number 2400000 ends with odd number of zeros. So it can not be perfect square.

7. (a) Prime factors of 1296

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

$\sqrt{1296} = 2 \times 2 \times 3 \times 3$

$\therefore \sqrt{1296} = 36$

2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

thus, the square root of 1296 is 36

(b) Prime factors of 2025

$= (3 \times 3) \times (3 \times 3) \times (5 \times 5)$

$\sqrt{2025} = 3 \times 3 \times 5$

$\therefore \sqrt{2025} = 45$

3	2025
3	675
3	225
3	75
5	25
5	5
	1

thus, the square root of 2025 is 45

(c) Prime factors of 4096

$= (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2)$

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$\sqrt{4096} = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$\therefore \sqrt{4096} = 64$

Thus, the square root of 4096 is 64

(d) Prime factors of 7056

$= (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (7 \times 7)$

$\sqrt{7056} = 2 \times 2 \times 3 \times 7$

$\therefore \sqrt{7056} = 84$

2	7056
2	3528
2	1764
2	882
3	441
3	147
7	49
7	7
	1

Thus, the square root of $\sqrt{7056}$ is 84

(e) Prime factors of 9216

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

$\sqrt{9216} = 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$\therefore \quad \sqrt{9216} = 96$

$$\begin{array}{r|r} 2 & 9216 \\ \hline 2 & 4608 \\ \hline 2 & 2304 \\ \hline 2 & 1152 \\ \hline 2 & 576 \\ \hline 2 & 288 \\ \hline 2 & 144 \\ \hline 2 & 72 \\ \hline 2 & 36 \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

thus, the square root of 9216 is 96

(f) Prime factors of 11025

$= (3 \times 3) \times (5 \times 5) \times (7 \times 7)$

$$\begin{array}{r|r} 3 & 11025 \\ \hline 3 & 3675 \\ \hline 5 & 1225 \\ \hline 5 & 245 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

$\sqrt{11025} = 3 \times 5 \times 7$

$\therefore \quad \sqrt{11025} = 105$

Thus, the square root of 11025 is 105

(g) Prime factors of 15876

$= (2 \times 2) \times (3 \times 3) \times (3 \times 3) \times (7 \times 7)$

$\sqrt{15876} = 2 \times 3 \times 3 \times 7$

$\therefore \quad \sqrt{15876} = 126$

$$\begin{array}{r|r} 2 & 15876 \\ \hline 2 & 7938 \\ \hline 3 & 3969 \\ \hline 3 & 1323 \\ \hline 3 & 441 \\ \hline 3 & 147 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Thus, the square root of 15876 is 126

(h) Prime factors of 17424

$= (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (11 \times 11)$

$\sqrt{17424} = 2 \times 2 \times 3 \times 11$

$\therefore \quad \sqrt{17424} = 132$

$$\begin{array}{r|r} 2 & 17424 \\ \hline 2 & 8712 \\ \hline 2 & 4356 \\ \hline 2 & 2178 \\ \hline 3 & 1089 \\ \hline 3 & 363 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

thus, the square root of 17424 is 132

8. (a) Prime factors of 294

$= (2) \times (3) \times (7 \times 7)$

as prime factors 2 and 3 are not in pair, so 294 is not perfect square thus, to make it perfect square, we must multiply given number by $2 \times 3 = 6$

$$\begin{array}{r|r} 2 & 294 \\ \hline 3 & 147 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

and New number $= 294 \times 6$

$= 1764$

(perfect square number)

also $1764 = (2 \times 2) \times (3 \times 3) \times (7 \times 7)$

$\sqrt{1764} = 2 \times 3 \times 7$

$\therefore \quad \sqrt{1764} = 42$

Thus 6 is the smallest number by which given number should be multiplied so as to get a perfect square and square root of New Number 1764 is 42.

(b) Prime factors of 720

$= (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times 5$

as the prime factor 5 is not paired. So 720 is not a perfect square number.

To make it perfect square, one more 5 is required to complete pair.

$$\begin{array}{r|r} 2 & 720 \\ \hline 2 & 360 \\ \hline 2 & 180 \\ \hline 2 & 90 \\ \hline 3 & 45 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

So given number should be multiplied by 5 to get a perfect square.

$\therefore$ $720 \times 5 = 3600$ is a perfect square

Thus $3600 = (2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (5 \times 5)$

$\therefore$ $\sqrt{3600} = 2 \times 2 \times 3 \times 5$

$= 60$

Thus square root of obtained perfect square number 3600 is 60

(c) Prime factors of 3042

$= (2) \times (3 \times 3) \times (13 \times 13)$

as the prime factor 2 is not paired

So 3042 is not a perfect square.

2	3042
3	1521
3	507
13	169
13	13
	1

To make it perfect square, one more digit 2 is required to complete pair so given number 3042 should be multiplied by 2 to get a perfect square

$\therefore$ $3042 \times 2 = 6084$ is a perfect square

thus $6084 = (2 \times 2) \times (3 \times 3) \times (13 \times 13)$

$\therefore$ $\sqrt{6084} = 2 \times 3 \times 13$

$= 78$

Thus square root of 6084 is 78.

(d) Prime factors of 6300

$= (2 \times 2) \times (3 \times 3) \times (5 \times 5) \times (7)$

as prime factor 7 is not paired. So given number 6300 is not a perfect square.

2	6300
2	3150
3	1575
3	525
5	175
5	35
7	7
	1

To make it perfect square, one more digit 7 is required to complete the pair.

So given number 6300 should be multiplied by 7 to get a perfect square.

$\therefore$ $6300 \times 7 = 44100$ is a perfect square

Thus $44100 = (2 \times 2) \times (3 \times 3) \times (5 \times 5) \times (7 \times 7)$

$\therefore$ $\sqrt{44100} = 2 \times 3 \times 5 \times 7$

$= 210$

So square root of 44100 is 210

9. (a) Prime factors of 2475

$= (3 \times 3) \times (5 \times 5) \times (11)$

We find that, prime factor 11 is unpaired so given number 2475 is not a perfect square

So, we must decide the number by 11 to make it perfect square

3	2475
3	825
5	275
5	55
11	11
	1

$\therefore$ $2475 \div 11 = 225$ is a perfect square

Thus $225 = (3 \times 3) \times (5 \times 5)$

$\therefore$ $\sqrt{225} = 3 \times 5$

$= 15$

Thus the square root of 225 is 15

(b) Prime factors of 3380

$= (2 \times 2) \times (5) \times (13 \times 13)$

We find that prime factor 5 is not paired.

So given number 3380 is not a perfect square. So we must divide the number by 5 to make it a perfect square.

2	3380
2	1690
5	845
13	169
13	13
	1

$\therefore$ $3380 \div 5 = 676$ is a perfect square

Thus $676 = (2 \times 2) \times (13 \times 13)$

$\therefore$ $\sqrt{676} = 2 \times 13$

$= 26$

Thus the square root of 676 is 26.

(c) Prime factors of 9408

$= (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (3) \times (7 \times 7)$

as prime factor 3 is not paired so number 9408 is not a perfect square

So, we must divide the number by 3 to make it perfect square

$$\begin{array}{r|r} 2 & 9408 \\ \hline 2 & 4704 \\ \hline 2 & 2352 \\ \hline 2 & 1176 \\ \hline 2 & 588 \\ \hline 2 & 294 \\ \hline 3 & 147 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

$\therefore$ 9408 ÷ 3 = 3136 is a perfect square

Thus $3136 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (7 \times 7)$

$\therefore \sqrt{3136} = 2 \times 2 \times 2 \times 7$

$= 56$

Thus the square root of 3136 is 56.

(d) Prime factors of 61347

$= 3 \times (11 \times 11) \times (13 \times 13)$

as prime factor 3 is not paired so number 61347 is not a perfect square. So we must divide number 61347 by digit 3 to get a perfect square.

$$\begin{array}{r|r} 3 & 61347 \\ \hline 11 & 20449 \\ \hline 11 & 1859 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

$\therefore$ 61347 ÷ 3 = 20,449 is a perfect square

thus $20,449 = (11 \times 11) \times (13 \times 13)$

$\therefore \sqrt{20,449} = 11 \times 13$

$= 143$

Thus the square root of 20,449 is 143.

10. (a) The smallest number divisible by 6, 9 and 15 is LCM of 6, 9 and 15

LCM of 6, 9, 15 $= 2 \times 3 \times 3 \times 5$

$= 90$

$$\begin{array}{r|l} 2 & 6,9,15 \\ \hline 3 & 3,9,15 \\ \hline 3 & 1,3,5 \\ \hline 5 & 1,1,5 \\ \hline & 1,1,1 \end{array}$$

Prime factors of 90 $= 2 \times (3 \times 3) \times 5$

as prime factors 2 and 5 are not paired

So we must multiplied it by $2 \times 5 = 10$ to get a perfect square

$\therefore$ $90 \times 10 = 900$ is a perfect square

Thus 900 is the smallest perfect square number which is divisible by 6, 9 and 15.

(b) The smallest number divisible by 4, 7, 8 and 16 is the LCM of (4, 7, 8, 16)

LCM of 4, 7, 8, 16

$= 2 \times 2 \times 2 \times 2 \times 7$

$= 112$

Prime factors of 112

$= (2 \times 2) \times (2 \times 2) \times (7)$

as prime factor 7 is not paired

So we must multiply 112 by 7 to get a perfect square number

$$\begin{array}{r|l} 2 & 4,7,8,16 \\ \hline 2 & 2,7,4,8 \\ \hline 2 & 1,7,2,4 \\ \hline 2 & 1,7,1,2 \\ \hline 7 & 1,7,1,1 \\ \hline & 1,1,1,1 \end{array}$$

$\therefore$ $112 \times 7 = 784$ is a perfect square

Thus 784 is the smallest perfect square number that is divisible by each of 4, 7, 8 and 16

(c) The smallest number divisible by 3, 6, 10 and 15 is the LCM of (3, 6, 10, 15)

LCM of (3, 6, 10, 15) $= 2 \times 3 \times 5$

$= 30$

Prime factors of 30 $= (2) \times (3) \times (5)$

as all the prime factors are not in pair

So 30 is not a perfect square number.

$$\begin{array}{r|l} 2 & 3,6,10,15 \\ \hline 3 & 3,3,5,15 \\ \hline 5 & 1,1,5,5 \\ \hline & 1,1,1,1 \end{array}$$

So we must multiply 30 by $2 \times 3 \times 5 = 30$ to get a perfect square nuber

$\therefore$ $30 \times 30 = 900$ is a perfect square number

Thus 900 is the smallest perfect square number.

11. (a) Prime factors of 625

$= (5 \times 5) \times (5 \times 5)$

$\therefore \sqrt{625} = 5 \times 5$

$= 25$

and prime factors of 729

$= (3 \times 3) \times (3 \times 3) \times (3 \times 3)$

$\therefore \sqrt{729} = 3 \times 3 \times 3$

$= 27$

Now, $\sqrt{\dfrac{625}{729}} = \dfrac{\sqrt{625}}{\sqrt{729}} = \dfrac{25}{27}$

(b) Prime factors of 169 = 13 × 13

$\therefore \sqrt{169} = 13$ and

Prime factors of 289 = 17 × 17

$\therefore \sqrt{289} = 17$

Now, $\sqrt{\dfrac{169}{289}} = \dfrac{\sqrt{169}}{\sqrt{289}} = \dfrac{13}{17}$

(c) Converting mix fraction $9\dfrac{67}{121}$ into proper fraction

$$9\frac{67}{121} = \frac{(121\times9)+67}{121} = \frac{1{,}156}{121}$$

$$\sqrt{9\frac{67}{121}} = \sqrt{\frac{1{,}156}{121}} = \frac{\sqrt{1156}}{\sqrt{121}}$$

$$= \frac{\sqrt{(2\times2)\times(17\times17)}}{\sqrt{(11\times11)}}$$

$$= \frac{2\times17}{11}$$

$$= \frac{34}{11}$$

$$= 3\frac{1}{11}$$

(d) Converting mix fraction $16\dfrac{169}{441}$ into improper fraction

$$16\frac{169}{441} = \frac{441\times16+169}{441} = \frac{7{,}225}{441}$$

$$\sqrt{16\frac{169}{441}} = \sqrt{\frac{7{,}225}{441}} = \frac{\sqrt{7{,}225}}{\sqrt{441}}$$

$$= \frac{\sqrt{(5\times5)\times(17\times17)}}{\sqrt{(3\times3)\times(7\times7)}}$$

$$= \frac{5\times17}{3\times7} = \frac{85}{21}$$

$$= 4\frac{1}{21}$$

(e) $\sqrt{98\times162}$

$= \sqrt{(2\times7\times7)\times(2\times3\times3\times3\times3)}$

$= \sqrt{(2\times2)\times(3\times3)\times(3\times3)\times(7\times7)}$

$= 2 \times 3 \times 3 \times 7$

$= 126$

(f) Prime factors of 45 = 3 × 3 × 5 and

Prime factors of 20 = 2 × 2 × 5

$\sqrt{45\times20} = \sqrt{(3\times3\times5)\times(2\times2\times5)}$

Now we write all prime factors in pairs

$= \sqrt{(2\times2)\times(3\times3)\times(5\times5)}$

$= 2 \times 3 \times 5$

$= 30$

(g) we have 1.96

Converting decimal into fraction

$$1.96 = \frac{196}{100}$$

$$\sqrt{1.96} = \sqrt{\frac{196}{100}} = \frac{\sqrt{196}}{\sqrt{100}}$$

$$= \frac{\sqrt{(2\times2)\times(7\times7)}}{\sqrt{(2\times2)\times(5\times5)}}$$

$$= \frac{2\times7}{2\times5}$$

$$= \frac{14}{10}$$

$= 1.4$

(h) Converting decimal into fraction

$$0.0064 = \frac{64}{10{,}000}$$

$$\sqrt{0.0064} = \sqrt{\frac{64}{10{,}000}}$$

$$= \sqrt{\frac{(8\times8)}{(100\times100)}}$$

$$= \frac{8}{100} = 0.08$$

12. Total Number of plants = 4225

at number of plants in each row = x

Since Number of plants in arow

= Number of rows

Number of rows = x

Total plants in garden = $x \times x$

= x^2

According to question,

$$x^2 = 4225$$

$$x = \sqrt{4225}$$

$$= \sqrt{(5\times5)\times(13\times13)}$$

$$= 5 \times 13$$

$$= 65$$

Thus, Number of rows is 65 and number of plants in each row is 65.

13. Given that area of a rectangle

= 1936 sq. m

and the length of rectangle

= 4 × breadth of rectangle

Let the breadth of rectangle is x

So the length of the rectangle = $4 \times x$

= $4x$

∴ area of the rectangle

= length × breadth

= $4x \times x$

= $4x^2$ sq. m

According to question

$$4x^2 = 1936$$

$$\Rightarrow \quad x^2 = \frac{1936}{4}$$

$$\Rightarrow \quad x^2 = 484$$

$$\Rightarrow \quad x = \sqrt{484}$$

$$\Rightarrow \quad x = \sqrt{(2\times2)\times(11\times11)}$$

$$\Rightarrow \quad x = 2 \times 11 = 22 \text{ m}$$

Thus the breadth of the rectangular is 22 m and the length of the rectangle is 22 × 4 = 88 m

14. Given that the product of two numbers = 7260 and one number = 15 × other number

Let the numbers are x and y

$$\therefore \quad xy = 7260 \qquad \text{...Eq. (1)}$$

also $\quad y = 15x$

Putting value of y in the equation (1) we get

$$x \times 15x = 7260$$

$$\Rightarrow \quad 15x^2 = 7260$$

$$\Rightarrow \quad x^2 = \frac{7260}{15}$$

$$\Rightarrow \quad x^2 = 484$$

$$\Rightarrow \quad x = \sqrt{484}$$

$$= \sqrt{(2\times2)\times(11\times11)}$$

$$x = 2 \times 11$$

$$x = 22$$

and $\quad y = 15x$

$$\therefore \quad y = 15 \times 22$$

$$= 330$$

Thus the numbers are 22 and 330

15. Total number of the students = 2000

and Number of Students who could not be accommodated in arrangement = 64

Now No of student for arrangements

= 2000 – 64

= 1936

as In arrangement, No of rows

= No of columns

Let Number of the rows = x

Then, Number of the columns = x

Total students for arrangement

= $x \times x$

= x^2

According to question

$$x^2 = 1936$$

$$\Rightarrow \quad x = \sqrt{1936}$$

$$\Rightarrow \quad x = \sqrt{(2\times2)\times(2\times2)\times(11\times11)}$$

$$= 2 \times 2 \times 11$$

$$\therefore \quad x = 44$$

Thus Number of rows is 44.

Class Work 1.4

1. (a) We know that if a number has 1, 4, 5, 6 or 9 in the unit place then its cube also end with same digit

So unit digit of the cube of 31 is 1

(b) unit digit of the cube of 109 is 9

(c) unit digit of the cube of 2465 is 5

(d) unit digit of the cube of 674 is 4

(e) unit digit of the cube of 378 is 2

(f) unit digit of the cube of 150 is 0

(g) unit digit of the cube of 392 is 8

(h) unit digit of the cube of 226 is 6

2. (a) Expressing 243 into prime factors, we have

$$243 = (3 \times 3 \times 3) \times 3 \times 3$$

$$\begin{array}{r|r} 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

Since 243 can not be expressed as product of trip lets of equal prime factors, thus 243 is not a perfect cube.

(b) Expressing 1728 into prime factors, we have

$$1728 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (3 \times 3 \times 3)$$

$$\begin{array}{r|r} 2 & 1728 \\ \hline 2 & 864 \\ \hline 2 & 432 \\ \hline 2 & 216 \\ \hline 2 & 108 \\ \hline 2 & 54 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

Since 1728 can be expressed as product of triplets of equal prime factors, thus 1728 is a perfect cube.

(c) Expressing 3824 into prime factors, we have

$$3824 = (2 \times 2 \times 2) \times 2 \times 239$$

$$\begin{array}{r|r} 2 & 3824 \\ \hline 2 & 1912 \\ \hline 2 & 956 \\ \hline 2 & 478 \\ \hline 239 & 239 \\ \hline & 1 \end{array}$$

Since prime factors of 3824, we find that, we are left with two prime factors 2 and 239. So 3824 can not be expressed as product of triplets of equal prime factors thus 3824 is not a perfect cube.

(d) Expressing 5324 into prime factors, we have

$$5324 = 2 \times 2 \times (11 \times 11 \times 11)$$

$$\begin{array}{r|r} 2 & 5324 \\ \hline 2 & 2662 \\ \hline 11 & 1331 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Since 5324 can not be express as product of triplets of equal prime factors thus 5324 is not a perfect cube.

(e) Prime factors of 2437 = 2437 × 1

Since 2437 can not be express as product of triplets of equal prime lactors thus 2437 is not a perfect cube.

(f) Prime lactors of 3375

$$= (3 \times 3 \times 3) \times (5 \times 5 \times 5)$$

$$\begin{array}{r|r} 3 & 3375 \\ \hline 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

Since 3375 can be expressed as product of triplets of equal prime factors thus 3375 is a perfect cube

(g) Prime factors of 74088

$$= (2 \times 2 \times 2) \times (3 \times 3 \times 3) \times (7 \times 7 \times 7)$$

$$\begin{array}{r|r} 2 & 74088 \\ \hline 2 & 37044 \\ \hline 2 & 18522 \\ \hline 3 & 9261 \\ \hline 3 & 3087 \\ \hline 3 & 1029 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Since, 74088 can be expressed as the product of triplets of equal prime factors, thus 74088 is a perfect cube

(h) Prime factors of 2197

$$= (13 \times 13 \times 13)$$

$$\begin{array}{r|r} 13 & 2197 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

Since 2197 can be expressed as product of triplets of equal prime factor 13. Thus 2197 is a perfect cube.

3. (a) Expressing 92 into prime factors, we have

$$92 = 2 \times 2 \times 23$$

Since 92 can not be express as the product of triplets of same prime factor

$$\begin{array}{r|r} 2 & 92 \\ \hline 2 & 46 \\ \hline 23 & 23 \\ \hline & 1 \end{array}$$

So 92 is not a perfect cube

To make it perfect cube, we must multiply by $2 \times 23 \times 23 = 1058$

(b) Writing 135 as a product of prime factors, we have

$$135 = (3 \times 3 \times 3) \times 5$$

Since 135 can be express in form of product of triplets of same prime factors

$$\begin{array}{r|r} 5 & 135 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

So 135 is not pefect cube.

To make it perfect cube, it must multiplied by $5 \times 5 = 25$

Thus 25 is the smallest number by which 135 should be multiplied to get perfect cube.

(c) Writing 243 as a product of prime factors, we have

$$243 = (3 \times 3 \times 3) \times 3 \times 3$$

Since all 3s can not be expressed in form of product of triplets. So 243 is not a perfect cube.

$$\begin{array}{r|r} 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

To make it perfect cube. It must multipled by 3

The 3 is the smallest number by which 243 should be multiplied to make it perfect cube.

(d) Expressing 3267 into prime factors. We have,

$$3267 = (3 \times 3 \times 3) \times 11 \times 11$$

Since 3267 can not be express in form of product of triplets of same prime factors so 3267 is not a perfect cube

To make it perfect cube, it must be multiplied by 11

$$\begin{array}{r|r} 3 & 3267 \\ \hline 3 & 1089 \\ \hline 3 & 363 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Thus 11 is the smallest number by which 3267 should be multiplied to make it perfect cube.

4. (a) Prime factors of 1125

$$= 3 \times 3 \times (5 \times 5 \times 5)$$

$$\begin{array}{r|r} 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

Since 3×3 is left after grouping in triplets

So 1125 is not a perfect cube

To make it perfect cube, we must divide 1125 by $3 \times 3 = 9$

Thus 9 is the smallest number by which 1125 must be divided to obtain perfect cube.

(b) Expressing 3087 into prime factors, we have

$$3087 = 3 \times 3 \times (7 \times 7 \times 7)$$

Since 3×3 is left after grouping in triplets

$$\begin{array}{r|r} 3 & 3087 \\ \hline 3 & 1029 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

So 3087 is not a perfect cube

To make it perfect cube, we must divide 3087 by 3 × 3 = 9

Thus I is the smallest number by which 3087 must be divided to obtain perfect cube.

(c) Expressing 8192 into prime factors, we have

$8192 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times 2$

Since 2 is left after grouping in triplets. So 8192 is not a perfect cube.

2	8192
2	4096
2	2048
2	1024
2	512
2	256
2	148
2	64
2	32
2	16
2	8
2	4
2	2
	1

To make it perfect cube, we must divide it by 2

Thus 2 is the smallest number by which 8192 must be divided to obtain a perfect cube.

(d) Expressing 53240 into prime factors, we have

$53240 = (2 \times 2 \times 2) \times 5 \times (11 \times 11 \times 11)$

Since 5 is left after grouping in triplets. So 53240 is not a perfect cube.

2	53240
2	26620
2	13310
5	26655
11	1331
11	121
11	11
	1

To make it perfect cube, we must divide it by 5 thus 5 is the smallelst number by which 53240 must be divided to obtain a perfect cube.

5. (a) $(0.05)^3 = 0.05 \times 0.05 \times 0.05$
$= 0.000125$

(b) $(-6)^3 = (-6) \times (-6) \times (-6)$
$= -216$

(c) $(-0.9)^3 = (-0.9) \times (-0.9) \times (-0.9)$
$= -0.729$

(d) $(2.1)^3 = 2.1 \times 2.1 \times 2.1$
$= 4.41 \times 2.1$
$= 9.261$

(e) $(0.33)^3 = 0.33 \times 0.33 \times 0.33$
$= 0.1089 \times 0.33$
$= 0.035937$

(f) $\left(-\frac{3}{2}\right)^3 = \left(\frac{-3}{2}\right) \times \left(\frac{-3}{2}\right) \times \left(\frac{-3}{2}\right)$

$= \frac{-27}{8}$

(g) cube of $2\frac{1}{2}$ = cube of $\frac{5}{2} = \left(\frac{5}{2}\right)^3 =$

$\frac{5}{2} \times \frac{5}{2} \times \frac{5}{2} = \frac{125}{8} = 15\frac{5}{8}$

(h) cube of $-3\frac{2}{3}$ = cube of $\frac{-11}{3}$

$= \left(\frac{-11}{3}\right)^3 = \frac{-11}{3} \times \frac{-11}{3} \times \frac{-11}{3}$

$= \frac{-1331}{27} = -49\frac{8}{27}$

Class Work 1.5

The difference between consecutive perfect cubes from a sequence of odd numbers. After three levels of calculation, all the differences become identical

Perfect Cubes

1 8 27 64 125 216 Level 1

7 19 37 61 91 Level 2

12 18 24 30 Level 2

6 6 6 Identical difference

NCERT Exercise 1.2

1. By prime factorisation

$27000 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$

2	27000
2	13500
2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$\therefore \sqrt[3]{27000}$
$= 2 \times 3 \times 5 = 30$

and 10648
$= \underline{2 \times 2 \times 2} \times \underline{11 \times 11 \times 11}$

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

$\therefore \sqrt[3]{10648} = 2 \times 11$
$= 22$

2. By prime factorisation,

$1323 = \underline{3 \times 3 \times 3} \times \underline{7 \times 7}$

3	1323
3	441
3	147
7	49
7	7
	1

It is clear that, 1323 is not a perfect cube.

To make perfect cube, we multiply 1323 by 7

Thus, $1323 \times 7 = 3 \times 3 \times 3 \times 7 \times 7 \times 7$
$= 9261$

3. (i) The cube of any odd number is odd.

e.g. $\left.\begin{matrix} 5^3 = 125 \\ 7^3 = 343 \end{matrix}\right\}$ which are again odd number Ans. **False**

(ii) The cubes of all the numbers having their unit place digit 2 will end with 8.

e.g. $(12)^3 = 12 \times 12 \times 12$
$= 1728$

which is even number. Ans. **False**

(iii) The cube of a 2 digit number may have 4 digits to 6-digits

e.g., $(11)^3 = 11 \times 11 \times 11 = 1331$ (4 digits)

and $(99)^3 = 99 \times 99 \times 99$
$= 970299$ (6 digits)

Ans. **False**

(iv) The cube of a 2 digit number may have 4 digit to 6 digit as shown in (iii) part. Ans. **False**

(iv) We know that $2^3 = 8$

1, 2, 4, 8 are factors of 8, which are 4 in number i.e., even number of factors. Ans. **False**

4. Given that 1331 is a perfect cube. Last digit of 1331 is 1 and we know that cube of number with last digit 1 also ends in 1 since 1331 is four digit number.

$\Rightarrow$ Its cube root will be 2-digit number.

Also, we know that

$10^3 = 1000$
$20^3 = 8000$

1331 lies between 1000 and 8000.

$\Rightarrow$ Cube root lies between 10 and 20.

$\Rightarrow$ Cube root of 1331 = 11 Ans.

Now, Consider 4913

Last digit = 3,

its cube ends in 7.

Cube root will be two-digit number.

$10^3 = 1000$
and $20^3 = 8000$

4913 lies between 1000 and 8000.

$\Rightarrow$ Cube root of 4913 = 17 Ans.

Now consider 12167

Last digit = 7

Its cube ends in 3.

$20^3 = 8000,$
$30^3 = 27000$

12167 lies between 8000 and 27000.

$\Rightarrow$ Cube root of 121 = 23

Again last digit of 32768 is 8.

So, its cube ends in digit 2.

Since 32768 is 5 – digit number.

Its cube will be 2–digit number.

We know that

$$30^3 = 27000$$
$$40^3 = 64000$$

32768 lies between 27000 and 64000.

$\therefore$ Cube root of 32768 = 32

5. (i) Given, $67^3 - 66^3$

We know that, if a and b are two consecutive numbers.

Then, $b^3 - a^3 = 1 + 3\,ab$, $b > a$

Here, $67^3 - 66^3 = 1 + 3\,(67)\,(66)$
$= 1 + 13266$
$= 13267$

(ii) Given, $43^3 - 42^3$

$b^3 - a^3 = 1 + 3\,ab$, $b > a$

$\therefore$ $43^3 - 42^3 = 1 + 3\,(43)\,(42)$
$= 1 + 5418$
$= 5419$

(iii) Given, $67^2 - 66^2$

We know that

$a^2 - b^2 = (a - b)\,(a + b)$

Here,672 – 662
$= (67 - 66)\,(67 + 66)$
$= 133$

(iv) Given, $43^2 - 42^2$

As $a^2 - b^2 = (a - b)\,(a + b)$

$43^2 - 42^2 = (43 - 42)\,(43 + 42)$
$= 85$

From above, It is clear that $67^3 - 66^3$ is the greatest. Ans.

Practice Exercise 1.2

1. (a) Prime factors of 389017
$= 73 \times 73 \times 73$

$\therefore \sqrt[3]{389017} = 73$

$$\begin{array}{r|r} 73 & 389017 \\ \hline 73 & 5329 \\ \hline 73 & 73 \\ \hline & 1 \end{array}$$

Thus cube root of 389017 is 73.

(b) Prime factors of 91125
$= (3 \times 3 \times 3) \times (3 \times 3 \times 3) \times (5 \times 5 \times 5)$

$\therefore \sqrt[3]{91125} = 3 \times 3 \times 5$
$= 45$

$$\begin{array}{r|r} 3 & 91125 \\ \hline 3 & 30375 \\ \hline 3 & 10125 \\ \hline 3 & 3375 \\ \hline 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

Thus cube roots of 91125 is 45

(c) Expressing 110592 into prime fractors, we have

$110592 = (2 \times 2 \times 2) \times (2 \times 2 \times 2)$
$\times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (3 \times 3 \times 3)$

$\therefore \sqrt[3]{110592} = 2 \times 2 \times 2 \times 2 \times 3$
$= 48$

$$\begin{array}{r|r} 2 & 110592 \\ \hline 2 & 55296 \\ \hline 2 & 27648 \\ \hline 2 & 13824 \\ \hline 2 & 6912 \\ \hline 2 & 3456 \\ \hline 2 & 1728 \\ \hline 2 & 864 \\ \hline 2 & 432 \\ \hline 2 & 216 \\ \hline 2 & 108 \\ \hline 2 & 54 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

Thus cube root of 110592 is 48

(d) Expressing 46656 into prime factors, we have

$46656 = (2 \times 2 \times 2) \times (2 \times 2 \times 2)$
$\times (3 \times 3 \times 3) \times (3 \times 3 \times 3)$

$\therefore \sqrt[3]{46656} = 2 \times 2 \times 3 \times 3$
$= 36$

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

Thus cube root of 46656 is 36

2. (a) Expressing 226981 into prime factors, we have

$226981 = (61 \times 61 \times 61)$

$\therefore \sqrt[3]{226981} = -(\sqrt[3]{226981}) = -61$

61	226981
61	3721
61	61
	1

Thus cube root of – 226981 is – 61

(b) Expressing 13824 into prime factors, we have

$13824 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (3 \times 3 \times 3)$

$\therefore \sqrt[3]{-13824} = -(\sqrt[3]{-13824})$

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

$= -24$

2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Thus cube root of – 13824 is – 24

(c) Expressing 571787 into prime factors, we have,

$571787 = (83 \times 83 \times 83)$

$\therefore \sqrt[3]{-571787} = -(\sqrt[3]{571787}) = -83$

83	571787
83	6889
83	83
	1

Thus cube root of –571787 is – 83.

(d) Expressing 175616 into prime factors, we have

$175616 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (7 \times 7 \times 7)$

$\therefore \sqrt[3]{-175616} = -(\sqrt[3]{175616})$

$= -(2 \times 2 \times 2 \times 7)$

$= -56$

2	175616
2	87808
2	43904
2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

Thus cube root of –175616 is – 56

3. (a) Given that $2460375 = 3375 \times 729$

in term of prime factors, it can be written as

$2460375 = (3 \times 3 \times 3 \times 5 \times 5 \times 5) \times (3 \times 3 \times 3 \times 3 \times 3 \times 3)$

Expressing prime factors in triplets form

$2460375 = (3 \times 3 \times 3) \times (5 \times 5 \times 5) \times (3 \times 3 \times 3) \times (3 \times 3 \times 3)$

$= 3^3 \times 5^3 \times 3^3 \times 3^3$

$= (3 \times 5 \times 3 \times 3)^3$

$\therefore \; 2460375 = (135)^3$

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

3	729
3	243
3	81
3	27
3	9
3	3
	1

Thus cube root of 2460375 is 135

(b) Given that 20346417

$= (9261) \times (2197)$

In term of prime factors, it can be written as

$20346417 = (3 \times 3 \times 3 \times 7 \times 7 \times 7) \times (13 \times 13 \times 13)$

Now Expressing Prime factor in triplets form

$20346417 = (3 \times 3 \times 3) \times (7 \times 7 \times 7) \times (13 \times 13 \times 13)$

$$\therefore \sqrt[3]{20346417} = 3 \times 7 \times 13 = 273$$

$$\begin{array}{r|r} 3 & 9261 \\ \hline 3 & 3087 \\ \hline 3 & 1029 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 13 & 2197 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

Thus cube root of 20346417 is 273

(c) Given that 210644875 = 42875 × 4913

Expressing factors in term of prime factors, we have

$210644875 = (5 \times 5 \times 5 \times 7 \times 7 \times 7) \times (17 \times 17 \times 17)$

Now Expressing Prime factor in triplets form

$210644875 = (5 \times 5 \times 5) \times (7 \times 7 \times 7) \times (17 \times 17 \times 17)$

$$\therefore \sqrt[3]{210644875} = 5 \times 7 \times 17 = 595$$

$$\begin{array}{r|r} 5 & 42875 \\ \hline 5 & 8575 \\ \hline 5 & 1715 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 17 & 4913 \\ \hline 17 & 289 \\ \hline 17 & 17 \\ \hline & 1 \end{array}$$

Thus cube root of 210644875 is 595

(d) Given that 57066625 = (166375) × (343)

In term of prime factors, it can be written as

$57066625 = (5 \times 5 \times 5 \times 11 \times 11 \times 11) \times (7 \times 7 \times 7)$

$$\begin{array}{r|r} 5 & 166375 \\ \hline 5 & 33275 \\ \hline 5 & 6655 \\ \hline 11 & 1331 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Expressing prime factors in form of triplets, we have

$57066625 = (5 \times 5 \times 5) \times (11 \times 11 \times 11) \times (7 \times 7 \times 7)$

$$\therefore \sqrt[3]{57066625} = 5 \times 11 \times 7 = 385$$

Thus cube root of 57066625 is 385

4. (a) Expressing 729 and 2197 into prime factors, we have

$$729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$$
$$2197 = 13 \times 13 \times 13$$

$$\begin{array}{r|r} 3 & 729 \\ \hline 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 13 & 2197 \\ \hline 13 & 169 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

$$\text{Now } \sqrt[3]{\frac{729}{2197}} = \frac{\sqrt[3]{729}}{\sqrt[3]{2197}} = \frac{\sqrt[3]{(3\times3\times3)\times(3\times3\times3)}}{\sqrt[3]{(13\times13\times13)}}$$

$$\therefore \sqrt[3]{\frac{729}{2197}} = \frac{3\times3}{13} = \frac{9}{3}$$

Thus cube root of $\frac{729}{2197}$ is $\frac{9}{13}$

(b) Epressing 3375 and 4913 into prime factors, we have

$3375 = (3 \times 3 \times 3) \times (5 \times 5 \times 5)$ and

$4913 = (17 \times 17 \times 17)$

$$\begin{array}{r|r} 3 & 3375 \\ \hline 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 17 & 4913 \\ \hline 17 & 289 \\ \hline 17 & 17 \\ \hline & 1 \end{array}$$

Now $\sqrt[3]{\frac{3375}{4913}} = \frac{\sqrt[3]{3375}}{\sqrt[3]{4913}}$

$$= \frac{\sqrt[3]{(3\times3\times3)\times(5\times5\times5)}}{\sqrt[3]{(17\times17\times17)}}$$

$\therefore \quad \sqrt[3]{\frac{3375}{4913}} = \frac{3\times5}{17} = \frac{15}{17}$

Thus cube root of $\frac{3375}{4913}$ is $\frac{15}{17}$

(c) Expressing 9261 and 42875 into prime factors, we have

9261 = (3 × 3 × 3) × (7 × 7 × 7)

42875 = (5 × 5 × 5) × (7 × 7 × 7)

$$\begin{array}{r|r} 3 & 9261 \\ \hline 3 & 3087 \\ \hline 3 & 1029 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 5 & 42875 \\ \hline 5 & 8575 \\ \hline 5 & 1715 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Now $\sqrt[3]{\frac{9261}{42875}} = \frac{\sqrt[3]{9261}}{\sqrt[3]{42875}}$

$$= \frac{\sqrt[3]{(3\times3\times3)\times(7\times7\times7)}}{\sqrt[3]{(5\times5\times5)\times(7\times7\times7)}}$$

$$= \frac{3\times7}{5\times7} = \frac{21}{35}$$

$\therefore \quad \sqrt[3]{\frac{9261}{42875}} = \frac{21}{35}$

Thus cube root of $\frac{9261}{42875}$ is $\frac{21}{35}$

(d) Expressing 343 and 166375 into prime factors, we have

343 = 7 × 7 × 7 and

166375 = 5 × 5 × 5 × 11 × 11 × 11

$$\begin{array}{r|r} 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array} \qquad \begin{array}{r|r} 5 & 166375 \\ \hline 5 & 33275 \\ \hline 5 & 6655 \\ \hline 11 & 1331 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Now $\sqrt[3]{\frac{343}{166375}} = \frac{\sqrt[3]{343}}{\sqrt[3]{166375}}$

$$= \frac{\sqrt{(7\times7\times7)}}{\sqrt{(5\times5\times5)\times(11\times11\times11)}}$$

$$= \frac{7}{5\times11} = \frac{7}{55}$$

$\therefore \sqrt[3]{\frac{343}{166375}} = \frac{7}{55}$

Thus cube root of $\frac{343}{166375}$ is $\frac{7}{55}$

5. (a) Expressing 3087 into prime factors, we have

3087 = 3 × 3 × (7 × 7 × 7)

$$\begin{array}{r|r} 3 & 3087 \\ \hline 3 & 1029 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

Since 3 × 3 is to left after grouping in triplets, so 3087 is not perfect cube

To make it perfect cube, we must multiply it by 3

Verification

New Number = 3087 × 3 = 9261 which is a perfect cube

also, 9261 = (3 × 3 × 3) × (7 × 7 × 7)

$\therefore \quad \sqrt[3]{9261} = 3 \times 7$

$= 21$

Thus 9261 is a perfect cube whose cube root is 21.

(b) Expressing 33275 into factors, we have

33275 = 5 × 5 × (11 × 11 × 11)

$$\begin{array}{r|r} 5 & 33275 \\ \hline 5 & 6655 \\ \hline 11 & 1331 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

Since 5 × 5 is left after grouping in triplets, so 33275 is not perfect cube to make it perfect cube, we must multiply it by 5

Verification

New Number = 33275 × 5 = 166,375 which is a perfect cube also 166,375 = $(5 \times 5 \times 5) \times (11 \times 11 \times 11)$

$\therefore \sqrt[3]{166375} = 5 \times 11$

$= 55$

Thus 166375 is a perfect cube which cube root is 55.

(c) Expressing 120393 into prime factors, we have

$120393 = (3 \times 3 \times 3) \times (7 \times 7 \times 7) \times 13$

Since 13 is left after grouping in triplets so 120,393 is not a perfect cube.

To make it perfect cube, we must multiply it by $13 \times 13 = 169$

$$\begin{array}{r|r} 3 & 120393 \\ \hline 3 & 40131 \\ \hline 3 & 13377 \\ \hline 7 & 4459 \\ \hline 7 & 637 \\ \hline 7 & 91 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

Thus 169 is the smallest number by which we must multiply given number to make a perfect cube.

Verification

New Number = 120393×169 = 20,346,417 which is a perfect cube

also 20,346,417 = $(3 \times 3 \times 3) \times (7 \times 7 \times 7) \times (13 \times 13 \times 13)$

$\sqrt[3]{20346417} = 3 \times 7 \times 13$

$= 273$

Thus 20346417 is the perfect cube which cube root is 273.

(d) Expressing 137842 into prime fctors, we have

$137842 = 2 \times (41 \times 41 \times 41)$

$$\begin{array}{r|r} 2 & 137842 \\ \hline 41 & 68921 \\ \hline 41 & 1681 \\ \hline 41 & 41 \\ \hline & 1 \end{array}$$

So 2 is left after grouping in trip lets, so 137842 is not perfect cube

We must multiply it by $2 \times 2 = 4$ to make it perfect cube.

Verification

New Number = 137842×4

= 551,368

which is a perfect cube

also, 551368 = $(2 \times 2 \times 2) \times (41 \times 41 \times 41)$

$\therefore \sqrt[3]{551368} = 2 \times 41$

$= 82$

Thus 551368 is the perfect cube which cube root is 82

6. From the solution of question 5 given above, we can draw the following table :

S. No.	**Numbers**	**Factors**	**To make perfect cube, we should divide by**
a	3087	$3^2 \times 7^3$	3^2
b	33275	$5^2 \times 11^3$	5^2
c	120393	$3^3 \times 7^3 \times 13$	13
d	137842	2×41^3	2

7. Given that number are ratio 2 : 3 : 4

Let the numbers are $2x$, $3x$ and $4x$

According to question,

$(2x)^3 + (3x)^3 + (4x)^3 = 12375$

$\Rightarrow \quad 8x^3 + 27x^3 + 64x^3 = 12375$

$\Rightarrow \quad 99x^3 = 12375$

$\Rightarrow \quad x^3 = \dfrac{12375}{99}$

$\Rightarrow \quad x^3 = 125$

$\Rightarrow \quad x^3 = (5 \times 5 \times 5) = 5^3$

$\Rightarrow \quad x = 5$

$\therefore \quad x = 5$

Thus, the required numbers are

$2x = 2 \times 5 = 10$,

$3x = 3 \times 5 = 15$ and

$4x = 4 \times 5 = 20$

8. Given that volume of cubical box is 5832 m^3 at the length of cubical box is x

and we know that

volume of cubical box whose length is $x = x^3$ according to question,

$$\begin{array}{r|r} 2 & 5832 \\ \hline 2 & 2916 \\ \hline 2 & 1458 \\ \hline 3 & 729 \\ \hline 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$\Rightarrow\ x = \sqrt[3]{5832}$

$\Rightarrow x = \sqrt[3]{(2\times2\times2)\times(3\times3\times3)\times(3\times3\times3)}$

$\therefore\ \ x = 2 \times 3 \times 3$

$x = 18$ m

Thus the length of cubical box is 18 m

Chapter Innings

A. Multiple Choice Questions

1. Option c, natural numbers between 11^2 and 12^2 are $2 \times 11 = 22$

2. $\sqrt{0.8}\times\sqrt{1.8} = \sqrt{0.8\times1.8} = \sqrt{1.44} = 1.2$

3. Since $9^2 = 81$, thus $(109)^2$ ends with digit 1 option d.

4. As 81000 contains old numbers of zeros. So 81000 is not perfect square option c.

5. Option d, 8 can not be unit digit of a perfect square number.

6. Option b,

$$\sqrt[3]{0.1\times0.1\times0.1\times12\times12\times12} = 0.1 \times 12 = 1.2$$

7. Prime factors of 1323 = (3 × 3 × 3) × 7 × 7

To make complete grouping of triplets of prime factors, we need one more digit 7.

So 7 is the smallest number by which 1323 must be multiplied option b.

8. Converting mix-fraction into improper fraction we get

$$1\frac{127}{216} = \frac{216\times1+127}{216} = \frac{343}{216}$$

$$\sqrt[3]{1\frac{127}{216}} = \sqrt[3]{\frac{343}{216}} = \frac{\sqrt[3]{343}}{\sqrt[3]{216}}$$

$$= \frac{\sqrt[3]{7\times7\times7}}{\sqrt[3]{6\times6\times6}} = \frac{7}{6} = 1\frac{1}{6}$$

option c.

9. Prime factors of 686 = 2 × (7 × 7 × 7)

as digit 2 left after grouping of triplets. So 2 is the smallest number by which 686 should be divided to make it a perfect cube option b.

10. $$\sqrt[3]{\frac{-125}{343}} = -\left(\sqrt[3]{\frac{125}{343}}\right) = -\left(\sqrt[3]{\frac{(5\times5\times5)}{(7\times7\times7)}}\right)$$

$$= -$$

option c.

B.

1. even number **2.** odd number
3. less **4.** odd
5. even **6.** perfect cubes
7. 3 **8.** 3
9. cube **10.** perfect cube

C.

1. e **2.** c
3. d **4.** f
5. b **6.** a

D.

1. False **2.** False
3. True **4.** False
5. False **6.** False
7. True **8.** False
9. False **10.** False

E. Very Short Answer Type Question

1. We know that a number ending 2, 3, 7 or 8 is never a perfect square.

So numbers 2162, 6843, 9637, 6598 ends with digit 2, 3, 7 and 8 hence given numbers are not perfect square. m

2. (a) $1 + 3 + 5 + 7 + 9 + 11 = 6^2 = 36$

(b) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 = 9^2 = 81$

3. (a) Prime factors of

$1764 = (2 \times 2) \times (3 \times 3) \times (7 \times 7)$

$\therefore\ \sqrt[2]{1764} = 2 \times 3 \times 7 = 42$

Thus square root of 1764 = 42

(b) Prime factors of

$4356 = (2 \times 2) \times (3 \times 3) \times (11 \times 11)$

$\therefore \sqrt[2]{4356} = 2 \times 3 \times 11 = 66$

Thus square root of 4356 is 66

4. (a) Converting decimal into fraction, we get

$$9.261 = \frac{9261}{1000}$$

$$\sqrt[3]{9.261} = \sqrt[3]{\frac{9261}{1000}} = \frac{\sqrt[3]{9261}}{\sqrt[3]{1000}}$$

$$= \frac{\sqrt[3]{(3\times3\times3)\times(7\times7\times7)}}{\sqrt[3]{(2\times2\times2)\times(5\times5\times5)}}$$

$$= \frac{3\times7}{2\times5} = \frac{21}{10}$$

$= 2.1$

(b) Converting decimal into fraction

$$0.729 = \frac{729}{1000}$$

$$\therefore \sqrt[3]{0.729} = \sqrt[3]{\frac{729}{1000}} = \frac{\sqrt[3]{729}}{\sqrt[3]{1000}}$$

$$= \frac{\sqrt[3]{(3\times3\times3)\times(3\times3\times3)}}{\sqrt[3]{(2\times2\times2)\times(5\times5\times5)}}$$

$$= \frac{3\times3}{2\times5}$$

$$= \frac{}{10}$$

$= 0.9$

5. Given that area of one face of cube is 81 sq. m and we know each face of the cube is a square

Let of one face = x^2

according to question,

$x^2 = 81$

$\Rightarrow \quad x = \sqrt{81}$

$\Rightarrow \quad x = 9$ m

$\therefore$ volume of the cube = x^3

Thus volume of the cube

$= 9^3 = 9 \times 9 \times 9$

$= 729$ cubic m.

F. Short Answer Type Questions

1. $\therefore \quad \sqrt{\frac{25}{36}} = \frac{\sqrt{25}}{\sqrt{36}} = \frac{5}{6}$ and

$$\frac{\sqrt{25}}{\sqrt{36}} = \frac{5}{6}$$

thus, both are equal.

2. (a) $\sqrt{\frac{225}{3136}} = \frac{\sqrt{225}}{\sqrt{3136}}$

$$= \frac{\sqrt{(3\times3)\times(5\times5)}}{\sqrt{(2\times2)\times(2\times2)\times(2\times2)\times(7\times7)}}$$

$$= \frac{3\times5}{2\times2\times2\times7}$$

$$= \frac{15}{56}$$

(b) $\sqrt{21\frac{2797}{3364}} = ?$

Converting mix fraction $21\frac{2797}{3364}$ into improper fractor.

$$21\frac{2797}{3364} = \frac{(3364\times21)+2797}{3364}$$

$$= \frac{73441}{3364}$$

Prime factors of 73,441 = 271 × 271 and

Prime factors of 3364 = (2 × 2) × (29 × 29)

271	73441
271	271
	1

2	3364
2	1682
29	841
29	29
	1

$$\therefore \sqrt{2\frac{2797}{3364}} = \sqrt{\frac{73441}{3364}}$$

$$= \sqrt{\frac{(271\times271)}{(2\times2)\times(29\times29)}}$$

$$= \frac{271}{2\times29} = \frac{271}{58}$$

$$= 4\frac{39}{58}$$

Thus square root of $\sqrt{21\frac{2797}{3364}}$ is $4\frac{39}{58}$

3. (a) Converting decimal into fraction we get

$$37.0881 = \frac{370881}{10,000}$$

Now, prime factors of

370881 = 3 × 3 × 7 × 7 × 29 × 29 and

Prime factors of

10,000 = (2 × 2) × (2 × 2) × (5 × 5) × (5 × 5)

3	370881
3	123627
7	41209
7	5887
29	841
29	29
	1

$$\therefore \sqrt{37.0881} = \sqrt{\frac{370881}{10,000}}$$

$$= \frac{\sqrt{370881}}{\sqrt{10,000}}$$

$$= \frac{\sqrt{(3\times3)\times(7\times7)\times(29\times29)}}{\sqrt{(2\times2)\times(2\times2)\times(5\times5)\times(5\times5)}}$$

$$= \frac{3\times7\times29}{2\times2\times5\times5}$$

$$= \frac{609}{100}$$

$= 6.09$

Thus square root of $\sqrt{37.0881}$ is 6.09

(b) Converting decimal into fraction

$$0.000529 = \frac{529}{1000000}$$

$$\therefore \sqrt{0.000529} = \sqrt{\frac{529}{1000000}}$$

$$= \sqrt{\frac{23\times23}{1000\times1000}}$$

$$= \frac{23}{1000}$$

$= 0.023$

Thus square root of 0.000529 is 0.023

4. (a) Prime factors of 250047

$= (3 \times 3 \times 3) \times (3 \times 3 \times 3) \times (7 \times 7 \times 7)$

$\therefore \sqrt[3]{250047}$

$= \sqrt[3]{(3\times3\times3)\times(3\times3\times3)\times(7\times7\times7)}$

$= 3 \times 3 \times 7$

$= 63$

3	250047
3	83349
3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Thus cube root of 250047 is 63.

(b) Prime factors of 438976

$= (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (19 \times 19 \times 19)$

$\therefore \sqrt[3]{438976}$

$= \sqrt[3]{(2\times2\times2)\times(2\times2\times2)\times(19\times19\times19)}$

$= 2 \times 2 \times 19$

$= 76$

2	438976
2	219488
2	109744
2	54872
2	27436
2	13718
19	6859
19	361
19	19
	1

Thus cube root of 438976 is 76

(c) Prime factors of 592704

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 7 \times 7 \times 7$

$\therefore \sqrt[3]{592704}$

$= \sqrt[3]{(2\times2\times2)\times(2\times2\times2)\times(3\times3\times3)\times(7\times7\times7)}$

$= 2 \times 2 \times 3 \times 7$

$= 84$

2	592704
2	296352
2	148176
2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Thus cube root of 592704 is 84

(d) Prime factors of 614125

$= 5 \times 5 \times 5 \times 17 \times 17 \times 17$

$\therefore \sqrt[3]{614125}$

$= \sqrt[3]{(5\times5\times5)\times(17\times17\times17)}$

$= 5 \times 17$

$= 85$

5	614125
5	122825
5	24565
17	4913
17	289
17	17
	1

Thus cube root of 614125 is 85

5. (a) $\therefore \sqrt[3]{\frac{343}{125}} = \frac{\sqrt[3]{343}}{\sqrt[3]{125}} = \frac{\sqrt[3]{7\times7\times7}}{\sqrt[3]{5\times5\times5}}$

$= \frac{7}{5}$

Thus cube root of $\frac{343}{125}$ is $\frac{7}{5}$

(b) $\therefore \sqrt[3]{\frac{-27}{512}} = -\left(\sqrt[3]{\frac{27}{512}}\right)$

$= -\left(\frac{\sqrt[3]{27}}{\sqrt[3]{512}}\right)$

$= -\left(\frac{\sqrt[3]{3\times3\times3}}{\sqrt[3]{8\times8\times8}}\right)$

$\sqrt[3]{\frac{-27}{512}} = -\frac{3}{8}$

Thus cube root of $\frac{-27}{512}$ is $\frac{-3}{8}$

(c) $\therefore \sqrt[3]{\frac{-2197}{1331}} = \left(\sqrt[3]{\frac{2197}{1331}}\right)$

$= -\left(\frac{\sqrt[3]{2197}}{\sqrt[3]{1331}}\right)$

$= -\left(\frac{\sqrt[3]{(13\times13\times13)}}{\sqrt[3]{11\times11\times11}}\right)$

$= -\frac{13}{11}$

$\sqrt[3]{\frac{-2197}{1331}} = \frac{-13}{11}$

Thus cube root of $\frac{-2197}{1331}$ is $\frac{-13}{11}$

6. (a) Let two consecutive integers are x and $(x + 1)$

given that sum of two consecutive integers is 15^2 according to question,

$x + (x + 1) = 15^2 = 225$

$\Rightarrow \quad 2x + 1 = 225$

$\Rightarrow \quad 2x = 225 - 1$

$\Rightarrow \quad 2x = 224$

$\Rightarrow \quad x = \frac{224}{2}$

$x = 112$

First Integer = 112 and

Second Integer = $x + 1 = 112 + 1$

$= 113$

Thus 112 and 113 are two consecutive integers whose sum is 15^2 and $15^2 = 112 + 113$

(b) Given that

Sum of integers is 23^2

According to Question,

$x + (x + 1) = 23^2 = 529$

$\Rightarrow \quad 2x + 1 = 529$

$\Rightarrow \quad 2x = 529 - 1$

$\Rightarrow \quad 2x = 528$

$\Rightarrow \quad x = \frac{528}{2}$

$x = 264$

$\therefore$ First Integer = 254 and

Second Integer = $x + 1 = 264 + 1 = 265$

Thus consecutive integers are 264 and 265 and $23^2 = 264 + 265$

(c) Given that sum of integers = 372

According to question,

$x + (x + 1) = 37^2 = 1369$

$\Rightarrow \quad 2x + 1 = 1369$

$\Rightarrow \quad 2x = 1369 - 1$

$\Rightarrow \quad 2x = 1368$

$\Rightarrow \quad x = \frac{1368}{2}$

$x = 684$

$\therefore$ First integer = 684 and

Second integer = $x + 1 = 684 + 1 = 685$

Thus consecutive integers are 684 and 685

and $\quad 37^2 = 684 + 685$

7. (a) Cube of – 13 = $(-13)^3$

$= (-13) \times (-13) \times (-13)$

$= -2197$

(b) Cube of $3\frac{1}{5}$ = Cube of $\frac{16}{5}$

$= \left(\frac{16}{5}\right)^3$

$= \frac{16}{5} \times \frac{16}{5} \times \frac{16}{5}$

$= \frac{4096}{125}$

$= 32\frac{96}{125}$

(c) Cube of $\left(-5\frac{1}{7}\right)$ = Cube of $\left(\frac{-36}{7}\right)$

$= \left(\frac{-36}{7}\right)^3$

$= \frac{-36}{7} \times \frac{-36}{7} \times \frac{-36}{7}$

$= -\frac{46656}{343}$

$= -136\frac{8}{343}$

8. (a) $\sqrt[3]{512 \times 729} = \sqrt[3]{512} \times \sqrt[3]{729}$

$= \sqrt[3]{(2\times2\times2)\times(2\times2\times2)\times(2\times2\times2)}$

$\sqrt[3]{(3\times3\times3)\times(3\times3\times3)}$

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

$= 8 \times 9$

$\sqrt[3]{512 \times 729} = 72$

(b) $\sqrt[3]{(-1331) \times 3375}$

$= \sqrt[3]{-(1331)} \times \sqrt[3]{3375}$

$= (\sqrt[3]{1331}) \times \sqrt[3]{3375}$

$= -(\sqrt[3]{(11\times11\times11)}) \times \sqrt[3]{(3\times3\times3)\times(5\times5\times5)}$

$= -11 \times (3 \times 5)$

$= -11 \times 15$

$\sqrt[3]{(-1331) \times 3375} = -165$

G. Long Answer Type Questions

1. Let the two numbers are x and y, $x > y$ as cube root of the greater of two number is 8

So $x^3 = 8^3 \Rightarrow x^3 = 512$

According to questions

$x^3 - y^3 = 387$

but we have $x^3 = 512$

$\Rightarrow \quad 512 - y^3 = 512$

$\Rightarrow \quad -y^3 = 387 - 512$

$\Rightarrow \quad -y^3 = -125$

$\Rightarrow \quad y^3 = 125$

$\Rightarrow \quad y = \sqrt[3]{125}$

$\Rightarrow \quad y = \sqrt[3]{5 \times 5 \times 5}$

$\therefore \quad y = 5$

Thus cube root of the smaller number is 5.

2. (a) $\therefore \sqrt[3]{-216 \times 1728} = \sqrt[3]{-216} \times \sqrt[3]{1728}$

$= -(\sqrt[3]{216}) \times \sqrt[3]{1728}$

$= -(\sqrt[3]{(2\times2\times2)\times(3\times3\times3)}$

$\times(\sqrt[3]{(2\times2\times2)\times(2\times2\times2)\times(3\times3\times3)}$

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

$= -6 \times 12$

$\sqrt[3]{-216 \times 1728} = -72$

(b) Prime factors of 1125

$= 3 \times 3 \times 5 \times 5 \times 5$ and

Prime factors of 375

$= 3 \times 5 \times 5 \times 5$

$\therefore \sqrt[3]{1125 \times (-375)}$

$= (\sqrt[3]{(3\times3\times5\times5\times5)\times(3\times5\times5\times5)})$

$= -(\sqrt[3]{(3\times3\times3)\times(5\times5\times5)\times(5\times5\times5)})$

$= -3 \times 5 \times 5$

$\sqrt[3]{1125 \times (-375)} = -75$

(c) Prime factors of 343 = $7 \times 7 \times 7$ and

Prime factors of 474.552

$= (2 \times 2 \times 2) \times (3 \times 3 \times 3) \times (13 \times 13 \times 13)$

$\therefore \sqrt[3]{(-343) \times (-474552)}$

$= \sqrt[3]{(-343)} \times \sqrt[3]{(-474552)}$

$= -(\sqrt[3]{343}) \times [-(\sqrt[3]{474552})][(-)\times(-) = +]$

$= \sqrt[3]{(7\times7\times7)}$

$\times \sqrt[3]{(2\times2\times2)\times(3\times3\times3)\times(13\times13\times13)}$

$= 7 \times 2 \times 3 \times 13$

$\sqrt[3]{(-343) \times (-474552)} = 546$

3. (a) $\sqrt[3]{27}+\sqrt[3]{0.008}+\sqrt[3]{0.064}$

$= \sqrt[3]{3\times3\times3}+\sqrt[3]{0.2\times0.2\times0.2}+\sqrt[3]{0.4\times0.4\times0.4}$

= 3 + 0.2 + 0.4

= 3.6

(b) $\sqrt[3]{\frac{0.027}{0.001}}+\sqrt[3]{\frac{0.216}{0.008}}+\sqrt[3]{\frac{0.064}{0.008}}$

Since $\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$

Using this

$= \frac{\sqrt[3]{0.027}}{\sqrt[3]{0.001}}+\frac{\sqrt[3]{0.216}}{\sqrt[3]{0.008}}+\frac{\sqrt[3]{0.064}}{\sqrt[3]{0.008}}$

$= \frac{\sqrt[3]{0.3\times0.3\times0.3}}{\sqrt[3]{0.1\times0.1\times0.1}}+\frac{\sqrt[3]{0.6\times0.6\times0.6}}{\sqrt[3]{0.2\times0.2\times0.2}}+\frac{\sqrt[3]{0.4\times0.4\times0.4}}{\sqrt[3]{0.2\times0.2\times0.2}}$

$= \frac{0.3}{0.1}+\frac{0.6}{0.2}+\frac{0.4}{0.2}$

$= 3+\frac{6}{2}+\frac{4}{2}$

= 3 + 3 + 2

= 8

(c) $\sqrt[3]{4\times4\times4}+\sqrt[3]{3\times3\times3}+\sqrt[3]{24\times3\times3}$

$= \sqrt[3]{4\times4\times4}+\sqrt[3]{3\times3\times3}+\sqrt[3]{(2\times2\times2)\times(3\times3\times3)}$

= 4 + 3 + 2 × 3

= 4 + 3 + 6

= 13

(d) $\sqrt[3]{\frac{0.027}{0.064}}\times\frac{4}{3}$

Using $\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$

$= \frac{\sqrt[3]{0.027}}{\sqrt[3]{0.064}}\times\frac{4}{3}$

$= \frac{\sqrt[3]{0.3\times0.3\times0.3}}{\sqrt[3]{0.4\times0.4\times0.4}}\times\frac{4}{3}$

$= \frac{0.3}{0.4}\times\frac{4}{3}$

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

$= \frac{12}{12}$

= 1

4. $\sqrt{0.2304} = \sqrt{\frac{2304}{10,000}} = \frac{\sqrt{2304}}{\sqrt{10,000}}$

$= \frac{\sqrt{48\times48}}{\sqrt{100\times100}} = \frac{48}{100} = 0.48$

Similarly

$\sqrt{0.1764} = \sqrt{\frac{1764}{10,000}} = \frac{\sqrt{1764}}{\sqrt{10,000}}$

$= \frac{\sqrt{42\times42}}{\sqrt{100\times100}} = \frac{42}{100} = 0.42$

$\frac{\sqrt{0.2304}+\sqrt{0.1764}}{\sqrt{0.2304}-\sqrt{0.1764}} = \frac{0.48+0.42}{0.48-0.42}$

$= \frac{0.90}{0.06}$

$= \frac{90}{6}$

$\frac{\sqrt{0.2304}+\sqrt{0.1764}}{\sqrt{0.2304}-\sqrt{0.1764}} = 15$

5. (a) as $\sqrt{a}\times\sqrt{b} = \sqrt{ab}$

So $\sqrt{147}\times\sqrt{243} = \sqrt{147\times243}$

$= \sqrt{(3\times7\times7)\times(3\times3\times3\times3\times3)}$

$= \sqrt{(3\times3)\times(3\times3)\times(3\times3)\times(7\times7)}$

= 3 × 3 × 3 × 7

= 189

(b) $\sqrt{1620}\times\sqrt{980} = \sqrt{1620\times980}$

$= \sqrt{(2\times2\times3\times3\times3\times3\times5)\times(2\times2\times5\times7\times7)}$

$= \sqrt{(2\times2)\times(2\times2)\times(3\times3)\times(3\times3)\times(5\times5)(7\times7)}$

= 2 × 2 × 3 × 3 × 5 × 7

H.

1. A

2. In assertion, since $25^2 = 625$ hence Square root of 625 is 25 hence assertion statement is wrong.

Thus Ans. option d.

3. Assertion

Cube of $-3\frac{4}{9} = -\frac{3\times9+4}{9} = -\frac{31}{9}$

$\therefore \quad \left(-\frac{31}{9}\right)^3 = \frac{-31}{9}\times\frac{-31}{9}\times\frac{-31}{9}$

$= \frac{-29.791}{729}$

$= -40\frac{631}{729}$

Thus assertion statement is wrong.

Ans. option d

4. A

5. Assertion :

$\sqrt[3]{125\times(-64)} = \sqrt[3]{125}\times\sqrt[3]{-64}$

$= \sqrt[3]{125}\times(-\sqrt[3]{64})$

$= (\sqrt[3]{5\times5\times5})\times(-\sqrt[3]{4\times4\times4})$

$= 5 \times (-4)$

$= -20$

Ans. option a

6. Assertion : Prime factors of 2744 :

$(2 \times 2 \times 2) \times (7 \times 7 \times 7)$

Since No Prime number it left after grouping in triplets hence 2744 is a perfect cube

Reason : Cube root of 243 is not 7 thus Assertion and Reason both are wrong

Ans. option c

Case Study

1. b

2. Prime factors of 23283 = $3 \times 3 \times 13 \times 199$

As Prime factors are not in grouping of triplets

So 23283 is not a perfect cube.

Ans. option d

3. To make 23283 a perfect cube we must mutliply it by $3 \times 13^2 \times 199^2$ the smallest required number

Ans. option c

4. b

5. If a number has 9 in the unit place, then its cube also end with same digit i.e. 9 thus one's place digit of the cube of 6789 is 9.

Ans. option b

❑❑

2. Power Play

Class Work 2.1

1. Expressing 32400 as a product of its prime factors = $2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 5 \times 5$

$32400 = 2^4 \times 3^4 \times 5^2$

2	32400
2	16200
2	8100
2	4050
3	2025
3	675
3	225
3	75
5	25
5	5
	1

2. $(-1)^5 = -1$ $\quad [(-1)^{\text{odd number}} = -]$

and $(-1)56 = +1$ $\quad [(-1)^{\text{even number}} = +1]$

3. $(-2)^4 = 24$

$= 2 \times 2 \times 2 \times 2$

$\therefore \quad (-2)^4 = 16$

Thus $(-2)^4 = 16$

4. $0^2 = 0 \times 0 = 0$

$0^5 = 0 \times 0 \times 0 \times 0 \times 0 = 0$

$0^n = 0 \times 0 \times$ ....n times = 0

NCERT Exercise 2.1

1. (i) Given, $6 \times 6 \times 6 \times 6 = 6^4$

(ii) Given, $y \times y = y^2$

(iii) Given, $b \times b \times b \times b = b^4$

(iv) Given, $5 \times 5 \times 7 \times 7 \times 7 = 5^2 \times 7^3$

(v) Given, $2 \times 2 \times a \times a = 2^2 \times a^2$

(vi) Given, $a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$

2. (i) Given, 648

By prime factorisation, we have 648 = 2 × 2 × 2 × 3 × 3 × 3 × 3

$= 2^3 \times 3^4$

2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

(ii) Given, 405

By prime factorisation, we have

405 = 3 × 3 × 3 × 3 × 5

$= 3^4 \times 5$ (in exponential form)

3	405
3	135
3	45
3	15
5	5
	1

(iii) Given, 540

By prime factorisation, we have

540 = 2 × 2 × 3 × 3 × 3 × 5

$= 2^2 \times 3^3 \times 5$ (in exponential form)

2	540
2	270
3	135
3	45
3	15
5	5
	1

(iv) Given, 3600

By Prime factorisation, we have

3600 = 2 × 2 × 2 × 2 × 5 × 5 × 3 × 3

$= 2^4 \times 3^2 \times 5^2$ (in exponential form)

2	3600
2	1800
2	900
2	450
5	225
5	45
3	9
3	3
	1

3. (i) 2×10^3

$= 2 \times 10 \times 10 \times 10$

$= 2000$ (Numerical value)

(ii) $7^2 \times 2^3 = 7 \times 7 \times 2 \times 2 \times 2$

$= 49 \times 8 = 392$ (Numerical value)

(iii) $3 \times 4^4 = 3 \times 4 \times 4 \times 4 \times 4$

$= 3 \times 256 = 768$

(iv) $(-3)^2 \times (-5)^2$

$= (-3) \times (-3) \times (-5) \times (-5)$

$= 9 \times 25 = 225$

(v) $3^2 \times 10^4 = 3 \times 3 \times 10 \times 10 \times 10 \times 10$

$= 9 \times 10000 = 90000$

(vi) $(-2)^5 \times (-10)^6$

$= (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-10) \times (-10)\ (-10) \times (-10) \times (-10) \times (-10)$

$= (-32) \times (1000000)$

$= -\ 32000000$

4. (v) Given, the initial thickness = v

After 1 fold, the thickness = $2 \times v = 2^1 v$

After 2 fold, the thickness = $2 \times (2v) = 2^2 v$

After 3 fold, the thickness = $2 \times (2^2 v) = 2^3 v$

....

....

After 10 folds, the thickness = $2^{10} v$

Practice Exercise 2.1

1.

	Exponential form	Exponent	Base
(a)	5^7	7	5

(b)	8^3	8	3
(c)	$(-6)^5$	5	(-6)

2. (a) $2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 4 \times 4 \times 4 = 64$

(b) $9^3 = 9 \times 9 \times 9$

$= 729$

(c) $11^2 = 11 \times 11$

$= 121$

(d) $54 = 5 \times 5 \times 5 \times 5$

$= 25 \times 25 = 625$

(e) $(-6)^4 = (-6) \times (-6) \times (-6) \times (-6)$

$[\because (-) \times (-) = +]$

$= 36 \times 36 = 1296$

(f) $(-2)^9 = (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2)$

$= 4 \times 4 \times 4 \times 4 \times (-2) = -512$

(g) $\left(\frac{-2}{3}\right)^5 = -\left(\frac{2}{3}\right)^5$

$[(-a)^{\text{odd number}} = -(a)^{\text{odd number}}]$

$= -\left(\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}\right) = \frac{-32}{243}$

(h) $\left(\frac{-4}{5}\right)^4 = \left(\frac{4}{5}\right)^4$

$[(-a)^{\text{even number}} = (a)^{\text{even number}}]$

$= \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{1024}{3125}$

3. (a) $6 \times 6 \times 6 \times 6 = 6^4$

(b) $t \times t = t^2$

(c) $b \times b \times b \times b = b^4$

(d) $5 \times 5 \times 7 \times 7 \times 7 = 5^2 \times 7^3 = 5^2 7^3$

(e) $2 \times 2 \times a \times a = 2^2 \times a^2 = 2^2 a^2$

(f) $a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d^1 = a^3 c^4 d^1$

4.

Exponential form		Expanded form
(a)	a^3b^2	$a \times a \times a \times b \times b$
(b)	a^2b^3	$a \times a \times b \times b \times b$
(c)	b^2a^3	$b \times b \times a \times a \times a$
(d)	b^3a^2	$b \times b \times b \times a \times a$

No, these are not same but here, (a) and (c) are equal and (b), (d) are equal

5. (a) as $4^3 = 4 \times 4 \times 4 = 64$ and

$3^4 = 3 \times 3 \times 3 \times 3 = 81$ and $81 > 64$

Thus, $3^4 > 4^3$

(b) as $5^3 = 5 \times 5 \times 5 = 125$

$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$

So, $243 > 125$

Thus $3^5 > 5^3$

(c) as $2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$

and $8^2 = 8 \times 8 = 64$

but $256 > 64$

Thus $2^8 > 8^2$

(d) as $2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 4 \times 4 \times 4 \times 4 \times 4 = 16 \times 16 \times 4 = 1024$

and $10^2 = 10 \times 10 = 100$

but $1024 > 100$

Thus $2^{10} > 10^2$

6. (a) $48 = 2 \times 2 \times 2 \times 2 \times 3 = 2^4 \times 3^1$

(b) $1728 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$

$= 2^6 \times 3^3$

(c) $420 = 2 \times 2 \times 3 \times 5 \times 7$

$= 2^2 \times 3^1 \times 5^1 \times 7^1$

(d) $12800 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$

$= 2^9 \times 5^2$

7. (a) $2^3 \times 5 = 2 \times 2 \times 2 \times 5$

$= 8 \times 5 = 40$

(b) $0 \times 10^2 = 0 \times 100 = 0$

(c) $5^2 \times 3^3 = (5 \times 5) \times (3 \times 3 \times 3)$

$= 25 \times 27 = 675$

(d) $2^4 \times 3^2 = (2 \times 2 \times 2 \times 2) \times (3 \times 3)$

$= 16 \times 9 = 144$

(e) $(-3) \times (-2)^3 = (-3) \times (-2) \times (-2) \times (-2)$

$= 6 \times 4 = 24 \quad [(-) \times (-) = +]$

(f) $(-2)^3 \times (-10)^3 = (-2) \times (-2) \times (-2) \times (-10) \times (-10) \times (-10)$

$= (-8) \times (-1000) = 8000$

(g) $26^2 \times (-1)^{41} = 676 \times (-1)$

$[\because (-1)^{\text{odd number}} = -1]$

$= -676$

(h) $4^2 \times 3^2 \times (-1)^{104} = (4 \times 4) \times (3 \times 3) \times 1$

$[\because (-1)^{\text{even number}} = +1]$

$= 16 \times 9 = 144$

9. (a) $2.7 \times 10^{12} = 2.7 \times 10^4 \times 10^8$

$= (2.7 \times 10000) \times 10^8$

$= 27000 \times 10^8$

Since $(27000 \times 10^8) > 1.5 \times 10^8$

So $2.7 \times 10^{12} > 1.5 \times 10^8$

(b) $3 \times 10^{17} = (3 \times 10^3) \times 10^{14}$

$= 3000 \times 10^{14}$

Since $3000 \times 10^{14} > 4 \times 10^{14}$

So $3 \times 10^{17} > 4 \times 10^{14}$

10. (a) $5^a = 625$

as $625 = 5 \times 5 \times 5 \times 5 = 5^4$

So $5^a = 5^4$

Since bases are same, so power will also be same

Thus, a = 4

(b) $(-3)^a = -243$

Since $-243 = (-3) \times (-3) \times (-3) \times (-3) \times (-3)$

$= (-3)^5$

So, $(-3)^a = -243 = (-3)5$

$\because$ $(-3)^a = (-3)^5$

Thus a = 5

(c) $(-4)^a = -1024$

Since $-1024 = (-4) \times (-4) \times (-4) \times (-4) \times (-4)$

$= (-4)^5$

So $(-4)^a = -1024 = (-4)^5$

$\because$ $(-4)^a = (-4)^5$

Thus a = 5

(d) $\left(\frac{2}{5}\right)^a = \frac{32}{3125}$

Since $\frac{32}{3125} = \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} = \left(\frac{2}{5}\right)^5$

So $\left(\frac{2}{5}\right)^a = \frac{32}{3125} = \left(\frac{2}{5}\right)^5$

$\because \left(\frac{2}{5}\right)^a = \left(\frac{2}{5}\right)^5$

Thus a = 5

(e) $\left(\frac{-3}{4}\right)^a = \frac{-243}{1024}$

Since $\frac{-243}{1024} = \frac{-3}{4} \times \frac{-3}{4} \times \frac{-3}{4} \times \frac{-3}{4} \times \frac{-3}{4}$

$= \left(\frac{-3}{4}\right)^5$

So $\left(\frac{-3}{4}\right)^a = \frac{-243}{1024} = \left(\frac{-3}{4}\right)^5$

$\because \left(\frac{-3}{4}\right)^a = \left(\frac{-3}{4}\right)^5$

Thus a = 5

(f) $\left(\frac{-5}{7}\right)^a = \frac{-3125}{16807}$

Since $\frac{-3125}{16807} = \frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7} \times \frac{-5}{7}$

$= \left(\frac{-5}{7}\right)^5$

So $\left(\frac{-5}{7}\right)^a = \frac{-3125}{16807} = \left(\frac{-5}{7}\right)^5$

$\because \left(\frac{-5}{7}\right)^a = \left(\frac{-5}{7}\right)^5$

Thus a = 5

Class Work 2.2

1. Product $p^4 \times p^6$

Exponential form

$= (p \times p \times p \times p \times p \times p \times p \times p \times p \times p)$

$= p^{10}$

2. (a) $2^5 \times 2^3 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 256$

Exponential form = 28

(b) $p^3 \times p^2 = p^{3+2} = p^5$ $[a^m \times a^n = a^{m+n}]$

(c) $4^3 \times 4^2 = 4^{3+2}$

$= 4^5$ (Exponential form)

$= 4 \times 4 \times 4 \times 4 \times 4$

$=1024$

(d) $a^3 \times a^2 \times a^7 = a^{3+2+7} = a^{12}$

(e) $5^3 \times 5^7 \times 5^{12} = 5^{3+7+12} = 5^{22}$

(f) $(-4)^{100} \times (-4)^{20} = (-4)^{100+20} = (-4)^{120}$

3. Here $= 2^{10} = 2 \times 2 \times 2$ .....(10 times)

$= 1024$

also $2^{10} = (2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2)$

or $= (2^5) \times (2^5)$

or $2^{10} = (2^5)^2$

Hence 2^{10} is equal to $(2^5)^2$

4. (a) First way

$8^6 = 8 \times 8 \times 8 \times 8 \times 8 \times 8$

$= 8^2 \times 8^2 \times 8^2$

$= (8^2)^3$

Second way

$8^6 = 8 \times 8 \times 8 \times 8 \times 8 \times 8$

$= (8 \times 8 \times 8) \times (8 \times 8 \times 8)$

$= 8^3 \times 8^3$

$8^6 = (8^3)^2$

Thus 8^6 can be written as $(8^2)^3$ or $(8^3)^2$

(b) Here $7^{15} = 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7$

$= (7 \times 7 \times 7) \times (7 \times 7 \times 7) \times (7 \times 7 \times 7) \times (7 \times 7 \times 7) \times (7 \times 7 \times 7)$

$= 7^3 \times 7^3 \times 7^3 \times 7^3 \times 7^3$

$7^{15} = (7^3)^5$

and $7^{15} = (7 \times 7 \times 7 \times 7 \times 7) \times (7 \times 7 \times 7 \times 7 \times 7) \times (7 \times 7 \times 7 \times 7 \times 7)$

$= 7^5 \times 7^5 \times 7^5$

$7^{15} = (7^5)^3$

(c) Here, $9^{14} = 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$

$= (9 \times 9) \times (9 \times 9) \times (9 \times 9) \times (9 \times 9) \times (9 \times 9) \times (9 \times 9) \times (9 \times 9)$

$= 9^2 \times 9^2 \times 9^2 \times 9^2 \times 9^2 \times 9^2 \times 9^2$

$9^{14} = (9^2)^7$

also $9^{14} = (9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9) \times (9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9)$

$9^{14} = (9^7)^2$

Thus 9^{14} can be expressed in form of $(9^2)^7$ and $(9^7)^2$

(d) Here, $5^8 = 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$

$= (5 \times 5) \times (5 \times 5) \times (5 \times 5) \times (5 \times 5)$

$= 5^2 \times 5^2 \times 5^2 \times 5^2$

$5^8 = (5^2)^4$

also $5^8 = (5 \times 5 \times 5 \times 5) \times (5 \times 5 \times 5 \times 5)$

$5^8 = (5^4)^2$

Thus 5^8 can be expressed in form of $(5^2)^4$ and $(5^4)^2$

5. (a) $(6^2)^4 = 6^{2\times4} = 6^6$ $[\because (a^m)^n = a^{m\times n}]$

(b) $(2^2)^{100} = 2^{2\times100} = 2^{200}$ $[\because (a^m)^n = a^{m\times n}]$

(c) $(7^{50})^2 = 7^{50\times2} = 7^{100}$ $[\because (a^m)^n = a^{m\times n}]$

(d) $(5^3)^7 = 5^{3\times7} = 5^{21}$ $[\because (a^m)^n = a^{m\times n}]$

Class Work 2.3

1. (a) $4^3 \times 2^3 = (4 \times 2)^3 = 8^3$ $[\because a^m \times b^m = (ab)^m]$

(b) $2^5 \times b^5 = (2 \times b)^5 = (2b)^5$ $[\because a^m \times b^m = (ab)^m]$

(c) $a^2 \times t^2 = (a \times t)^2 = (at)^2$ $[\because a^m \times b^m = (ab)^m]$

(d) $5^6 \times (-2)^6 = [5 \times (-2)]^6 = (-10)^6$ $[\because a^m \times b^m = (ab)^m]$

2. (a) $4^5 \div 3^5 = \left(\dfrac{4}{3}\right)^5$ $\left[\because a^m \div b^m = \left(\dfrac{a}{b}\right)^m\right]$

(b) $(-2)^3 \div b^3 = \left(\dfrac{-2}{b}\right)^3$

(c) $p^4 \div q^4 = \left(\dfrac{p}{q}\right)^4$

(d) $5^6 \div (-2)^6 = \left(\dfrac{5}{-2}\right)^6$

3. Using $a^{-n} = \dfrac{1}{a^n}$, $a \neq 0$

(a) $2^{-4} = \dfrac{1}{2^4}$

(b) $10^{-5} = \dfrac{1}{10^5}$

(c) $(-7)^{-2} = \dfrac{1}{(-7)^2}$

(d) $10^{-100} = \dfrac{1}{10^{100}}$

4. Using $a^m \times a^n = a^{m+n}$

(a) $2^{-4} \times 2^7 = 2^{-4+7} = 2^3$

(b) $3^3 \times 3^{-5} \times 3^6 = 3^{3+(-5)+6} = 3^4$

(c) $p^3 \times p^{-10} = p^{3+(-10)} = p^{-7}$

(d) $2^4 \times (-4)^{-2}$

$\Rightarrow 2^4 \times \frac{1}{(-4)^2}$

$\Rightarrow 2^4 \times \frac{1}{4^2}$ $[\because (-a)^{\text{even number}} = a^{\text{even number}}]$

$= 2^4 \times \frac{1}{(2 \times 2)^2}$

$= 2^4 \times \frac{1}{(2^2)^2}$ $[\because (a^m)^n = a^{m \times n}]$

$= 2^4 \times \frac{1}{2^4}$

$= 2^4 \times 2^{-4}$ $[\because \frac{1}{a^n} = a^{-n}]$

$= 2^{4+(-4)}$ $[\because a^m \times a^n = a^{m+n}]$

$= 2^0$ $[\because a^0 = 1]$

$= 1$

Magical Pond

Page-31

1. (a) Since it doubles every day for 30 days starting from first flower, the total number of lotuses is 2^{30}.

(b) On day 29, the pond was half covered so the number of lotuses is 2^{29}.

2. Damayanti starts with 1 lotus. After 4 days of doubling, the number of lotuses becomes 24 = 16 lotuses.

She takes all lotuses and put them into tripling pond. Then number of lotuses in pond after 4 more days

$= 2^4 \times 3^4$

$= 16 \times 81 = 1296$ lotuses

3. Damayanti starts with 1 lotus in tripling pond. After 4 days of tripling, the number of lotuses becomes $3^4 = 81$ lotuses. She takes all 81 lotuses and put them into doubling pond. So now number of lotuses in pond

$= 3^4 \times 2^4$

$= 81 \times 16$

$= 1296$ lotuses

Class Work 2.4

1. (a) $3^2 \times 3^4 \times 3^8 = 3^{2+4+8} = 3^{14}$ $[\because a^m \times a^n = a^{m+n}]$

(b) $6^{15} \div 6^{10} = 6^{15-10}$ $[\because a^m \div a^n = a^{m-n}, m > n]$

(c) $a^3 \times a^2 = a^{3+2} = a^5$ $[\because a^m \times a^n = a^{m+n}]$

(d) $7^x \times 7^2 = 7^{x+2}$ $[\because a^m \times a^n = a^{m+n}]$

(e) (52)3 ÷ 53 $= 5^{2\times3} \div 5^3$ $[\because (a^m)^n = a^{m\times n}]$

$= 5^6 \div 5^3$ $[\because a^m \div a^n = a^{m-n}, m>n]$

$= 5^{6-3} = 5^3$

(f) $2^5 \times 5^5 = (2\times5)^5 = 10^5$ $[\because a^m \times b^m = (ab)^m]$

(g) $a^4 \times b^4 = (a \times b)^4 = (ab)^4$

(h) $(3^4)^3 = 3^{4\times3} = 3^{12}$ $[\because (a^m)^n = a^{m\times n}]$

(i) $(2^{20} \div 2^{15}) \times 2^3$ $[\because a^m \div a^n = a^{m-n}, m > n]$

$= (2^{20-15}) \times 2^3$

$= 2^5 \times 2^3$ $[a^m \times a^n = a^{m+n}]$

$= 2^{5+3} = 2^8$

(j) $8^t \div 8^2 = 8^{t-2}$ $[\because a^m \div a^n = a^{m-n}, m > n]$

2. (a) $\frac{2^3 \times 3^4 \times 4}{3 \times 32} = \frac{2^3 \times 3^4 \times (2\times2)}{3 \times (2\times2\times2\times2\times2)}$

$= \frac{2^3 \times 3^4 \times 2^2}{3^1 \times 2^5}$

$= \frac{2^3 \times 2^2 \times 3^4}{3^1 \times 2^5}$

$= \frac{2^{3+2} \times 3^4}{3^1 \times 2^5}$ $[\because a^m \times a^n = a^{m+n}]$

$= \frac{2^5 \times 3^4}{2^5 \times 3^1}$

$= \frac{2^5}{2^5} \times \frac{3^4}{3^1}$ $[a^m \div a^n = a^{m-n}, m > n]$

$= 2^{5-5} \times 3^{4-1}$

$= 2^0 \times 3^3$ $[a^0 = 1]$

$= 1 \times 3^3 = 3^3$

(b) $[(5^2)^3 \times 5^4] \div 5^7$

$= (5^{2\times3} \times 5^4) \div 5^7$ $[\because (a^m)^n = a^{m\times n}]$

$= (5^6 \times 5^4) \div 5^7$ $[\because a^m \times a^n = a^{m+n}]$

$= 5^{6+4} \div 5^7$ $[a^m \div a^n = a^{m-n}, m > n]$

$= 5^{10-7} = 5^3$

(c) $25^4 \div 5^3$

Since 25 can be expressed as 52

So $25^4 \div 5^3 = (5^2)^4 \div 5^3$

$= 5^{2\times4} \div 5^3 \quad [\because (a^m)^n = a^{m\times n}]$

$= 5^8 \div 5^3$

$= 5^{8-3} \quad [a^m \div a^n = a^{m-n}, m > n]$

$= 5^5$

(d) $\dfrac{3\times7^2\times11^8}{21\times11^3} = \dfrac{3\times7^2\times11^8}{(3\times7)\times11^3}$

$= \dfrac{3\times7^2\times11^8}{3\times7\times11^3}$

$= \dfrac{\cancel{3}}{\cancel{3}}\times\dfrac{7^2}{7^1}\times\dfrac{11^8}{11^3} \quad [\because a^m \div a^n = a^{m-n}, m > n]$

$= 7^{2-1} \times 11^{8-3} = 7 \times 11^5$

(e) $\dfrac{3^7}{3^4\times3^3} = \dfrac{3^7}{3^{4+3}} \quad [a^m \times a^n = a^{m+n}]$

$= \dfrac{3^7}{3^7} = 3^{7-7} \quad [a^m \div a^n = a^{m-n}]$

$= 3^0 = 1 \quad [a^0 = 1]$

(f) $2^0 + 3^0 + 4^0 = 1 + 1 + 1 = 3 \quad [\because a^0 = 1]$

(g) $2^0 \times 3^0 \times 4^0 = 1 \times 1 \times 1 = 1 \quad [\because a^0 = 1]$

(h) $(5^0 + 6^0) \times 7^0 = (1 + 1) \times 1 \quad [\because a^0 = 1]$

$= 2 \times 1 = 1$

(i) $\dfrac{2^8\times a^5}{4^3\times a^3} = \dfrac{2^8\times a^5}{(2^2)^3\times a^3}$

$= \dfrac{2^8\times a^5}{2^{2\times3}\times a^3} \quad [\because (a^m)^n = a^{m\times n}]$

$= \dfrac{8}{6}\times\dfrac{5}{3}$

$= 2^{8-6} \times a^{5-3} \quad [\because a^m \div a^n = a^{m-n}]$

$= 2^2 \times a^2 \quad [\because a^m \times b^m = (a \times b)^m]$

$= (2 \times a)^2 = (2a)^2$

(j) $\dfrac{a^5}{a^3}\times a^8 = a^{5-3} \times a^8 \quad [\because a^m \div a^n = a^{m-n}]$

$= a^2 \times a^8 = a^{2+8} \quad [a^m \times a^n = a^{m+n}]$

$= a^{10}$

(k) $\dfrac{4^5\times a^8b^3}{4^5\times a^5b^2} = \dfrac{\cancel{4^5}}{\cancel{4^5}}\times\dfrac{a^8}{a^5}\dfrac{b^3}{b^2}$

$= 1\times\dfrac{a^8}{a^5}\dfrac{b^3}{b^2}$

$= a^{8-5}.b^{3-2} \quad [\because a^m \div a^n = a^{m-n}]$

$= a^3b$

(l) $(2^3 \times 2)^2 = (2^3)^2 \times 2^2 \quad [\because (a\times b)^m = a^m \times b^m]$

$= 2^{3\times2} \times 2^2 \quad [(a^m)^n = a^{m\times n}]$

$= 2^6 \times 2^2$

$= 2^{6+2} = 2^8 \quad [a^m \times a^n = a^{m+n}]$

3. (a) False

as $10^1 \times 10^{11} = 10^{1+11} \quad [a^m \times a^n = a^{m+n}]$

$= 10^{12}$

(b) False, given $2^3 > 5^2$

$(2 \times 2 \times 2) = 8$ and $5^2 = 5 \times 5 = 25$

as $8 > 25$

So, $2^3 < 5^2$

(c) False, as $2^3 = 2 \times 2 \times 2 = 8$

and $3^2 = 3 \times 3 = 9$

So $2^3 \times 3^2 = 8 \times 9 = 72$

(d) True, as $3^0 = 1$ and $(1000)^0 = 1$

Thus, $3^0 = (1000)^0$

4. (a) Prime factors of 108

$= 2 \times 2 \times 3 \times 3 \times 3$

$= 2^2 \times 3^3$

Prime factors of 192

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$= 2^6 \times 3^1$

Prime factors of 108×192

$= (2^2 \times 3^3) \times (2^6 \times 3^1)$

$= (2^2 \times 2^6) \times 3^3 \times 3^1)$

$= (2^{2+6}) \times (3^{3+1}) \quad [a^m \times a^n = a^{m+n}]$

(b) Prime factors of 270

$= 2 \times 3 \times 3 \times 3 \times 5$

$= 2^1 \times 3^3 \times 5^1$

(c) Prime factors of 729

$= 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

and Prime factors of 64

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$

Prime factors of 729×64

$= 3^6 \times 2^6$

$= (3 \times 2)^6 \quad [a^m \times b^m = (a \times b)^m]$

$= 6^6$

(d) Prime factors of 768

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$= 2^8 \times 3$

5. (a) $\frac{(2^5)^2 \times 7^3}{8^3 \times 7} = \frac{2^{5\times2} \times 7^3}{(2^3)^3 \times 7}$ $[(a^m)^n = a^{m\times n}]$

$= \frac{2^{10} \times 7^3}{2^9 \times 7^1}$

$= 2^{10-9} \times 7^{3-1}$ $[a^m \div a^n = a^{m-n}]$

$= 2 \times 7^2 = 2 \times 49 = 98$

(b) $\frac{25 \times 5^2 \times t^8}{10^3 \times t^4} = \frac{5^2 \times 5^2 \times t^8}{(2 \times 5)^3 \times t^4}$

$= \frac{5^{2+2} \times t^8}{2^3 \times 5^3 \times t^4}$ $[\because a^m \times a^n = a^{m+n}]$ $[(a \times b)^m = a^m \times b^m]$

$= \frac{5^4 \times t^8}{2^3 \times 5^3 \times t^4}$

$= \frac{5^{4-3} \times t^{8-4}}{2^3}$ $[a^m \div a^n = a^{m-n}]$

$= \frac{5 \times t^4}{2^3} = \frac{5t^4}{8}$

(c) $\frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5} = \frac{3^5 \times (2 \times 5)^5 \times 5^2}{5^7 \times 6^5}$

$= \frac{3^5 \times 2^5 \times 5^5 \times 5^2}{5^7 \times (2 \times 3)^5}$ $[(a \times b)^m = a^m \times b^m]$

$= \frac{3^5 \times 2^5 \times 5^{5+2}}{5^7 \times 2^5 \times 3^5}$ $[a^m \times a^n = a^{m+n}]$

$= \frac{\overset{1}{\cancel{3^5}}}{\cancel{3^5}} \times \frac{\overset{1}{\cancel{2^5}}}{\cancel{2^5}} \times \frac{\overset{1}{\cancel{5^7}}}{\cancel{5^7}} = 1$

6. Given that $\left(\frac{12}{13}\right)^4 \times \left(\frac{13}{12}\right)^{-8} = \left(\frac{12}{13}\right)^{2x}$

$\Rightarrow \left(\frac{12}{13}\right)^4 \times \left(\frac{12}{13}\right)^8 = \left(\frac{12}{13}\right)^{2x}$

$[\because a^{-m} = \frac{1}{a^m}]$

$\Rightarrow \left(\frac{12}{13}\right)^{4+8} = \left(\frac{12}{13}\right)^{2x}$ $[a^m \times a^n = a^{m+n}]$

$\Rightarrow \left(\frac{12}{13}\right)^{12} = \left(\frac{12}{13}\right)^{2x}$

Since, bases are same, so powers will also be same

$\therefore \quad 2x = 12 \Rightarrow x = \frac{12}{2} \Rightarrow x = 6$

7. Given that $(-3)^{x-1} = -243$

Exponential form of -243

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

$= (-3)^5$

So $(-3)^{x-1} = (-3)^5$

Since bases are same, so powers will also be same

$\therefore \quad x - 1 = 5 \Rightarrow x = 5 + 1$

So $(-7)^{x-6} = (-7)^{6-6}$

$= (-7)^0 = 1$ $[a^0 = 1]$

8. Let the required number be x

Then, $34 \times x = 37$

$\Rightarrow \quad x = \frac{3^7}{3^4}$

$\Rightarrow \quad x = 3^{7-4}$ $[a^m \div a^n = a^{m-n}]$

$\Rightarrow \quad x = 33 \quad \Rightarrow x = 27$

(b) Let the required number be x

Then $(-6)-1 \times x = 10-1$

$\Rightarrow \quad \frac{1}{-6} \times x = \frac{1}{10}$ $[a^{-1} = \frac{1}{a}]$

$\Rightarrow \quad x = \frac{-6}{10} \Rightarrow x = \frac{-3}{5}$

Class Work 2.5

1. $172 = 1 \times 100 + 7 \times 10 + 2 \times 1$

$= 1 \times 10^2 + 7 \times 10^1 + 2 \times 10^0$

2. $5642 = 5 \times 1000 + 6 \times 100 + 4 \times 10 + 2 \times 1$

$= 5 \times 10^3 + 6 \times 10^2 + 4 \times 10^1 + 2 \times 10^0$

3. $6374 = 6 \times 1000 + 3 \times 100 + 7 \times 10 + 4 \times 1$

$= 6 \times 10^3 + 3 \times 10^2 + 7 \times 10^1 + 4 \times 10^0$

4. $104278 = 1 \times 100000 + 4 \times 1000 + 2 \times 100 + 78 \times 10 + 8 \times 1$

$= 1 \times 10^5 + 4 \times 10^3 + 2 \times 10^2 + 7 \times 10^1 + 8 \times 10^0$

NCERT Exercise 2.2

5. (i) We know that the population of ants in the world

= 20 quadrillion

= 2 × 1016

And the population of human in the world

= 8.2 billion

= 8.2 × 109

So, the number of ants for every human

$= \frac{2 \times 10^{16}}{8.2 \times 10^{9}} = 2.43 \times 10^{7}$

= 0.243 × 106

(ii) Given, the number of birds contained by a flock of starlings = 10000 = 10^4

We know that total global population of starlings

= 500 million

= 500000000 = 5×10^8

So, the number of flocks in the world

$= \frac{\text{Total global population of starlings}}{\text{Number of birds per flock}}$

$= \frac{5 \times 10^8}{10^4} = 5 \times 10^{(8-4)}$

$= 5 \times 10^4 = 50000$

(iii) Given, the number of leaves on a tree

$= 10^4$

We know that the total number of trees in the world

$= 3 \times 10^{12}$

So, the total number of leaves on all the trees in the world

$= 3 \times 10^{12} \times 10^4$

$= 3 \times 10^{(12+4)}$

$[\because a^m \times a^n = a^{m+n}]$

$= 3 \times 10^{16}$

(iv) We know that the distance from the Earth to Moon

= 384400000 km

$= 3.844 \times 10^8$ m

and the thickness of a standard paper

= 0.1mm

= 0.0001m

$= 1 \times 10^{-4}$ m

So, number of sheets

$= \frac{\text{Distance to Moon}}{\text{Thickness of one sheet}}$

$= \frac{3.844 \times 10^8 \text{m}}{1 \times 10^{-4} \text{ m}}$

$= 3.844 \times 10^{12}$

Therefore, we need approximately 3.844×10^{12} sheets of paper stacked on top of each other to reach the Moon.

NCERT Exercise 2.3

1. Given that,

$2^{224} \div 4^{32}$

$= \frac{2^{224}}{(2^2)^{32}}$ $[\because 4 = 2^2]$

$= \frac{2^{224}}{2^{64}} = 2^{224-64}$ $\left[\because \frac{a^m}{a^n} = a^{m-n}\right]$

$= 2^{160}$

To find unit digit

we know that $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^6 = 64$, $2^7 = 128$ .... .

Clearly, cycle repeats after every 4 powers

So, $\frac{160}{4}$ [for 2^{160}]

= 40

So, the unit digit in the value of $2^{224} \div 4^{32}$ = 6

2. Given, 5 bottles in a container everyday

So, total number of bottles after 40 days

= 40 × 5 + 5 initial bottles

= 200 + 5 = 205 bottles

3. (i) $64^3 = (8^2)^3 = 8^{2\times3} = 8^2 \times 8^3$ [since $(a^m)^n = a^{mn}$]

Also, $64^3 = (4^3)^3 = 4^{3\times3}$

$= 4^3 \times 4^3$ $[a^{m+n} = a^m \times a^n]$

Also, $64^3 = (2 \times 32)^3 = (2 \times 2^5)^3$

$= 2^3 \times 2^{15}$

(ii) $192^8 = (64 \times 3)^8 = (8^2 \times 3)^8 = 8^{16} \times 3^8$

Also, $(192)^8 = (64 \times 3)^8 = (2^6 \times 3)^8$

$= 2^{48} \times 3^8$

Also, $(192)^8 = (64 \times 3)^8$

$= (4^3 \times 3)^8 = 4^{24} \times 3^8$

(iii) $(32)^{-5} = (2^5)^{-5} = 2^{5\times(-5)}$

Also, $(32)^{-5} = 2^{-25} = 2^{(-5-10-10)}$

$= 2^{-5} \times 2^{-10} \times 2^{-10}$

Also, $(32)^{-5} = (2^5)^{-5} = 2^{-25} = 2^{(10-35)}$

$= 2^{10} \times 2^{-35}$

4. (i) Given statement is only sometimes true

e.g. $4 = 2^2$ is a square but not a cube.

$64 = 4^3 = 8^2$, both cube and square

$8 = 2^3$, cube but not square

(ii) Given statement is always true.

e.g. $2^4 = 4^2$

$3^4 = 9^2$

(iii) Given statement is always true.

e.g. $n^5 = n^3 \times n^2$, which is divisible by n^3

(iv) Given statement is always true.

e.g. $a^3 \times b^3 = (a \times b)^3$

(v) Given statement is never true

q^{46}

46 is not divisible by 4

46 is not divisible by 6

$\therefore$ q^{46} cannot be both 4th power and 6th power.

5. (i) $10^{-2} \times 10^{-5} = 10^{-2-5} = 10^{-7}$

(ii) $5^7 \div 5^4 = 5^{7-4} = 5^3$

(iii) $9^{-7} \div 9^4 = 9^{-7-4} = 9^{-11}$

(iv) $(13^{-2})^{-3} = 13^{(-2)(-3)} = 13^6$

(v) $m^5\ n^{12}\ (mn)^9 = m^5\ n^{12}\ m^9\ n^9 = m^{5+9}\ n^{12+9} = m^{14}\ n^{21}$

6. (i) Given, $(1.2)^2$

$$= \left(\frac{12}{10}\right)^2 = \frac{12\times12}{10\times10} = \frac{144}{100}$$

$= 1.44$

(ii) Given, $(0.12)^2$

$$= \left(\frac{12}{100}\right)^2 = \frac{144}{10000} = 0.0144$$

(iii) Given, $(0.012)^2$

$$(0.012)^2 = \left(\frac{12}{1000}\right)^2$$

$$= \frac{12^2}{(1000)^2} = \frac{144}{1000000} = 0.000144$$

(iv) Given, $(120)^2$

$(120)^2 = (12 \times 10)^2 = 12^2 \times 10^2$

$= 144 \times 100 \qquad = 14400$

7. (i) $2^4 \times 3^6$

(ii) $6^4 \times 3^2 = (2 \times 3)^4 \times 3^2$

$= 2^4 \times 3^4 \times 3^2$

$= 2^4 \times 3^{4+2}$

$= 2^4 \times 3^6$

(iii) $6^{10} = (2 \times 3)^{10}$

$= 2^{10} \times 3^{10}$

(iv) $18^2 \times 6^2 = (2 \times 3 \times 3)^2 \times (2 \times 3)^2$

$= 2^2 \times 3^2 \times 3^2 \times 2^2 \times 3^2$

$= 2^4 \times 3^6$

(v) $6^{24} = (2 \times 3)^{24}$

$= 2^{24} \times 3^{24}$

from above, it is clear that the numbers $2^4 \times 3^6$, $18^2 \times 6^2$ and $6^4 \times 3^2$ are same.

8. (i) 4^3 or 3^4

$4^3 = 4 \times 4 \times 4 = 64$

$3^4 = 3 \times 3 \times 3 = 81$

$\because$ $64 < 81$

$\therefore$ $4^3 < 3^4$

(ii) 2^8 or 8^2

$2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 256$

$8^2 = 64$

clearly $256 > 64$

$\therefore$ $2^8 > 8^2$

(iii) 100^2 or 2^{100}

$100^2 = 100 \times 100 = 10000$

$2^{100} = (2^{10})^{10} = (1024)^{10}$

since, $1024 > 100$

clearly, $(1024)^{10} > 10000$

$\therefore\ 100^2 < 2^{100}$

9. Number of packets produce in a year = 8.5 billion

= 8.5×10^9 [1 billion = 10^9]

Since, 10^9 is less than 8.5×10^9 and 10^{10} is greater than 8.5×10^9.

So, the dairy needs at least 10 digits for unique ID.

10. Yes, there are other numbers that are both squares and cubes.

e.g. $1^2 = 1$

$1^3 = 1$

$1^6 = 1$

$4^6 = 4096 = 64^2 = 16^3$

..... and so on

In general, any number which is both perfect square and a perfect cube must be of the form k^6.

11. Alphanumeric character can be a digit (0 – 9)

i.e 10 options.

or a letter (A – Z) *i.e.* 26 options

Total possible characters = 10 + 26 = 36

Length of passcode is 5 (given)

$\therefore$ Total number of possible codes

= $36 \times 36 \times 36 \times 36 \times 36$

= 36^5 = 60466176

12. (i) Given that,

Total population of sheep = 10^9

and total population of goats = 10^9

so, total population of goat and sheep

= $10^9 + 10^9$

13. (i) We know that population of the world

= 8×10^9

Number of pieces, of clothing each person head

= 30

$\therefore$ Total number of pieces of clothing

= $8 \times 10^9 \times 30$

= 240×10^9

= 2.4×10^{11}

(ii) Number of bee colonies in the world

= 100 million

= 100×1000000

= 10^8

Number of bees in each colony

= 50,000

$\therefore$ Total number of honeybees

= $50,000 \times 10^8$

= $5 \times 10^4 \times 10^8$

= 5×10^{12}

(iii) Number of bacterial cells in human body

= 38 trillion

= 38×10^{12}

= 3.8×10^{13}

and population of the world = 8×10^9

$\therefore$ Number of bacterial population residing in all humans in the world = $3.8 \times 10^{13} \times 8 \times 10^9$

= $30.4 \times 10^{13+9}$

= 30.4×10^{22}

= 3.04×10^{23}

(iv) Let us assume that, an average life span of 70 years and 1 hours per day spent eating.

So, time spent in eating in 1 day = 1 hour

= 60×60 sec

= 3600 sec

Time spent in eating in 1 year

= 3600×365

= 1314000 [1 year = 365 days]

Total time spent eating in a lifetime in seconds

= 1314000×70

= 91980000 seconds

= 9.198×10^7 seconds

14. Let's today's date is 31 May 2025.

1 arab/1 billion seconds = $\frac{1000000000}{60}$ minutes

[1 minutes = 60 sec]

$= \frac{100000000}{60\times60}$ hours [60 minutes = 1 hrs]

$= \frac{100000000}{60\times60\times24}$ days [1 day = 24 hrs]

= 1157407 days

$= \frac{1157407}{365.25}$ [1 leap year = 365 – 25 day]

= 31.68 years

It means 1 arab seconds = 31 years 7 months (approx) on subtracting 31 years 7 months from 31 May 2025, we get 31 October 1994.

Practice Exercise 2.2

1. (a) 279404 = 2 × 100000 + 7 × 10000 + 9 × 1000 + 4 × 100 + 4 × 1

$= 2 \times 10^5 + 7 \times 10^4 + 9 \times 10^3 + 4 \times 10^2 + 4 \times 10^0$

(b) 3006194 = 3000000 + 6 × 1000 + 1 × 100 + 9 × 10 + 4 × 1

$= 3 \times 10^6 + 6 \times 10^3 + 1 \times 10^2 + 9 \times 10^1 + 4 \times 10^0$

(c) 2806196 = 2 × 1000000 + 8 × 100000 + 6 × 1000 + 1 × 100 + 9 × 10 + 6 × 1

$= 2 \times 10^6 + 8 \times 10^5 + 6 \times 10^3 + 1 \times 10^2 + 9 \times 10^1 + 6 \times 10^0$

(d) 120719 = 100000 + 2 × 10000 + 7 × 100 + 1 × 10 + 9 × 1

$= 1 \times 10^5 + 2 \times 10^4 + 7 \times 10^2 + 1 \times 10^1 + 9 \times 10^0$

(e) 20068 = 2 × 10000 + 6 × 10 + 8 × 1

$= 2 \times 10^4 + 6 \times 10^1 + 8 \times 10^0$

2. (a) 86045

(b) 405302

(c) 30705

(d) 90023

3. (a) 5×10^8

(b) 7×10^6

(c) $3 .18 \times 10^9$

(d) 3.90×10^3

4. (a) 3.84×10^8 m is the distance between Earth and Moon.

(b) Speed of light in vaccum is 3×10^8 m/sec

(c) Diameter of Earth is 1.27×10^7 m

(d) Diameter of Sun is 1.4×10^9 m

(e) The universe is estimated to be about 1.2×10^{10} years

(f) 6.023×10^{22} molecules are contained in a drop of water weighing 1.8 gm.

(g) The earth has 1.353×10^9 cubic km of sea water.

(h) The population of India was about 1.468×10^9 in 2025.

5. (a) Prime factors of 24000 = 2 × 2 × 2 × 2 × 2 × 2 × 3 × 5 × 5 × 5

Exponental form = $2^6 \times 3^1 \times 5^3$

(b) Prime factors of 126000 = 2 × 2 × 2 × 2 × 3 × 3 × 5 × 5 × 5 × 7

Exponental form = $2^4 \times 3^2 \times 5^3 \times 7^1$

(c) Prime factors of 14157 = 3 × 3 × 11 × 11 × 13

Exponental form = $3^2 \times 11^2 \times 13^1$

6. To prove $\left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^a}\right)^b \times \left(\frac{x^a}{x^b}\right)^c = 1$

$\Rightarrow (x^{b-c})^a \times (x^{c-a})^b \times (x^{a-b})$ $[a^m \div a^n = a^{m-n}]$

$\Rightarrow x^{ab-ac} \times x^{bc-ab} \times x^{ac-bc}$ $[a^m \times a^n = a^{m+n}]$

$\Rightarrow x^{\cancel{ab}-\cancel{ac}+\cancel{bc}-\cancel{ab}+\cancel{ac}-\cancel{bc}}$

$\Rightarrow x^0 \Rightarrow 1$ $[a^0 = 1]$

Chapter Innings

A. Multiple Choice Questions

1. (a) **2.** (c) **3.** (d) **4.** (a) **5.** (a)

6. (b) **7.** (c) **8.** (a) **9.** (b) **10.** (c)

B. Fill in the Blanks

1. $\left[\left\{\left(\frac{-1}{2}\right)^2\right\}^{-2}\right]^{-1}$

$= \left(\frac{-1}{2}\right)^{2\times(-2)\times(-1)}$ $[\because (a^n)n = a^{m\times n}]$

$= \left(\frac{-1}{2}\right)^4$

$= \frac{(-1)^4}{2^4} = \frac{1}{16}$ $[(-1)^{\text{even number}} = 1]$

2. $\left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$

$\Rightarrow \left(\frac{5}{3}\right)^{-5+11} = \left(\frac{5}{3}\right)^{8x}$ $[a^m \times a^n = a^{m+n}]$

$\Rightarrow \left(\frac{5}{3}\right)^{6} = \left(\frac{5}{3}\right)^{8x}$

$\Rightarrow 8x = 6 \Rightarrow x = \frac{6}{8}$ $\boxed{x = \frac{3}{4}}$

3. $(-2)^n = -128$

$(-2)^n = (-2)^7$

$n = 7$

4. $2^9 \times 2^{91} - 2^{19} \times 2^{81}$

$= 2^{9+91} - 2^{19+81}$

$= 2^{100} - 2^{100} = 0$

5. $(100)^0 = 10^n$

$\Rightarrow (10^2)^0 = 10^n$

$\Rightarrow 10^{2\times 0} = 10^n$

$\Rightarrow 10^0 = 10^n$ $\boxed{n = 0}$

C. Match the Following:

1. (b) **2.** (c) **3.** (e) **4.** (a) **5.** (d)

D. True or False

1. T **2.** F **3.** T **4.** T **5.** F

E. Very Short Answer Type Questions

1. As $x = (100)^{-3} \div (100)^0$

$= (100)^{-3} \div 1$

$x = (100)^{-3}$

So, $x^{-3} = [(100)^{-3}]^{-3}$

$= (100)^{(-3)\times(-3)}$ $[(a^m)^n = a^{m\times n}]$

$x^{-3} = 100^9$

2. Let x be the number by which $(-2a)^0$ should be multiply

According to question

$x \times (-29)^0 = (29)^0$

$\therefore$ $x \times 1 = 1$ $[a^0 = 1]$

Thus $x = 1$

3. Let x be the number by which $(-15)^{-1}$ should be divided

According to question,

$(-15)^{-1} \div x = (-15)–1$

$\Rightarrow x = \frac{(-15)^{-1}}{(-15)^{-1}}$

$\Rightarrow x = 1$

4. $(-7)^{-2} \div (90)^{-1} = (49)^{-1} \div (90)^{-1}$

$= \frac{1}{49} \div \frac{1}{90} = \frac{90}{49}$

So multiplicative inverse of $(-7)^{-2} \div (90)^{-1}$ is the multiplicative inverse of $\frac{90}{49} = \frac{49}{90}$

5. $5^{3x-1} \div 25 = 125$

$\Rightarrow 5^{3x-1} \div 5^2 = 5^3$

$\Rightarrow 5^{3x-1-2} = 5^3$ $[a^m \div a^n = a^{m-n}]$

$\Rightarrow 5^{3x-3} = 5^3$

Since bases are same, so power will also be same hence

$3x - 3 = 3$

$\Rightarrow 3x = 3 + 3 = 6$

$\Rightarrow x = \frac{6}{3}$

$\Rightarrow x = 2$

6. Product of 3.2×10^6 and 4.1×10^{-1}

$= (3.2 \times 10^6) \times (4.1 \times 10^{-1})$

$= (3.2 \times 4.1) \times (10^6 \times 10^{-1})$

$= 13.12 \times 10^{6-1}$

$= 13.12 \times 10^5$

Standard form $= 1.312 \times 10^1 \times 10^5$

$= 1.312 \times 10^6$

F. Short Answer Type Questions

1. $\left[\left(\frac{2}{3}\right)^3 \times \left(\frac{-3}{4}\right)^2\right] \div \left(\frac{-2}{5}\right)^3$

$= \left(\frac{8}{27} \times \frac{9}{16}\right) \div \left(\frac{-8}{125}\right)$

$= \frac{\cancel{8}}{27} \times \frac{9}{16} \times \frac{125}{-\cancel{81}}$

$= -\dfrac{1125 \div 3}{432 \div 9} = -\dfrac{125}{48}$

2. $\left[\left\{\left(-\dfrac{2}{3}\right)^2\right\}^{-1}\right]^{-2}$

$= \left(\dfrac{-2}{3}\right)^{2\times(-1)\times(-2)}$ $[\because (a^m)^n = a^{m\times n}]$

$= \left(\dfrac{-2}{3}\right)^4$ $[(-) \times (-1) = +]$

$= \dfrac{-2}{3} \times \dfrac{-2}{3} \times \dfrac{-2}{3} \times \dfrac{-2}{3} = \dfrac{16}{81}$

3. (a) $10^2 \times 7^0 + 3^3 \times 2^2$

$= 100 \times + 27 \times 4$ $[a^0 = 1]$

$= 100 + 108$

$= 208$

Prime factors of 208 = $2 \times 2 \times 2 \times 2 \times 13$

Exponential form of 208 = $2^4 \times 13^1$

(b) $4^3 \times 5^0 + (-3)^4 - 7^0$

$= 64 \times 1 + 81 - 1$ $[a^0 = 1]$

$= 64 + 81 - 1 = 144$

Prime factors of 144 = $2 \times 2 \times 2 \times 2 \times 3 \times 3$

Exponential form of 144 = $2^4 \times 3^2$

4. $\left[\left(-\dfrac{3}{4}\right)^3 - \left(\dfrac{-5}{2}\right)^3\right] \times \left(\dfrac{-2}{3}\right)^4$

$= \left[\dfrac{(-3)^3}{(4)^3} - \dfrac{(-5)^3}{2^3}\right] \times \dfrac{(-2)^4}{(3)^4}$

$= \left[\dfrac{-27}{64} - \left(\dfrac{-125}{8}\right)\right] \times \dfrac{16}{81}$

$= \left[\dfrac{-27}{64} + \dfrac{125}{8}\right] \times \dfrac{16}{81}$

$= \left[\dfrac{-27+1000}{64}\right] \times \dfrac{16}{81}$

$= \dfrac{973}{\cancel{64}_4} \times \dfrac{\cancel{16}}{81}$

$= \dfrac{973}{324}$ (Improper fraction)

$= 3\dfrac{1}{324}$ (Mixed fraction)

5. $\left(\dfrac{1}{3}\right)^{-2} + \left(\dfrac{1}{4}\right)^{-2} + \left(\dfrac{1}{5}\right)^{-2} - \left(\dfrac{1}{6}\right)^{-2}$

$= (3)^2 + (4)^2 + (5)^2 - (6)^2$ $[a^{-m} = \dfrac{1}{a^m}]$

$= 9 + 16 + 25 - 36 = 14$

G. Long Answer Type Questions

1. (a) Since number of zeros in 5.976×10^{24} is greater than number of zeros in 8.689×10^{23}

Thus $(5.976 \times 10^{24}) > (8.689 \times 10^{23})$

(b) Since $3.7662 < 3.7671$

Thus $(3.7662 \times 10^{17}) < (3.7671 \times 10^{17})$

2. (a) $\dfrac{7^3 \times 11^4 \times 13^0}{7^2 \times 11^2}$

$= \dfrac{7^3}{7^2} \times \dfrac{11^4}{11^2} \times 1$ $[a^0 = 1]$

$= 7^{3-2} \times 11^{4-2}$ $[a^m \div a^n = a^{m-n}]$

$= 7^1 \times 11^2$

$= 7 \times 121 = 847$

(b) $\dfrac{(-2)^3 \times (3x)^2 \times (-xy^3)}{3x^2 y}$

$= \dfrac{-8 \times 3^2 x^2 \times (-x) y^3}{3x^2 y}$

$= \dfrac{+8 \times \cancel{3} \times 3 \times \cancel{x^2} \times x \times \cancel{y} \times y^2}{3 \times \cancel{x^2} \times \cancel{y}} = 24xy^2$

3. (a) $\therefore \dfrac{(-3)^5 \times 8^3 \times 2^5}{3^2 \times 4^4}$

$= \dfrac{-(3)^5 \times (2^3)^3 \times 2^5}{3^2 \times (2^2)^4}$ $[(-a)^{\text{odd number}} = -(a)^{\text{odd number}}]$

$= \dfrac{-(3)^5 \times 2^9 \times 2^5}{3^2 \times 2^8}$ $[(a^m)^n = a^{m\times n}]$

$= \dfrac{-(3)^5 \times 2^{14}}{3^2 \times 2^8}$ $[a^m \times a^n = a^{m+n}]$

$= (3)^{5-2} \times 2^{14-8}$ $[a^m \div a^n = a^{m-n}]$

$= -3^3 \times 2^6$

$= -27 \times 64 = -1728$

Prime factors of 1728 = 3 × 3 × 3 × 2 × 2 × 2 × 2 × 2 × 2

Exponential form of –1728 = $(-3)^3 \times (2)^6$

(b) $\dfrac{9^8 \times (x^2)^5}{(27)^4 \times (x^3)^2}$

$= \dfrac{(3^2)^8 \times x^{10}}{(3^3)^4 \times x^6}$ $[(a^m)^n = a^{m \times n}]$

$= \dfrac{3^{16}}{3^{12}} \times \dfrac{x^{10}}{x^6}$

$= 3^{16-12} \times x^{10-6}$ $[a^m \div a^n = a^{m-n}]$

$= 3^4 \times x^4$ $[a^m \times b^m = (a \times b)^m]$

$= (3x)^4$

4. Given that $a = -1$ and $b = 2$

(a) $a^b + b^a = (-1)^2 - (2)^{-1}$

$= (-1 \times -1) + \dfrac{1}{2}$ $[a^{-1} = \dfrac{1}{a}]$

$= 1 + \dfrac{1}{2} = \dfrac{3}{2}$

(b) $a^b - b^a = (-1)^2 - (2)^{-1}$

$= [(-1) \times (-1)] - \dfrac{1}{2}$ $[a^{-1} = \dfrac{1}{a}]$

$= 1 - \dfrac{1}{2} = \dfrac{1}{2}$

(c) $a^b \times b^a = (-1)^2 \times (2)^{-1}$

$= 1 \times \dfrac{1}{2} = \dfrac{1}{2}$

(d) $a^b \div b^a = (-1)^2 \div (2)^{-1}$

$= 1 \div \dfrac{1}{2}$

$= 1 \times 2 = 2$

5. (a) Prime factors of 1296 = 2 × 2 × 2 × 2 × 3 × 3 × 3 × 3

Exponential form of –1296 = $-(2^4 \times 3^4)$

and prime factors of 14641 = 11 × 11 × 11 × 11

Exponential form of 14641 = $(11)^4$

Thus, Exponential form of $\dfrac{-1296}{14641}$

$= -\left(\dfrac{2^4 \times 3^4}{11^4}\right)$

$= -\left(\dfrac{2 \times 3}{11}\right)^4 = -\left(\dfrac{6}{11}\right)^4$

(b) ∴ Exponential form of $\dfrac{-125}{343}$

$= \dfrac{-5 \times -5 \times -5}{7 \times 7 \times 7} = \dfrac{-5^3}{7^3} = \left(\dfrac{-5}{7}\right)^3$

H. Assertion-Reason Based Questions

1. (C) **2.** (A) **3.** (A)

4. (D), In assertion, 52 × 53 = 52+3 = 55

so assurtion is wrong but reason is correct thus its answer is option D

5. (D), as assertion is false but reason is true.

I. Case Study

1. (b) The distance of Radhika from her home town = 1967.5 km and 1 km = 10^6 mm

distance = 1967.5×10^6 mm

In standard form = $1.9675 \times 10^3 \times 10^6$ mm = 1.9675×10^9 mm

2. (*) Distance of Reshma from her home town = 2218.4 km

and 1 km = 10^4 decimetre

distance in decimeter = 2218.4×10^4 decimeter

in standard form = $2.2184 \times 10^3 \times 10^4$

= 2.2184×10^7 decimetre

3. (*) Distance of Radhika from Reshma

= (2218.5 – 1967.5) km

= 250.9 km

Since 1 km = 10^2 decametre

distance = 250.9×10^2 decametre

in standard form = $2.509 \times 10^2 \times 10^2$

= 2.509×10^4 decametre.

3. A Story of Numbers

NCERT Exercise 3.1

1. In method 1, generally sticks are used to represent number. According to question,

Addition : Combine the two collection of sticks and then count to total.

Subtraction : Remove the sticks from one collection from another and count.

Multiplication : Prepare same size sticks group and then count them.

Division : Divide total no. of sticks equally in required number of parts and then count each part.

2. Yes, we can extend the system by using letters aa; ab, ba, bb, ac, ca, ... and so on.

3. Do your self.

4. (i) Given that 1222

1222 = 1000 + 100 + 100 + 10 + 10 + 1 + 1

In Roman system,

1222 = MCCXXII

(ii) Given that 2999

2999 = 1000 + 1000 + 100 + 100 + 100 + 100 + 100 + 100 + 100 + 100 + 100 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1

In Roman system,

2999 = MMCMXCIX

(iii) Give that 302

302 = 100 + 100 + 100 + 1 + 1

In Roman system,

302 = CCCII

(iv) Given that 715

715 = 100 + 100 + 100 + 100 + 100 + 100 + 100 + 10 + 1 + 1 + 1 + 1 + 1

In Roman system,

715 = DCCXV

Practice Exercise 3.1

1. Early human needed to count during the stone age to keep track of animals, food, people and other daily needs.

2. The modern oral and written number system originated in India.

3. Evidence for the Indian origin of digit 0 through 9 is found in ancient indian inscriptions and manuscripts where these digits were used.

4. Arab mathemticians and traders helped transmit and popularize the indian number system in the Arab World.

5. The Hindu-Arabic numeral system spread to Europe via Arab traders and scholors in the middle east and North Africa. This transition primarily occured between the 10th and 12th centuries, notably popularized by fibonacci's book liber Abaci in 1202

6. They are called "Arabic numerals" because Europeans first encountered them through Arabian mathematicians. While the system was invented in India, it was the Arab world that introducted and transmitted it to the west.

7. One-to-one mapping is the process of matching each item in a set being counted with exactly one distinct number in a sequence. This ensures every item is counted once and only once.

8. **Impacticality :** It becomes difficult to manage or keep track of a massive physical tally.

Errors : It is very easy to lose count or skip a sound/stick when dealing with high numbers.

Efficiency : The process is extremely slow and lacks a compact way to represent large values.

9. The Roman numerals system uses letters I. V, X, L, C, D, M to represent values its primary limitations is the lack of a symbol for zero and a place-value system, which makes performing complex arithmatic like multiplication and dimision very difficult.

10. Numerals are the symbols or figures used to represent a number. While a "number" is an abstract concept of quantity, a "numeral" is the written mark used to denote that quantity.

Class Work 3.2

1. LXXXVII + LXXVII = ?

We have

L	XXX	V	III
L	XX	V	II
C	L	X	V

= CLXV

2. To multiply roman numerals without converting them to Hindu-Arabic numbers, you can use the Ancient Roman multiplication method.

3. V × L = 5 × 50 = 250

in roman = CCL

L × D = 50 × 500 = 25000

in roman = XXV

V × D = 5 × 500

= 2500

in roman = MMD

VII × IX = 7 × 9 = 63

in roman = LXIII

4. (a) 1222 = 1000 + 200 + 20 + 2

in roman = MCCXXII

(b) 2999 = 2000 + 900 + 90 + 9

in roman = MMCMXCIX

(c) 302 = 300 + 2

in roman = CCCII

(d) 715 = 700 + 10 + 5

in roman = DCCXV

NCERT Exercise 3.2

1. A group of indigenous people in a pacific island use different sequences of number names to count different objects because their systems are designed to specific cultural, practical or linguistic needs.

2. We know that

ukasar denote 2 and urapon denote 1

(i) (ukasar – ukasar – ukasar – ukasar – urapon) + (ukasar – ukasar – ukasar – urapon)

= ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar

[∵ urapon + urapon = ukasar]

[Addition is done by joining the number names together]

(ii) (ukasar – ukasar – ukasar – ukasar – urapon) – (ukasar – ukasar – ukasar)

= ukasar – urapon [Subtraction is done by removing same number names from a longer sequence]

(iii) (ukasar – ukasar – ukasar – ukasar – urapon) × (ukasar – ukasar)

= ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar

[Multiplication is done by repeating the same word]

(iv) (ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar – ukasar) ÷ (ukasar – ukasar)

= ukasar – ukasar

[By splitting the word into equal groups division is done]

3. Comparison between Hindu number system and Roman number system is as follows :

	Hindu Number System	Roman Number System
1.	It is a place-value system	It is not a place-value system
2.	This system allows writing and reading of large numbers	This system does not allow
3.	This system has symbol for nothing *i.e.* 0	This system does not have
4.	This system allows to perform Addition, Subtraction, Multiplication and division	This system allow only basic addition

4. Do it yourself.

Practice Exercise 3.2

1.	**Roman number**	**Hindu-Arabic numeral next to roman**
(a)	CC = 200	201
(b)	CXC = 190	191
(c)	CL = 150	151
(d)	DCCX = 710	711
(e)	CDV = 405	406
(f)	DLXXII = 572	573

(g)	DLX = 560	561
(h)	CLXXIX = 179	180
(i)	CML = 950	951
(j)	DCCLXX = 770	771
(k)	CMXXXVII = 937	938
(l)	DCLXXXIV = 684	685

2.	**Hindu-Arabic number**	**Roman number next to Hindu-Arabic number**
(a)	320 = 300 + 20	CCCXXI
(b)	532 = 500 + 30 + 2	DXXXIII
(c)	809 = 800 + 9	DCCCX
(d)	615 = 600 + 10 + 5	DCXVI
(e)	674 = 600 + 70 + 4	DCLXXV
(f)	150 = 100 + 50	CLI
(g)	298 = 200 + 90 + 8	CCXCIX
(h)	412 = 400 + 10 + 2	CDXIII
(i)	943 = 900 + 40 + 3	CMXLIV
(j)	541 = 500 + 40 + 1	DXLII
(k)	477 = 400 + 70 + 7	CDLXXVIII
(l)	839 = 800 + 30 + 9	DCCCXL

3. (a) CDXXXII = (500 – 100) + (10 + 10 + 10) + (1 + 1) = 432

and CCCLXVII = (100 + 100 + 100) + 50 + 10 + 5 + 1 + 1 = 367

$\therefore$ 432 > 367

Thus CDXXXII $\boxed{>}$ CCCLXVII

(b) as CDLXIII = (500 – 100) + 50 + 10 + 1 + 1 + 1 = 463

and CCLI = (100 + 100) + 50 + 1 = 251

$\therefore$ 463 > 251

Thus CDLXIII $\boxed{>}$ CCLI

(c) as XXXIX = (10 + 10 + 10) + (10 – 1) = 39

and CDLIV = (500 – 100) + 50 + (5 – 1) = 454

$\therefore$ 39 < 454

Thus XXXIX $\boxed{<}$ CDLIV

(d) as CLXI = 100 + 50 + 10 + 1 = 161

and CXXX = 100 + 10 + 10 + 10 = 130

$\therefore$ 161 > 130

CLXI $\boxed{>}$ CXXX

(e) as CCIV = 10 + 100 + (5 – 1) = 204

and LVII = 50 + 5 + 1 + 1 = 57

$\therefore$ 204 > 57

Thus CCIV $\boxed{>}$ LVII

(f) as LXXXV = 50 + 10 + 10 + 10 + 5 = 85

and CCCIII = 100 + 100 + 100 + 1 + 1 + 1 = 303

$\therefore$ 85 < 303

Thus LXXXV $\boxed{>}$ CCCIII

(g) as CXCI = 100 + (100 – 10) + 1 = 191

and CDXLI = (500 – 100) + (50 – 10) + 1 = 441

$\therefore$ 191 < 441

CXCI $\boxed{>}$ CDXLI

(h) as CLXVIII = 100 + 50 + 10 + 5 + 1 + 1 + 1 = 168

and CDLXXIII = (500 – 100) + 50 + 10 + 10 + 1 + 1 + 1 = 473

$\therefore$ 168 < 473

Thus CLXVIII $\boxed{>}$ CDLXXIII

4. (a) as XXIII = 10 + 10 + 1 + 1 + 1 = 23

and XXVI = 10 + 10 + 5 + 1 = 26

$\therefore$ 23 + 26 = 49

So $\boxed{\text{XXIII + XXVI = XLIX}}$

(b) as XXXIII = 10 + 10 + 10 + 1 + 1 + 1 = 33

and XXIII = 10 + 10 + 1 + 1 + 1 = 23

$\therefore$ 33 – 23 = 10

Thus $\boxed{\text{XXXIII – XXIII = X}}$

(c) as XXXVII = 10 + 10 + 10 + 5 + 1 + 1 = 37

and XXXIII = 10 + 10 + 10 + 1 + 1 + 1 = 33

XIX = 10 + (10 – 1) = 19

$\therefore$ 37 – 33 + 19 = 23

Thus $\boxed{\text{XXXVII – XXXIII + XIX = XXIII}}$

(d) as III = 3

XXIII = 23

and III = 3

$\therefore$ 3 + 23 + 3 = 29

Thus $\boxed{\text{III + XXIII + III = XXIX}}$

(e) as VI = 6

XXVIII = 28

and VII = 7

$\therefore$ 6 + 28 + 7 = 41

Thus $\boxed{\text{VI + XXVIII + VII = XLI}}$

(f) as III = 3

XXII = 22

and IV = 4

$\therefore$ 3 + 22 + 4 = 29

Thus $\boxed{\text{III + XXII + IV = XXIX}}$

(g) as XXXI = 31

XXXII = 32

and VI = 6

$\therefore$ 31 + 32 – 6 = 57

Thus $\boxed{\text{XXXI + XXXIII – VI = LVII}}$

(h) as XLVI = 46

XIX = 19

and VIII = 8

$\therefore$ 46 – 19 – 8 = 19

Thus $\boxed{\text{XLVI – XIX – VIII = XIX}}$

5. (a) as XXIX = 29

LXXX = 80

XXVII = 27

XIX = 19

and XL = 40

$\therefore$ ascending order

= 19 < 27 < 29 < 40 < 80

Thus $\boxed{\text{XIX < XXVII < XXIX < XL < LXXX}}$

(b) as LXVIII = 68

XVIII = 18

XLI = 41

XLVII = 47

and LXIX = 69

$\therefore$ ascending order

= 18 < 41 < 47 < 68 < 69

Thus

$\boxed{\text{XVIII < XLI < XLVII < LXVIII < LXIX}}$

(c) as LXXI = 71

XCIX = 99

LVIII = 58

XXIX = 29

and LXXIV = 74

$\therefore$ ascending order

= 29 < 58 < 71 < 74 < 99

Thus

$\boxed{\text{XXIX < LVIII < LXXI < LXXIV < XCIX}}$

(d) as LXXII = 72

XXXIX = 39

XXIX = 29

LXXIV = 74

and LVIII = 58

$\therefore$ ascending order

= 29 < 58 < 71 < 74 < 99

Thus

$\boxed{\text{XXIX < LVIII < LXXI < LXXIV < XCIX}}$

Class Work 3.3

We know that, in Egyption number system

Landmark number	1	10	10^2	10^3	10^4	10^5	10^6	10^7
Symbol	I	𓎆	𓍢	𓆼	𓂭	𓆐	𓁨	𓇳

1. Using above table we can find product of :

(a) 𓎆 × 𓎆 = 𓍢

10 × 10 = 100

(b) 𓍢 × 𓎆 = 100 × 10 = 1000 = 10^3 (𓆼)

hence 𓍢 × 𓎆 = 𓆼

(c) 𓆼 × 𓎆 = 1000 × 10 = 10,000

= 10^4 (𓂭)

hence 𓆼 × 𓎆 = 𓂭

(d) 𓂭 × 𓎆 = 10^4 × 10 = 10^5 (𓆐)

hence 𓂭 × 𓎆 = 𓆐

2. Using above table, we get the following result :

S. No.	Expression	Landmark number	Sym-bol
(a)	𓎆 × 𓍢 = 10 × 10^2	10^3	𓆼
(b)	𓍢 × 𓍢 = 10^2 × 10^2	10^4	𓂭
(c)	𓆼 × 𓍢 = 10^3 × 10^2	10^5	𓆐
(d)	𓂭 × 𓍢 = 10^4 × 10^2	10^6	𓁨

3.

S. No.	Expression	Landmark number	Symbol
(a)	𓎆 × 𓆐 = 10^2 × 10^5	10^7	𓇳
(b)	𓍢 × 𓆼 = 10^2 × 10^3	10^5	𓆐

(c) 𓆼 × 𓆼 = $10^3 \times 10^3$ 10^6 𓁨

(d) 𓂭 × 𓁨 = $10^4 \times 10^6$ $10^{10} = 10^7 \times 10^3$ 𓇳 × 𓆼

4. Using above table, we have

(a) (𓍢𓍢𓍢𓍢𓍢 𓎆𓎆 𓏤𓏤) × 𓎆 = 𓍢

Symbols in landmark number

= (500 + 20 + 2) × 10

= 522 × 10 = 5220

Expressing result landmark number in symbol = $(10^3 + 10^3 + 10^3 + 10^3 + 10^3) + (10^2 + 10^2) + (10 + 10)$

(𓍢𓍢𓍢𓍢𓍢 𓎆𓎆 𓏤𓏤) × 𓎆

= 𓆼𓆼𓆼𓆼𓆼𓍢𓍢𓎆𓎆

(b) Expressing given symbols in landmark number

= $(10^3 + 10) \times 10$

= 1010 × 10 = 10100

So 𓆼 𓎆 × 𓎆 = 10,100 = $10^4 + 10^2$

= 𓂭𓍢

5. The product of a landmark number with another landmark number is also a landmark number.

NCERT Exercise 3.3

1. Given number,

10 45 8

= 10000 + 100 + 100 + 100 + 100 + 10 + 10 + 10 + 10 + 10 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1

= $10^4 + 4 \times 10^2 + 5 \times 10^1 + 8 \times 10^0$

In Egyptian system,

10458 =

𓂭 𓍢𓍢𓍢𓍢 𓎆𓎆𓎆𓎆𓎆 𓏤𓏤𓏤𓏤𓏤𓏤𓏤𓏤

Again, 1023 = 1000 + 10 + 10 + 1 + 1 + 1

= $10^3 + 2 \times 10^2 + 3 \times 10^0$

In Egyptian system,

1023 = 𓆼 𓎆 𓏤𓏤𓏤

Again, 2660 = 1000 + 1000 + 100 + 100 + 100 + 100 + 100 + 100 + 10 + 10 + 10 + 10 + 10 + 10

= $2 \times 10^3 + 6 \times 10^2 + 6 \times 10^0$

In Egyptian system,

2660 =

𓆼𓆼 𓍢𓍢𓍢𓍢𓍢𓍢 𓎆𓎆𓎆𓎆𓎆𓎆

Again, 784 = 7 × 100 + 8 × 10 + 4

= $7 \times 10^2 + 8 \times 10^1 + 4 \times 10^0$

In Egyptian system,

784 =

𓍢𓍢𓍢𓍢𓍢𓍢𓍢 𓎆𓎆𓎆𓎆𓎆𓎆𓎆𓎆 𓏤𓏤𓏤𓏤

Again, 1111 = 1000 + 100 + 10 + 1

= $10^3 + 10^2 + 10^1 + 10^0$

In Egyptian system, 𓆼 𓍢 𓎆 𓏤

Again, 70707 = 7 × 10000 + 7 × 100 + 7 × 1

= $7 \times 10^4 + 7 \times 10^2 + 7 \times 10^0$

In Egyptian system,

70707 =

𓂭𓂭𓂭𓂭𓂭𓂭𓂭 𓍢𓍢𓍢𓍢𓍢𓍢𓍢 𓏤𓏤𓏤𓏤𓏤𓏤𓏤

2. (i) Given that,

𓍢𓍢
𓎆𓎆𓎆
𓎆𓎆𓎆
𓏤𓏤𓏤 𓏤𓏤𓏤 𓎆

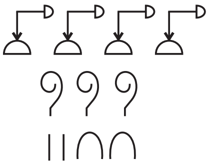
We know that 𓍢 = 10^2, 𓎆 = 10 and 𓏤 = 1

∴ Given numeral

= $2 \times 10^2 + 7 \times 10 + 6 \times 1$

= 276

(ii) Given that,



$= 4 \times 10^3 + 3 \times 10^2 + 2 \times 10 + 2 \times 1$

$= 4322$

3. (i) $15 = 3 \times 5^1 + 0 \times 5^0$

= □ □ □ (base-5)

(ii) $50 = 2 \times 5^2 + 0 \times 5^1 + 0 \times 5^0$

= ⬡ ⬡ (base-5)

(iii) $137 = 125 + 10 + 2$

$= 1 \times 5^3 + 0 \times 5^2 + 2 \times 5^1 + 2 \times 5^0$

= ○ □ □ △ △ (base-5)

(iv) $293 = 250 + 25 + 15 + 3$

$= 2 \times 125 + 25 + 3 \times 5 + 3$

$= 2 \times 5^3 + 1 \times 5^2 + 3 \times 5^1 + 3 \times 5^0$

= ○ ○ ⬡ □ □ □ △ △ △ (base-5)

(v) $651 = 625 + 25 + 1$

$= 1 \times 5^4 + 0 \times 5^3 + 1 \times 5^2 + 0 \times 5^1 + 1 \times 5^0$

= ∼ ⬡ △ (base-5)

4. No, because any positive integer can be expressed as a sum of powers of 5 multiplied by digit from 0 to 4.

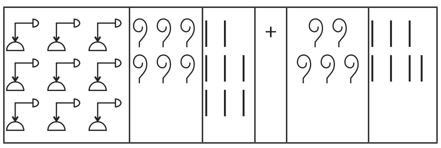
5. In general,

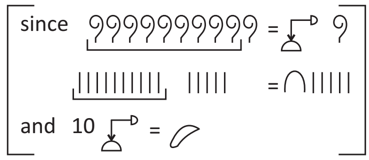
The landmark numbers of a base-n number system are the powers of n stating from $n^0 = 1, n, n^2, n^3$ ....

In a base-7 system, the landmark numbers are the powers of 7.

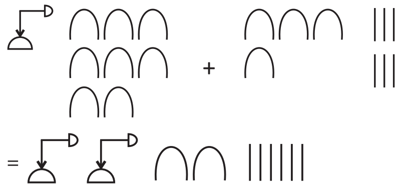
is $7^0 = 1, 7^1 = 7, 7^2 = 49, 7^3 = 343$, ...

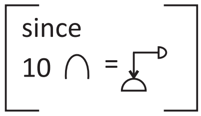
6. (i) Given that





(ii) Given that





7. We know that, In the base-5 system

$5^0 = 1$	△
$5^1 = 5$	□
$5^2 = 25$	⬡
$5^3 = 125$	○
$5^4 = 625$	∼
$5^5 = 3125$	↑

Therefore, ○ ⬡ ⬡ □ △ △

\+ ○ ○ ○ ⬡ □ □ △ △

= ○ ○ ○ ○ ⬡ ⬡ ⬡ □ □ □ △ △ △ △

$= 4\times5^3 + 3\times5^2 + 3\times5^1 + 4\times5^0$

$= 500 + 75 + 15 + 4 = 594$

8. No, because the Egyptian system has landmark numbers as the power of 10.

9.

Base-10 system	**Number of base-10 system as a sum of landmark numbers of base-4 system**	**Base-4 system**

1	$1 = 1 \times 4^0$	1
2	$2 = 2 \times 4^0$	2
3	$3 = 3 \times 4^0$	3
4	$4 = 1 \times 4^1 + 0 \times 4^0$	10
5	$5 = 1 \times 4^1 + 1 \times 4^1$	11
6	$6 = 1 \times 4^1 + 2 \times 4^0$	12
7	$7 = 1 \times 4^1 + 3 \times 4^0$	13
8	$8 = 2 \times 4^1 + 0 \times 4^0$	20
9	$9 = 2 \times 4^1 + 1 \times 4^0$	21
10	$10 = 2 \times 4^1 + 2 \times 4^0$	22
11	$11 = 2 \times 4^1 + 3 \times 4^0$	23
12	$12 = 3 \times 4^1 + 0 \times 4^0$	30
13	$13 = 3 \times 4^1 + 1 \times 4^0$	31
14	$14 = 3 \times 4^1 + 2 \times 4^0$	32
15	$15 = 3 \times 4^1 + 3 \times 4^0$	33
16	$16 = 1 \times 4^2 + 0 \times 4^1 + 0 \times 4^0$	100

10. In base-5 system

$5^0 = 1$	△
$5^1 = 5$	□
$5^2 = 25$	⬡
$5^3 = 125$	○
$5^4 = 625$	∼
$5^5 = 3125$	↑

In this system. It we count to multiply any number by 5 then add a '0' at the end of the given number.

Practice Exercise 3.3

1. Sequence of landmark number in the Egyption number system is 1, 10 10^2, 10^3, 10^4, 10^5, 10^6 and 10^7

2. Representation of 324 in the Egyption number system

324 = (100 + 100 + 100) + (10 + 10) + (1 + 1 + 1 + 1)

= 𓍢𓍢𓍢∩∩||||

3. Very large numbers required to invent new symbols for every higher power of 10. This made the system complicated and hard to continue using.

4. The second landmark number would be 5.

5. The sequence of landmark number in the base-5 number system is 1, 5, 5^2, 5^3, 5^4.....

So 143 can be expressed as 125 + 5 + 5 + 5 + 1 + 1 + 1

6. The general form of landmark numbers in a base-n system is n^0, n^1, n^2, n^3, n^4,....

7. A base-n system has major advantages in arithmatic and number representation because multiplying landmark numbers corresponds to adding their exponents making it efficient and consistent.

8. Multiplication in base n-system is much easier because multiplication of two landmark number is also a landmark number. But multiplying in roman numerals is quite difficult.

NCERT Exercise 3.4

1. (i) Given that,

63 = 1 × 60 + 3

= ◇1 ▽▽▽

[we know that in Mesopotamian system 60 = ◇1 and 3 = ▽▽▽]

(ii) Given number,

132 = 2 × 60 + 10+ 2

= ▽▽ ◇1 < ▽▽

[∵ 10 = < and 2 = ▽▽]

(iii) Given number,

200 = 3 × 60 + 20

= ▽▽▽ ◇1 <<

[∵ 20 <<]

(iv) Given number,

60 = 1 × 60

= ◇1

(v) Given number,

3605 = 3600 + 5

= 60^2 + 5

= ◇2 ▽▽▽▽▽

[∵ $60^2 = 3600$ ②]

2. (i) Given number is 77

$77 = 3 \times 20 + 17$

Symbols in the Mayan number system are placed vertically to represent a number.

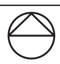
Landmark numbers	Number of occurrence	Symbols
20	3	• • •
1	17	• • ≡

So, 77 = • • •
• •
≡

(ii) Given number is 100

$100 = 20 \times 5 + 1 \times 0$

Landmark numbers	Number of occurrence	Symbols
20	5	—
1	0	

= 

(iii) $361 = 360 \times 1 + 20 \times 0 + 1$

Landmark numbers	Number of occurrence	Symbols
360	1	•
20	0	
1	1	•

361 = 

(iv) $721 = 360 \times 2 + 20 \times 0 + 1$

Landmark numbers	Number of occurrence	Symbols
360	2	• •
20	0	
1	1	•

721 = 

3. To distinguish place values in their decimal system the Chinese alternated between the zong and Heng symbols. If only the zong symbols were to be used then 41 be represent as,

|||||

Which could be easily misread as 5, If there is no significance space between two successive positions.

4. For base-2 system,

Symbol for Ukasar is 1

and symbol for Urapon is 0

New Base-2 Place value system

Decimal system	New Base-2 system	Gumulgal's style Base-2 system
0		Urapon
1		Ukasar
2	$2 = 1 \times 2^1 + 0 \times 2^0 = 10$	Ukasar – Urapon
3	$3 = 1 \times 2^1 + 1 \times 2^0 = 11$	Ukasar – Urapon
4	$4 = 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 = 100$	Ukasar – Urapon – Ukasar
5	$5 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 101$	Ukasar – Urapon – Ukasar
6	$6 = 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 = 110$	Ukasar – Ukasar – Urapon

Comparison between new base-2 and original Gumulgal system :

	New Base-2 System	Gumulgal System

1.	This system is a place value system	This system is not a place value system
2.	In this system we can count unlimited number	This system used 'ras' after 6

5. Hindu numerals and 0, play very important role in our today life and forming the basis of much of modern science, technology, commuting, accounting, surveying and more, we cannot imagine our lives without there numbers.

6. According to questions,

If we had only 8 fingers instead of 10, then

Symbols	0	1	2	3	4	5	6	7
Landmark numbers	8^0	8^1	8^2	8^3	8^4	8^5	8^6	8^7

If we were using base-5 system, then

Symbols	0	1	2	3	4
Landmark numbers	5^0	5^1	5^2	5^3	5^4

Hindu numeral 25 as base-8 system

$25 = 3 \times 8^1 + 1 \times 8^0$

In base-8 number system 25 can be written as 31_8

In base-5, Hindu numeral $25 = 1 \times 5^2 + 0 \times 5^1 + 0 \times 5^0$

Then in base-5 system, 25 can be written as 100_5

Again, In base-2 number system

$25 = 1\times2^4 + 1\times2^3 + 0\times2^2 + 0\times2^1 + 1\times2^0$

$\Rightarrow 25 = 11001_2$

Practice Exercise 3.4

1. Base-60 system known as the sexagesimal system.

2. The mesopotamians use landmark numbers like 1, 10, 60, 600, 3600, 36000, ... before developing the base-60 system.

3. The influence of the mesopotamian sexagesimal system can be seen even today in our units of time measurement like 1 hour = 60 minutes and 1 minutes = 60 seconds.

4. The placeholder symbol is similar to the modern digit zero.

5. Central America.

6. Between 3rd and 10th centuries.

7. Mayans used symbol ⋎⋎ as a place holder symbol for zero.

8. The Mayans used symbols dot . for |, and a bar – for 5 to represent numbers from 1 to 19.

9. Chinese rod numbers were numbers shown using small rods arranged vertically and horizontally. They were used for counting and calculations.

10. Arya bhatta explained the idea of zero in place value while Brahmagupta gave rules for arithmatic operations involving zero.

Chapter Innings

A. Multiple Choice Questions

1. (b) **2.** (c) **3.** (b) **4.** (b) **5.** (a) **6.** (b)

B. Fill in the Blanks

1. Roman numerals **2.** 10 **3.** zongs **4.** 27 **5.** Tally marks

C. Match the Following:

1. (b) **2.** (c) **3.** (a) **4.** (e) **5.** (d)

D. True or False

1. F **2.** T **3.** T **4.** F **5.** T

E. Very Short Answer Type Questions

1. Expressing 378 in the base-5 system as

$\therefore$ 378 = 125 + 125 + 125 + 3

Thus 378 = ○○○ΔΔΔ

2. 843 in the Mayan number system can be expressed as
●●●
$\underline{\bullet}$
●●●

3. Representation of 2854 in Chinese number system as ═ ∏ ≣ ||||

4. Representation of 3725 in mesopotamian number system is $1 \times 60^2 + 2 \times 60 + 5$

5. Because it uses 360 instead of 400 as the third landmark number.

F. Short Answer Type Questions

1. (a) as CXXI = 121

and XXXIV = 34

so, 121 + 34 = 155

Thus CXXI + XXXIV = CLV

(b) We have

CCLXXII = 272

and LXXXIX = 89

So 272 – 89 = 183

(c) We have C = 100 and

IV = 4

So 100 × 4 = 400

Thus, C × IV = CD

(d) We have CDLVI = 456 and VIII = 8

So 456 ÷ 8 = 57

Thus CDLVI ÷ VIII = LVII

2. The amount paid by father for a toy

= ₹ DCCX = ₹ 710

and discount of toy = ₹ CXV = ₹ 115

Final cost of the teddy bear = ₹ 710 – ₹ 115 = ₹ 595

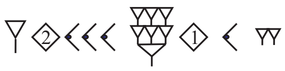
In roman = ₹ DXCV

3. (a) 2478 in Egyptian system = (2 × 1000) + (4 × 100) + (7 × 10) + (8 × 1)

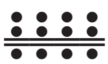
= 

(b) 5832 in the Mesopotamian number system can be expressed as

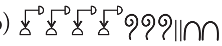
$5832 = 1 \times 60^2 + 37 \times 60 + 12$

= 

(c) 1728 in the Mayan number system can be expressed as



4. Number	Egyptian system
(a) 231 = 200 + 30 + 1	
(b) 1043 = 1000 + 40 + 3	

5. Egyptian system	Hindu number system
(a) 	276
(b) 	4322

G. Long Answer Type Questions

1. See solution of question 3 of practice exercise 3.3

2. Same as solution of question 7 of practice exercise 3.3

3. Same as solution of question 9 of practice exercise 3.3

4. The Mesopotamians introduced a place holder symbol to denote a blank space.

5. The third landmark number was 360 instead of 400.

H. Assertion-Reason Based Questions

1. (A) **2.** (C) **3.** (B)

I. Case Study

1. (*) 365 in Roman number = 300 + 60 + 5 = CCCLXV

2. (*) Result = 500 – 365 = 135

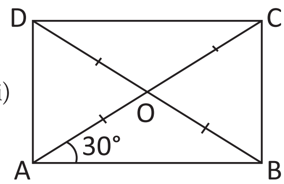
3. (*) Strength : Easy for small number

Weakness : (i) difficult for large numbers and (ii) there is no zero.

4. Quadrilateral

NCERT Exercise 4.1

1. (i)



Given that $\angle BAO = 30°$

we know that all the angles

$\angle ABC = \angle BCD = \angle CDA$

$= \angle DAB = 90°$

$\therefore \angle BAD = \angle BAO + \angle OAD$

$\Rightarrow 90° = 30° + \angle OAD$

$\Rightarrow \angle OAD = 90° - 30° = 60°$

But CD parallel to AB

$\therefore \angle DCA = \angle CAB = 30°$

$\angle BCA = \angle CAD = 60°$

(alternate angles)

Since OA = OB

$\Rightarrow \angle OAB = \angle OBA = 30°$

Similarly, $\angle OCD = \angle ODC = 30°$

In Δ AOB, $\angle A + \angle B + \angle O = 180°$

(Angle sum property)

$\Rightarrow 30° + 30° + \angle O = 180°$

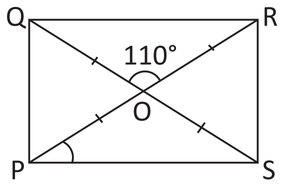
$\Rightarrow \angle O = 180° - 60° = 120°$

$\therefore \angle AOB = 120° = \angle COD$

(vertically opposite angles)

and $\angle AOD = 180° - 120°$
$= 60°$ (Linear pair property)
$\angle BOC = \angle AOD = 60°$

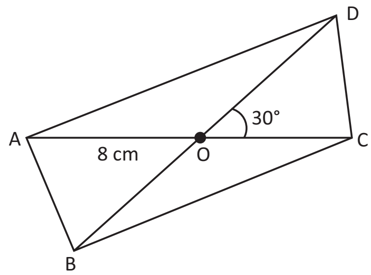
(ii)



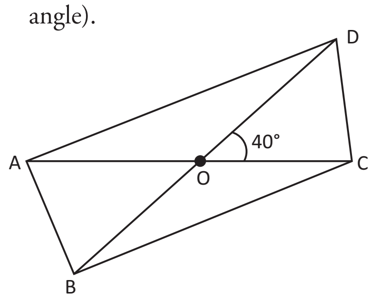
Given $\angle QOR = 110°$
$\Rightarrow \angle QOR = \angle POS = 110°$
(vertically opposite angles)
Since $OQ = OR$
$\Rightarrow \angle OQR = \angle ORQ$
$\therefore$ In ΔQOR,
$\angle OQR + \angle QRO + \angle ROQ = 180°$
(Angle sum property)
$\Rightarrow 2\,\angle OQR + 110° = 180°$
$\Rightarrow 2\,\angle OQR = 180° - 110°$
$\Rightarrow \angle OQR = \dfrac{70}{2} = 35°$
$\Rightarrow \angle OQR = \angle ORQ = 35°$
$\Rightarrow \angle RPS = \angle QSP = 35°$
(alternate angles)
$\angle QOP = 180° - 110°$ (Linear pair)
$= 70°$
In ΔQOP, $OQ = OP$
$\Rightarrow \angle OQP = \angle OPQ$
$\therefore \angle OQP + \angle OPQ + \angle QOP = 180°$
$2\,\angle OQP + 70° = 180°$
$2\,\angle OQP = 180° - 70°$
$2\,\angle OQP = 110°$
$\Rightarrow \angle OQP = 55° = \angle OPQ$
Similarly, $\angle ORS = \angle RSO = 55°$
(alternate angles)

2. (i) Steps of construction:

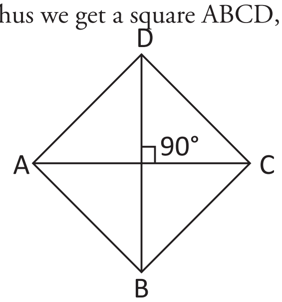
(1) Draw $AC = 8$ cm
(2) Mark Mid Point O of AC.
(3) Draw $BD = 8$ cm such that O is the mid point of BD and $\angle DOC = 30°$.
(4) Join the end points A, B, C, D.
(5) ABCD is required quadrilateral (Rectangle).



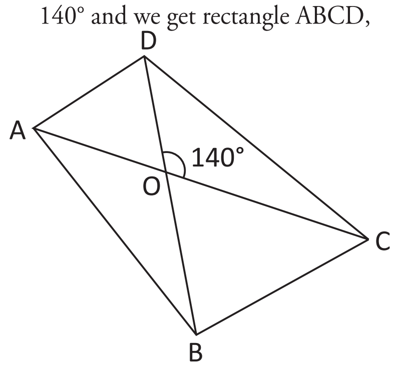
(ii) Construct quadrilateral ABCD as above, but $\angle DOC = 40°$
ABCD is required quadrilateral (rectangle).



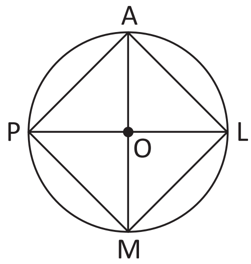
(iii) Construct a quadrilateral as above whose diagonals cut each other at 90°. Thus we get a square ABCD,



(iv) Draw quadrilateral as above whose diagonals intersect at 140° *i.e.* $\angle COD = 140°$ and we get rectangle ABCD,



3.



PL and AM are perpendicular diameters of the circle *i.e.* AM and PL are diagonals which are equal and bisect at 90°.

$\therefore$ APML is a square.

4. Do yourself.

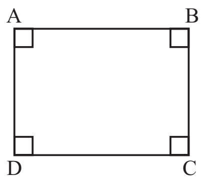
5. We know that, A quadrilateral with opposite sides equal and parallel is a parallelogram.

Given, each interior angle of rectangle is 90°. So Quadrilateral with only opposite sides parallel or parallel and equal is not necessarily a rectangle.

Practice Exercise 4.1

1. Given that measure of one angle = 90°

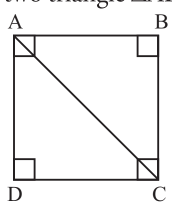
We know that measure of each angle in rectangle is 90°



Thus sum of other three angles

$= 90° + 90° + 90° = 270°$

2. Let ABCD is a square with AB = BC = CD = DA and AC is a diagonal that dicides square into two triangle ΔABC and ΔADC



Now in ΔABC and ΔADC

AB = CD [Equal sides of square]

AD = BC [Equal sides of square]

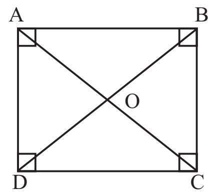
and AC = CA [Colmmon]

By SSS criterian

$\Delta ABC \cong \Delta ADC$.

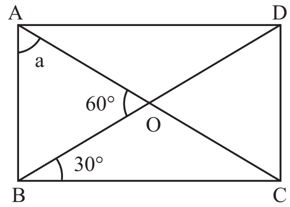
Thus both triangles are congruent and Isosceles triangles.

3. Given that ABCD is rectangle in which diagonals AC and BD intersect each other at O



Since given equalities to prove $\Delta AOD \cong \Delta COB$, do not satisfy the condition of congruency because SSA is not any type of congruency.

4. (a)



Given that ABCD is a rectangle in which $\angle OBC = 30°$

But $\angle B = 90°$ [each angle in rectangle is 90°]

$\therefore \quad \angle ABO = \angle B - \angle OBC$

$= 90° - 30°$

$= 60°$

In ΔAOB

$\angle AOB + \angle OBA + \angle OAB = 180°$ [angle sum property in triangle]

$\Rightarrow \quad 60° + 60° + a = 180°$

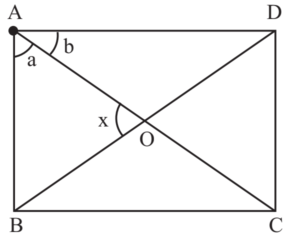
$\Rightarrow \quad 120° + a = 180°$

$\therefore \quad a = 180° - 120°$

$\boxed{a = 60°}$

Thus value of a is 60°

(b) Given that ABCD is a rectangle in which $\angle A = \angle B = \angle C = \angle D = 90°$



So $a + b = 90° \Leftrightarrow \boxed{b = 90° - a}$

We know that diagonals in rectangle bisect each other at point O

So OA = OB

In ΔAOB, OA = OB

$\Leftrightarrow$ ∠OBA = ∠OAB (angles opposite to equal sides are equal)

Thus ΔAOB is an isosceles triangle with ∠OBA = a and ∠AOB + ∠OBA + ∠OAB = 180° [angle sum property in triangle]

$\Rightarrow \quad x + a + a = 180°$

$\Rightarrow \quad 2a + x = 180°$

$\Rightarrow \quad 2a = 180° - x$

$\Rightarrow \quad a = \dfrac{180° - x}{2} = \dfrac{180°}{2} - \dfrac{x}{2}$

$\Rightarrow \quad \boxed{a = 90° - \dfrac{x}{2}}$

$\because \quad a + b = 90°$

and $\quad b = 90 - a$

$\Rightarrow \quad b = 90 - \left(90 = \dfrac{x}{2}\right)$

$\because \quad b = \dfrac{x}{2}$

Thus value of a and b in term of x is $90° - \dfrac{x}{2}$ and $\dfrac{x}{2}$

5. Each angle of a square is 90°

6. No, the interior angles of a rectangle and a square are not different.

7. Because, square has all the properties of a rectangle.

8. Given that ABCD is a rectangle in which ∠A = ∠B = ∠C = ∠D = 90° and ∠AOB = 118° we know that diagonals in rectangle bisect each other at point O

In ΔAOB,

OA = OB

∠OAB = ∠OBA (angles opposite to equal sides are equal)

In ΔAOB, we have

∠OAB + ∠OBA + ∠AOB = 180°

[angle sum property in triangle]

$\Rightarrow$ ∠OAB + ∠OAB + 118° = 180°

[$\because$ ∠OAB = ∠OBA]

$\Rightarrow \quad$ 2∠OAB = 180° – 118°

2∠OAB = 62°

$\angle OAB = \dfrac{62°}{2} = 31°$

$\therefore \quad$ ∠OAB = ∠ABO (or ∠OBA) = 31°

In ΔABC, we have

∠BAC + ∠ABC + ∠ACB = 180°

$\Rightarrow \quad$ 31° + 90° + ∠ACB = 180°

$\Rightarrow \quad$ 121° + ∠ACB = 180°

$\Rightarrow \quad$ ∠ACB = 180° – 121°

$\Rightarrow \quad$ ∠ACB = 59°

Since ∠ACB and ∠OCB both define same angle hence ∠OCB = 59°

Again in ΔBAD, we have

∠BAD + ∠ABD + ∠ADB = 180°

$\Rightarrow \quad$ 90° + 31° + ∠ADB = 180°

$\Rightarrow \quad$ 121° + ∠ADB = 180°

$\Rightarrow \quad$ ∠ADB = 180° – 121°

$\Rightarrow \quad$ ∠ADB = 59°

Thus $\quad$ ∠ADO = 59°

9. Given that ABCD is a rectangle in which ∠CEB : ∠ECB = 3 : 2

In ΔCBE, we have

∠CBE + ∠BEC + ∠ECB = 180°

[angle sum property in triangle]

But ∠CBE = 90°

90° + ∠BEC + ∠ECB = 180°

$\Rightarrow \quad$ ∠BEC + ∠ECB = 180° – 90°

$\Rightarrow \quad$ ∠BEC + ∠ECB = 90°

$\Rightarrow \quad$ ∠CEB + ∠ECB = 90°

Since $\quad$ ∠CEB : ∠ECB = 3 : 2

Let ∠CEB and ∠ECB are $3x$ and $2x$

Then, $\quad 3x + 2x = 90°$

$\Rightarrow \quad 5x = 90°$

$\Rightarrow \quad x = \dfrac{90°}{5}$

$\Rightarrow \quad \boxed{x = 18°}$

$\because \quad \angle ECB = 2x = 2 \times 18° = 36°$

Again, $\angle BCD = 90°$ [angle of rectangle]

$\angle ECB + \angle DCE = 90°$

$\Rightarrow \quad 36° + \angle DCE = 90°$

$\Rightarrow \quad \angle DCE = 90° - 36°$

$\Rightarrow \quad \angle DCE = 54°$

Since $\angle DEC + \angle DCF = 180°$ [Linear pair]

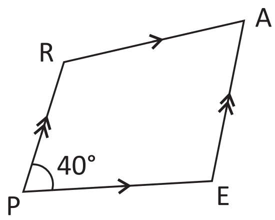
$\Rightarrow \quad 54° + \angle DCF = 180°$

$\Rightarrow \quad \angle DCF = 180° - 54°$

$\Rightarrow \quad \angle DCF = 126°$

NCERT Exercise 4.2

1. (i)



Given, $\angle RPE = 40°$, in parallelogram PEAR.

We know that opposite angles are same in parallelogram.

$\therefore \angle RAE = \angle RPE = 40°$

$\because$ Sum of all angles of parallelogram $= 360°$

$\therefore \angle RPE + \angle PEA + \angle EAR + \angle ARP = 360°$

$\therefore 40° + \angle PEA + 40° + \angle ARP = 360°$

$\Rightarrow 80° + \angle PEA + \angle ARP = 360°$

$\Rightarrow \angle PEA + \angle ARP = 360° - 80°$

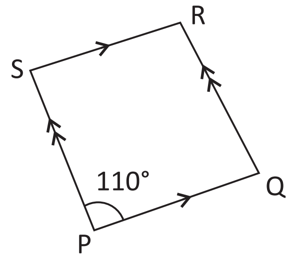
$\Rightarrow 2\angle PEA = 280°$

(since $\angle PEA = \angle ARP$)

$\Rightarrow \angle PEA = 140°$

$\Rightarrow \angle PEA = \angle ARP = 140°$

(ii)



Given that, In parallelogram PQRS,

$\angle SPQ = 110°$

we know that opposite angles are equal in parallelogram.

$\therefore \quad \angle SPQ = \angle SRQ = 110°$

Also, $\angle SPQ + \angle PQR + \angle QRS + \angle RSP = 360°$

(Angle sum property of quadrilateral)

$\Rightarrow 110° + \angle PQR + 110° + \angle RSP = 360°$

$\Rightarrow 220° + \angle PQR + \angle RSP = 360°$

$\Rightarrow \angle PQR + \angle RSP = 360° - 220°$

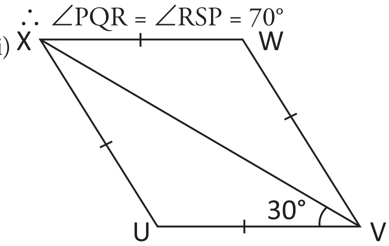
$\Rightarrow 2\angle PQR = 140°$

($\because \angle PQR = \angle RSP$)

$\Rightarrow \angle PQR = 70°$

$\therefore \angle PQR = \angle RSP = 70°$

(iii)



In given quadrilateral UVWX, all sides are equal and opposite angles are equal (not 90°).

$\Rightarrow$ UVWX is a rhombus.

$\therefore \angle UXV = \angle UVX = 30°$

($\because$ sides UV = UX)

In ΔXUV,

$\angle XUV + \angle UVX + \angle VXU = 180°$

(Angle sum property of triangle)

$\Rightarrow \angle XUV + 30° + 30° = 180°$

$\Rightarrow \angle XUV = 180° - 60°$

$\Rightarrow \angle XUV = 120°$

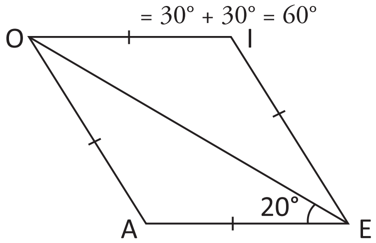
Since, UV is parallel to XW

$\therefore \quad \angle UVX = \angle VXW = 30°$

and $\angle UXV = \angle XVW = 30°$

$\Rightarrow \quad \angle UXW = \angle UXV + \angle VXW$
$= 30° + 30° = 60°$

(iv)



In given quadrilateral AEIO, all sides are equal and opposite angles are equal (not 90°).

$\therefore$ AEIO is a Rhombus.

In ΔAEO,

$\angle AEO + \angle EOA + \angle OAE = 180°$
(Angle sum property of triangle)

$\Rightarrow 20° + 20° + \angle OAE = 180°$
(side OA = AE)

$\Rightarrow \quad \angle OAE = 180° - 40° = 140°$

$\therefore \quad \angle AEO = \angle IOE = 20°$
$[\because AE \,|\, OI]$

and $\angle AOE = \angle OEI = 20°$

$\Rightarrow \quad \angle AOI = \angle AEI = 40°$

2. Construction of parallelogram

Step-1 Draw a line segment AC = 7 cm.

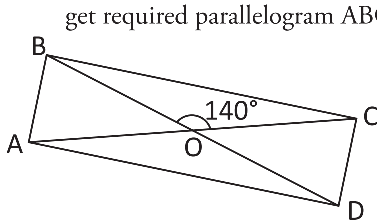
Step-2 Take O as mid point of AC such that

$OA = OC = \frac{7}{2} = 3.5$ cm

Step-3 Draw line segment BD = 5 cm at point O making an angle of 140° such that $\angle BOC = 140°$.

and $OB = OD = \frac{5}{2} = 2.5$ cm

Step-4 Joint AB, BC, CD and AD and we get required parallelogram ABCD.



3. We know that diagonals of a Rhombus bisect each other at 90°.

Construction of Rhombus:

Step-1 Draw a live segment AC = 5 cm.

Step-2 Mark mid point O of AC such that

$OA = OC = \frac{5}{2} = 2.5$ cm

Step-3 Draw a line segment BD = 4 cm at point O such that OB = OD = 2 cm

Join points A, B, C and D.

Thus, ABCD is required rhombus.

Practice Exercise 4.2

1. We know that sum of the angles in a quadrilateral is 360°. Using this

(a) $a + 120° + 60 + 50° = 360°$

$\Rightarrow \quad a + 230° = 360°$

$\Rightarrow \quad a = 360° - 230°$

$\Rightarrow \quad \boxed{a = 130°}$

(b) $a + 40° + 140° + 100° = 360°$

$\Rightarrow \quad a + 280° = 360°$

$\Rightarrow \quad a = 360° - 280°$

$\Rightarrow \quad \boxed{a = 80°}$

(c) $a + 110° + 60° + 90° = 360°$

$\Rightarrow \quad a + 260° = 360°$

$\Rightarrow \quad a = 360° - 260°$

$\Rightarrow \quad \boxed{a = 100°}$

2. We know that sum of all exterior angles of a polygon is 360°. Using this

(a) $a + 80° + 120° + 100° = 360°$

$\Rightarrow \quad a + 300° = 360°$

$\Rightarrow \quad a = 360° - 300°$

$\Rightarrow \quad \boxed{a = 60°}$

(b) $a + 90° + 60° + 90° + 70° = 360°$

$\Rightarrow \quad a + 310° = 360°$

$\Rightarrow \quad a = 360° - 310°$

$\Rightarrow \quad \boxed{a = 50°}$

3. Since, $\angle MNP$ is a quadrilateral in which

(a) $\angle L + \angle M + \angle N + \angle P = 360°$

$\Rightarrow \quad (3m + 10)° + (3m + 4)° + (50° + m) + (5m + 8)° = 360°$

$\Rightarrow \quad (3m + 3m + m + 5m) + (10° + 4° + 50° + 8°) = 360°$

$\Rightarrow \quad 12m + 72° = 360°$

$\Rightarrow \quad 12m = 360° - 72°$

$\Rightarrow \quad 12m = 288°$

$\Rightarrow \quad m = \dfrac{288°}{12}$

$\Rightarrow \quad \boxed{m = 24°}$

(b) $\angle LMN = (3m + 4)°$

$= 3 \times 24° + 4 = 76°$

(c) In ΔMLN, we have

$\angle LMN + \angle MNL + \angle MLN = 180°$

$76° + \angle MLN + 50° = 180°$

$\angle MLN + 126° = 180°$

$\angle MLN = 180° - 126°$

$\angle MLN = 54°$

4. Ratio of the angles of a quadrilateral

$= 1 : 4 : 6 : 9$

Let the angles are x, $4x$, $6x$ and $9x$

Now, $x + 4x + 6x + 9x = 360°$ [angle sum property in quadrilateral]

$\Rightarrow \quad 20x = 360°$

$\Rightarrow \quad x = \dfrac{360°}{20}$

$\boxed{x = 18°}$

Thus angles are

$x = 18°$

$4x = 4 \times 18° = 72°$

$6x = 6 \times 18° = 108°$ and

$9x = 9 \times 18° = 162°$

5. Ratio of adjacent angles of $a \parallel^{gm} = 1 : 2$

We know that sum of adjacent angles in parallelogram = 180°

Let angles are x and $2x$

$\Rightarrow \quad x + 2x = 180°$

$\Rightarrow \quad 3x = 180°$

$\Rightarrow \quad x = \dfrac{180°}{3} \quad \boxed{x = 60°}$

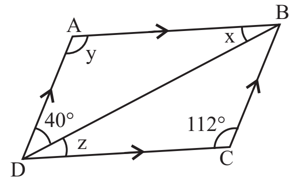
adjacent angles are

$x = 60°$ and

$2x = 2 \times 60° = 120°$

Since opposite angles in parallelogram are equal hence angles are 60°, 60°, 120° and 120°

6. (a) In given parallelogram



$y = 112°$ [opposite angles are equal]

In ΔABD, we have

$x + y + 40° = 180°$

[angle sum property in triangle]

$\Rightarrow \quad x + 112° + 40° = 180°$

$\Rightarrow \quad x + 152° = 180°$

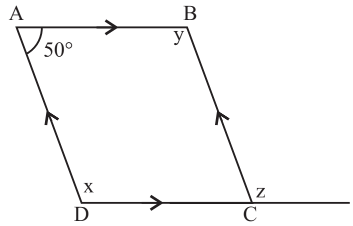
$\Rightarrow \quad x = 180° - 152°$

$\Rightarrow \quad \boxed{x = 24°}$

Since, x and z are allternate angles hence

$x = z = 28°$

(b) Since 50° and y are adjacent angle and we know that sum of adjacent angles in a parallelogram is 180°,



So,

$\Rightarrow \quad 50° + x = 180°$

$\Rightarrow \quad x = 180° - 50°$

$\boxed{x = 130°}$

again, x and y are opposite angles which are equal in measure

Thus $\quad x = y = 130°$

Similaqrly, $\quad \angle A = \angle BCD = 50°$

$\because \quad 50° + z = 180°$ [Linear pair]

$\Rightarrow \quad z = 180° - 50°$

$\boxed{z = 130°}$

(c) In given parallelogram

$y = 80°$ [Opposite angles are equal]

and $x + y = 180°$ [adjacent angle property]

$\Rightarrow \quad x + 80° = 180°$

$\Rightarrow \quad x = 180° - 80°$

$x = 100°$

Since angle x and z are equal due to alternate angle thus $z = y = 80°$

7. (a) $\therefore\ 3y - 1 = 26$ [opposite sides are equal in parallelogram]

$\Rightarrow\quad 3y = 26 + 1$

$\Rightarrow\quad 3y = 27$

$\Rightarrow\quad y = \frac{27}{3}$ $\boxed{y = 9}$

Similarly, $3x = 18$

$x = \frac{18}{3}$ $\boxed{x = 6}$

(b) $y + 7 = 20$ [diagonals bisect eachother in parallelogram]

$\Rightarrow\quad y = 20 - 7$ $\boxed{y = 13}$

Similarly,

$x + y = 16$

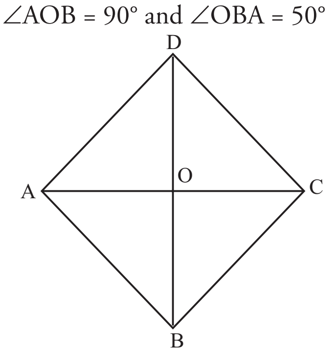
$\Rightarrow\quad x + 13 = 16\quad [\because y = 13]$

$\Rightarrow\quad x = 16 - 13$ $\boxed{x = 3}$

8. Given that, ABCD is a Rhombus in which $\angle ABD = 50°$

(a) We know that in rhombus, diagonals bisect eachother at 90°

So $\angle AOB = 90°$ and $\angle OBA = 50°$ (given)



In ΔAOB, we have

$\angle AOB + \angle CAB + \angle OBA = 180°$

[angle sum property in triangle]

$\Rightarrow 90° + \angle CAB + 50° = 180°$

$\Rightarrow\quad \angle CAB = 180° - (90° + 50°)$

$\Rightarrow\quad \angle CAB = 180° - 140°$

$\Rightarrow\quad \angle CAB = 50°$

(b) In ΔBCD we have,

$\angle ABD = \angle BDC$ [Alternate angle of AB || CD]

$\therefore\ \angle BDC = 50°$

Since BC = CD [Equal sides of Rhombus]

$\therefore\ \angle BDC = \angle CBD = 50°$ [angles opposite to equal sides are equal]

$\angle BCD + \angle BDC + \angle CBD = 180°$ [angle sum property in triangle]

$\Rightarrow\quad \angle BCD + 50° + 50° = 180°$

$\Rightarrow\quad \angle BCD = 180° - 100°$

$\Rightarrow\quad \angle BCD = 80°$

(c) We know that diagonals in Rhombus also bisect the angles they pass through

So $\quad \angle ABC = 2\angle ABD$

$= 2 \times 50°$

$\angle ABC = 100°$

again, we know that opposite angles in Rhombus are equal

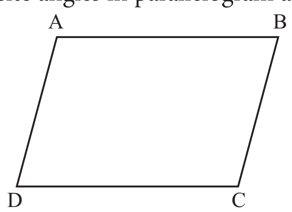
So, $\quad \angle ABC = \angle ADC = 100°$

Thus $\quad \angle ADC = 100°$

9. Given that ABCD is a Rhombus in which diagonals bisect each other

So, $\quad y = 6$ and $x = 8$

10. (a) Need not $\angle A + \angle C = 180°$ need not possible in a parallelogram because opposite angles in parallelogram are equal



(b) No, since opposite sides in parallelogram are equal.

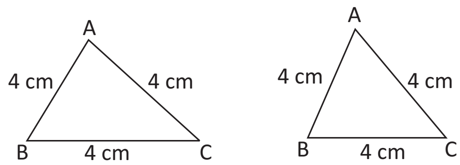
(c) No, opposite angles in parallelogram are equal.

(d) Yes, sum of adjacent angles in parallelogram become 180°.

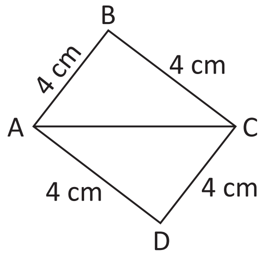
(e) Need not, in a parallelogram (AC = BD), (AC < BD) or (AC > BD)

NCERT Exercise 4.3

1. Let ΔABC and ΔADC are two equilateral triangles with sides 4 cm.



Following is the figure after joining these two equilateral triangles,



We know that each angle of an equilateral triangle = 60°

$\therefore \quad \angle BAC = \angle ABC = \angle BCA$
$= \angle ACD = \angle CDA$
$= \angle DAC = 60°$

$\therefore \quad \angle BAD = \angle BAC + \angle CAD$
$= 60° + 60° = 120°$

Similarly, $\angle BCD = 120°$
and sides of quadrilateral
$AB = BC = CD = AD$
$= 4$ cm

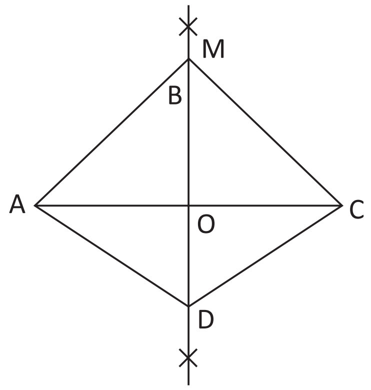
2. Construction of a kite with diagonals 6 cm and 8 cm

Step-1 Draw a line segment AC = 6 cm.

Step-2 Draw perpendicular bisector of AC, which intersect AC at point O.

Step-3 Mark point B and D such that OB + OD = 8 cm.

Step-4 Join AB, BC, AD and DC and obtained figure is kite ABCD.



3. (i) In trapezium ABCD, adjacent angles are supplementary.

$\therefore$ 135° + $\angle D$ = 180°

$\Rightarrow \angle D = 180° - 135°$
$= 45°$

Similarly, $\angle C = 180° - 105°$
$= 75°$

(ii) In the trapezium PQRS,

$\angle P$ and $\angle S$ are supplementary.

$\therefore \angle P + \angle S = 180°$

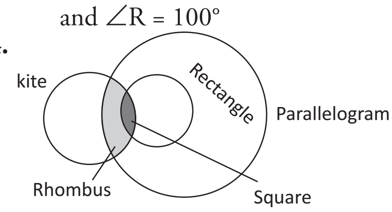
$\Rightarrow \angle P = 180° - 100°$

$\Rightarrow \angle P = 80°$

$\therefore \angle Q = \angle P = 80°$ [Since base angles of an isosceles trapezium are equal]

and $\angle R = 100°$

4.



(i) Rhombus, because rhombus has all properties of a parallelogram and kite.

(ii) Yes, square has all the properties of a rectangle and kite.

(iii) No, not necessarily every kite is a rhombus.

A rhombus is a special type of kite where all four sides are equal in length.

5. Given that PAIR is a rectangle.

$\therefore \angle AIR = 90°$

And $\angle ORI + \angle OIR + \angle IOR = 180°$
(By angle sum property of triangle)

$\Rightarrow 30° + 90° + \angle IOR = 180°$

$\Rightarrow 120° + \angle IOR = 180°$

$\Rightarrow \angle IOR = 180° - 120° = 60°$ ...(i)

Again, RODS is a rectangle.

$\therefore \angle ROD = 90°$

$\Rightarrow \angle ROI + \angle IOD = 90°$

$\Rightarrow 60° + \angle IOD = 90°$ [From equation (i)]

$\Rightarrow \angle IOD = 90° - 60° = 30°$

6. Construction of a square with diagonal 6 cm

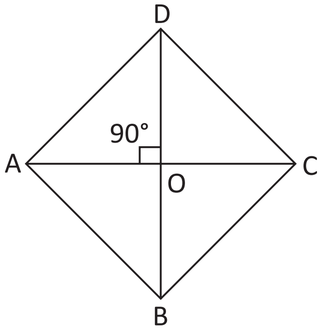
Step-1 Draw line segment AC = 6 cm.

Step-2 Draw perpendicular bisector of AC.

Step-3 Mark 0 as mid point of AC.

Step-4 Mark B and D on perpendicular bisector on AC such that OB = OD = 3 cm.

Step-5 Join AB, AD, CD and DA. Thus, square ABCD is obtained.



7. Given that CASE is a square.

The points U, V, W and X are the mid-points of the sides of the square. Then UVWX is a square.

Figure (b) shows a square whose vertices lie on the sides of outer square ABCD, but not necessarily at the mid-points other ways of constructing a square PQRS are rotation and by using diagonals.

8. Yes, Quadrilateral with four equal sides and one angle of 40° will be a square.

Steps of construction:

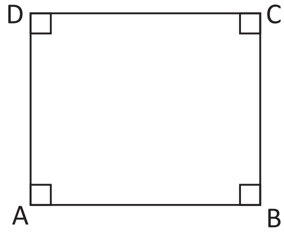
(1) Draw a line segment AB of any length.

(2) At point A draw perpendicular AD of same length AB.

(3) From point D, draw DC of same length AB and ∥ to AB.

(4) Join C to B.

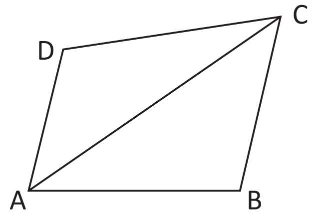
(5) ABCD is a square because we observe that all sides are equal and all angles are 90°.



9. Let us consider a quadrilateral ABCD.

Such that AB = CD

and BC = AD



In Δ ABC and ΔCDA.

AB = CD [opposite side of parallelogram]

AD = BC [opposite side of parallelogram]

AC = AC (Common)

$\therefore$ $\Delta ABC \cong \Delta CDA$ (By SSS congruence Rule)

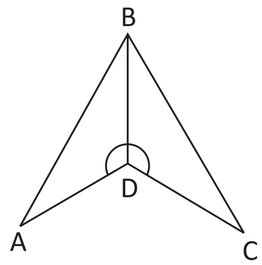
$\Rightarrow \angle BAC = \angle DCA$

and $\angle BCA = \angle DAC$

$\Rightarrow$ AB ∥ CD and BC ∥ DA.

Thus ABCD is a parallelogram.

10. Sum of the angles in a quadrilateral is 360°. We can show by the following way :



In ΔABD,

$\angle ABD + \angle BDA + \angle DAB = 180°$

(Angle sum property of triangle)

Similarly, In ΔDBC,

$\angle DBC + \angle BCD + \angle CDB = 180°$

(Angle sum property)

$\therefore$ Sum of angles in the quadrilateral

= 180° + 180° = 360°

By measuring the angles in given figure, we get:

$\angle A = 40°, \angle B = 50°$

$\angle C = 40°, \angle D = 230°$

Sum of these angles.

$\angle A + \angle B + \angle C + \angle D$

= 40° + 50° + 40° + 230°

= 360° **Hence Proved**

11. (1) False, a quadrilateral whose diagonals are equal and bisect each other is a Rectangle.

(2) True, since 4th angle of quadrilateral

= 360° – (90° + 90° + 90°)
= 360 – 270° = 90°

(3) True, This is a property of parallelogram.

(4) False, because, rhombus has perpendicular diagonal but other quadrilateral can also have perpendicular diagonals.

(5) True, this is a property of parallelogram.

(6) True, this is a property of Rectangle.

(7) False, An isosceles trapezium has only one pair of parallel sides.

Practice Exercise 4.3

1. Since $\angle C + \angle D = 70° + 110° = 180°$

hence $\angle C$ and $\angle D$ are pair of co-interior angles when AD || BC

Thus in quadrilateral ABCD, AD || BC and pair of side AB and CD are oblique sides

So, quadrilateral ABCD is a trapezium in which AD and BC are parallel.

2. Given that KLMN is a trapezium in which KN || LM and $\angle M$ is 120°

Since, $\angle M + \angle N = 180°$ [Co-interior angles when KN || LM]

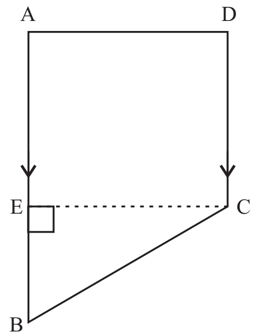
$\Rightarrow \quad 120° + \angle N = 180°$

$\Rightarrow \quad \angle N = 180° - 120°$

$\Rightarrow \quad \angle N = 60°$

3. Given that, ABCD is a trapezium in which AB || DC and $\angle C = 130°$

Since $\angle C + \angle B = 180°$ [Pair of co-interior when AB || CD]



$\therefore \quad 130° + \angle B = 180°$

$\Rightarrow \quad \angle B = 180° - 130°$

$\boxed{\angle B = 50°}$

Construction : We draw a perpendicular CE from point C to the side AB

Since, AD || EC and AD = EC [distance between parallel line AB || CD]

Thus, AECD is a parallelogram in which $\angle AEC = 90°$

We know that opposite angles in parallelogram are equal

Thus $\angle ADC = \angle AEC = 90°$

4. Given that PQRS is a kite in which $\angle PQR = 70°$ and $\angle PSR = 80°$

(a) In ΔPSR,

PS = SR [given]

$\angle P = \angle R$ [angles opposite to equal sides are equal]

also, $\angle P + \angle S + \angle R = 180°$ [angle sum property in triangle]

$\Rightarrow \angle R + \angle R + 80° = 180°$

$\Rightarrow \quad 2\angle R = 180° - 80°$

$\Rightarrow \quad 2\angle R = 100°$

$\Rightarrow \quad \angle R = \frac{100}{2}$

$\angle R = 50°$

Thus $\boxed{\angle SRO = 50°}$

(b) Similarly in ΔPQR

We have, $PQ = QR \Leftrightarrow \angle OPQ = \angle ORQ$

$\angle OPQ + \angle ORQ + \angle PQR = 180°$

$2\angle OPQ = 180° - 70°$

$2\angle OPQ = 110°$

$$\angle OPQ = \frac{110^\circ}{2}$$

$$\boxed{\angle OPQ = 55^\circ}$$

(c) $\angle SPQ = \angle SPO + \angle OPQ$

$= 50^\circ + 55^\circ$

$= 105^\circ$

(d) Since diagonal SQ bisect angles $\angle S$ and $\angle Q$ in kite PQRS

hence $\angle PSQ = \frac{1}{2}\angle PSR$

$= \frac{1}{2} \times 80^\circ$

$$\boxed{\angle PSQ = 40^\circ}$$

5. Since, $x = 120^\circ$

also $x + y + 120^\circ + 50^\circ = 360^\circ$ [angle sum property in quadrilateral]

$\Rightarrow y + 120^\circ + 120^\circ + 50^\circ = 360^\circ$

$\Rightarrow y + 290^\circ = 360^\circ$

$\Rightarrow y = 360^\circ - 290^\circ$

$$\boxed{y = 70^\circ}$$

Chapter Innings

A. Multiple Choice Questions

1. The adjacent angles are $(2a + 25)^\circ$ and $(3a - 5)^\circ$ sum of the adjacent angles in parallelogram is 180°

So, $(2a + 25)^\circ + (3a - 5)^\circ = 180^\circ$

$\Rightarrow (2a + 3a) + 25^\circ - 5^\circ = 180^\circ$

$\Rightarrow 5a + 20^\circ = 180^\circ$

$\Rightarrow 5a = 180^\circ - 20^\circ$

$\Rightarrow 5a = 160^\circ$

$\Rightarrow a = \frac{160^\circ}{5}$

$\Rightarrow a = 32$

Ans. option (b)

2. d, parallelogram

3. d, 90°

4. c, Rectangle

5. In a square, all sides are equal

So AB = BC

Thus $2x + 3 = 3x - 5$

$\Rightarrow 3x - 2x = 3 + 5$

$x = 8$

Ans. option (d)

6. Let both diagonal intersect each other at O

$\angle OAB = 30^\circ$

$\angle AOB = 180^\circ - 60^\circ$

$\angle AOB = 120^\circ$

Since, $x = \angle AOB = 120^\circ$

[vertically opposite angles]

hence $x = 120^\circ$

Ans. option (d)

7. $\angle DAC = \angle DCA = 50^\circ$

$\angle BAC = 180^\circ - (90^\circ + 36^\circ) = 54^\circ$

$\therefore x = \angle DAC + \angle BAC$

$= 50^\circ + 54^\circ$

Thus $x = 104^\circ$

Ans. option (c)

8. Let the smallest angle be x

Other angle $= 2x - 24$

and $x + (2x - 24)^\circ = 180^\circ$

$\Rightarrow 3x - 24^\circ = 180^\circ$

$\Rightarrow 3x = 180^\circ - 24$

$\Rightarrow 3x = 204^\circ$

$\Rightarrow x = \frac{204^\circ}{3}$

$x = 68^\circ$

$\therefore$ largest angle $= 2x - 24 = 2 \times 68^\circ - 24$

$= 112^\circ$

Thus Ans. option (c)

B. Fill in the Blanks

1. Kite

2. 7 cm

3. Rectangle

4. Let the angles are x, $2x$, $3x$ and $4x$

$x + 2x + 3x + 4x = 360^\circ$

$\Rightarrow 10x = 360^\circ$

$\Rightarrow x = \frac{360^\circ}{10}$

$x = 36^\circ$

angles are $x = 36^\circ$

$2x = 2 \times 36^\circ = 72^\circ$

$3x = 3 \times 36^\circ = 108^\circ$

and $4x = 4 \times 36^\circ = 144^\circ$

5. $\angle P - \angle R = 0^\circ$

C. Match the Following

1. d **2.** e

3. a **4.** b

5. c

D. True or False

1. False **2.** True

3. False **4.** True

5. True

E. Very Short Answer Type Questions

1. We know that, sum of adjacent angles in a parallelogram is 180°

So, $(5x - 5)^\circ + (10x + 35)^\circ = 180^\circ$

$\Rightarrow (5x + 10x) - 5^\circ + 35^\circ = 180^\circ$

$\Rightarrow 15x + 30^\circ = 180^\circ$

$\Rightarrow 15x = 180^\circ - 30^\circ$

$\Rightarrow 15x = 150^\circ$

$\Rightarrow x = \frac{150^\circ}{15}$

$x = 10^\circ$

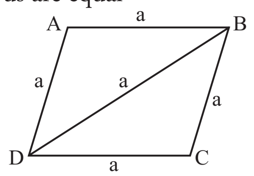
angles are $(5x - 5)^\circ = 5 \times 10^\circ - 5 = 45^\circ$

and $(10x + 35)^\circ = 10 \times 10^\circ + 35^\circ = 135^\circ$

$\text{Ratio} = \frac{45^\circ}{135^\circ} = \frac{1}{3}$

Ratio = 1 : 3

2. Given that, one of diagonals and sides a Rhombus are equal



So, diagonal divides Rhombus into two equilateral triangle with each angle of 60°

Thus $\angle A = 60^\circ$

Since, $\angle A + \angle D = 180^\circ$

[adjacent angle property]

$\Rightarrow 60^\circ + \angle D = 180^\circ$

$\angle D = 180^\circ - 60^\circ$

$\Rightarrow \angle D = 120^\circ$

We know that opposite angles in Rhombus are equal

Thus angles are 60°, 120°, 60° and 120°

3. Given that Ratio of adjacent angles of a parallelogram is 4 : 5

Let the angles are $4x$ and $5x$ and

We know that sum of adjacent angles of a parallelogram is 180°

So, $4x + 5x = 180^\circ$

$\Rightarrow 9x = 180^\circ$

$\Rightarrow x = \frac{180^\circ}{9}$

$x = 20^\circ$

Thus adjacent angles are

$4x = 4 \times 20^\circ = 80^\circ$

and $5x = 5 \times 20^\circ = 100^\circ$

but opposite angles in parallelogram are equal hence angles are 80°, 100°, 80° and 100°.

4. (a) Since each angle of a square is a right angle. So it is a Rectangle.

(b) Square is a quadrilateral because sum of all angles of a square is 360° and it is a close figure with four sides.

(c) Diagonals in square perpendicularly bisect each other. So it is a Rhombus.

(d) Opposite sides of a square are equal and parallel to each other so a square is a parallelogram

5. (a) The quadrilateral whose diagonals are equal is a rectangle or a square.

(b) Parallelogram, Rhombus, Rectangle or square

(c) a square or Rhombus

F. Short Answer Type Questions

1. (a) Given that ABCD is a trapezium

$(x - 20^\circ) + (x + 40^\circ) = 180^\circ$

$\Rightarrow 2x + 20^\circ = 180^\circ$

$\Rightarrow 2x = 180^\circ - 20^\circ$

$\Rightarrow 2x = 160^\circ$

$\Rightarrow x = \frac{160^\circ}{2}$

$x = 80^\circ$

(b) We have, EB and EC are bisectors of $\angle B$ and $\angle C$

but $\angle B + \angle C = 180^\circ$

[Pair of co-interior when AB || CD]

or $\frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{1}{2} \times 180^\circ$

or $\angle EBC + \angle ECB = 90^\circ$

$[\angle EBC = \frac{1}{2}\angle B$ and $\angle ECB = \frac{1}{2}\angle C]$

in ΔBEC,

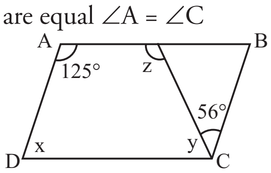
$\angle BEC + \angle ECB + \angle EBC = 180^\circ$

$\Rightarrow \quad \angle BEC + 90^\circ = 180^\circ$

$\Rightarrow \quad \angle BEC = 180^\circ - 90^\circ$

$\angle BEC = 90^\circ$

2. We know that in a parallelogram, opposite angles are equal $\angle A = \angle C$



$\therefore \quad y + 56 = 125^\circ$

$y = 125^\circ - 56^\circ$

$y = 69^\circ$

and $\quad \angle A + \angle D = 180^\circ$

[adjacent angle property]

$\Rightarrow \quad 125^\circ + \angle D = 180^\circ$

$\Rightarrow \quad \angle D = 180^\circ - 125^\circ$

$\angle D = 55^\circ \Rightarrow x = 55^\circ$

again, $x + y + z + 125^\circ = 360^\circ$

[angle sum property in quadrilateral]

$\Rightarrow \quad 55^\circ + 69^\circ + z + 125^\circ = 360^\circ$

$\Rightarrow \quad z + 249^\circ = 360^\circ$

$\Rightarrow \quad z = 360^\circ - 249^\circ$

$z = 111^\circ$

3. Given that TEAR is a kite in which

$\angle TEA = 70^\circ, \angle ART = 80^\circ$

in ΔRAT, $\quad RT = RA \quad$ [Kite Property]

$\Rightarrow \quad \angle RAT = \angle KTA$

$\therefore \quad \angle RAT + \angle RTA + \angle ART = 180^\circ$

$\Rightarrow \quad \angle RAT + \angle RAT + 80^\circ = 180^\circ$

$\Rightarrow \quad 2\angle RAT = 180^\circ - 80^\circ$

$\Rightarrow \quad 2\angle RAT = 100^\circ$

$\Rightarrow \quad \angle RAT = \frac{100^\circ}{2}$

$\angle RAT = 50^\circ$

Thus $\quad \angle RAT = \angle RTA = 50^\circ$

Similarly, in ΔTEA,

We have $\quad EA = ET$

$\Rightarrow \quad \angle ETA = \angle EAT$

and $\quad \angle TEA = 70^\circ$

also $\angle EAT + \angle ETA + \angle TEA = 180^\circ$

$\Rightarrow \quad \angle EAT + \angle EAT + 70^\circ = 180^\circ$

$\Rightarrow \quad 2\angle EAT = 180^\circ - 70^\circ$

$\Rightarrow \quad \angle EAT = \frac{110^\circ}{2} = 55^\circ$

Thus $\quad \angle EAT = \angle ETA = 55^\circ$

Now $\quad \angle RTE = \angle RAE = 50^\circ + 55^\circ$

$= 105^\circ$

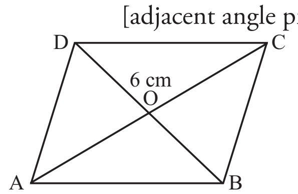
Thus $\quad \angle RTE = 105^\circ$ and $\angle RAE$

$= 105^\circ$

4. Given that ABCD is a Rhombus in which $\angle ADC = 120^\circ$ and OD = 6 cm

(a) Since, $\angle ADC + \angle DAC = 180^\circ$

[adjacent angle property]



$\Rightarrow \quad 120^\circ + \angle DAC = 180^\circ$

$\Rightarrow \quad \angle DAC = 180^\circ - 120^\circ$

$\Rightarrow \quad \angle DAC = 60^\circ$

but diagonals bisect the angles

So, $\quad \angle OAD = \frac{1}{2}\angle DAC$

$= \frac{1}{2} \times 60^\circ$

$\angle OAD = 30^\circ$

(b) Since, $\quad \angle A = 2\angle OAD$

$\angle A = 2 \times 30^\circ$

$\angle A = 60^\circ$

and $\quad \angle ADB = \frac{120^\circ}{2} = 60^\circ = \angle B$

[opposite angles are equal]

as $\angle A = \angle ABD = \angle ADB = 60^\circ$

So ΔADB is an equilateral triangle in which

BD = 20D

= 2 × 6

= 12 cm

Since, there are all sides equal in equilateral triangle hence

AB = 12 cm

(c) Perimeter of the Rhombus

ABCD = 4 × Side AB

$= 4 \times 12$

$= 48$ cm

5. Since, $120^\circ + \angle ADC = 180^\circ$ [Linear Pair]

$\Rightarrow \quad \angle ADC = 180^\circ - 120^\circ$

$\Rightarrow \quad \angle ADC = 60^\circ$

and Rellex $\angle ABC = 360^\circ - 140^\circ = 220^\circ$

New in quadrilateral ABCD,

x + Rellex ABC + $\angle C + \angle ADC = 360^\circ$

$\Rightarrow \quad x + 220^\circ + 53^\circ + 60^\circ = 360^\circ$

$\Rightarrow \quad x + 333^\circ = 360^\circ$

$\Rightarrow \quad x = 360^\circ - 333^\circ$

$x = 27^\circ$

G. Long Answer Type Questions

1. Given that ABCD is a parallelogram in which

AB = CD

$\therefore \quad 3x - 1 = 2x + 2$

$\Rightarrow \quad 3x - 2x = 2 + 1$

$x = 3$

we know that opposite angles in parallelogram are equal

So, $\angle B = \angle D = 102^\circ$

Now, in ΔACD

$50^\circ + 102^\circ + z = 180^\circ$

[angle sum property in triangle]

$\Rightarrow \quad z + 152^\circ = 180^\circ$

$\Rightarrow \quad z = 180^\circ - 152^\circ$

$z = 28^\circ$

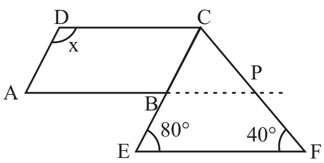
again, $y + z = 180^\circ$ [linear pair]

$\Rightarrow \quad y + 28^\circ = 180^\circ$

$\Rightarrow \quad y = 180^\circ - 28^\circ$

$y = 152^\circ$

2. Given that AB || CD || EF and AD || BC, $\angle CEF = 80^\circ$



Now extending side AB intersect CF at P

Here, AP || EF

So, $\angle CBP = \angle CEF$

[Corresponding angle]

$\angle CBP = 80^\circ$

but, $\angle CBP + \angle CBA = 180^\circ$ [Linear pair]

$\Rightarrow \quad 80^\circ + \angle CBA = 180^\circ$

$\Rightarrow \quad \angle CBA = 180^\circ - 80^\circ$

$\Rightarrow \quad \angle CBA = 100^\circ$

As, opposite angles in parallelogram are equal thus

$\angle CBA = x = 100$

$x = 100$

3. Given that ABCD is a parallelogram and bisectors of $\angle A$ and $\angle B$ meet at P

To prove : $\angle APB = 90^\circ$

Proof : Since AP and BP are bisectors of $\angle A$ and $\angle B$

So $\angle PAB = \frac{1}{2} \angle A$ and $\angle PBA = \frac{1}{2} \angle B$

$\because \quad \angle A + \angle B = 180^\circ$

[adjacent angle property]

$\Rightarrow \quad \frac{1}{2} \angle A + \frac{1}{2} \angle B = \frac{1}{2} \times 180^\circ$

$\Rightarrow \quad \angle PAB + \angle PBA = 90^\circ \quad \ldots(1)$

Now, in ΔPAB

$\angle APB + \angle PAB + \angle PBA = 180^\circ$

[angle sum property in triangle]

$\Rightarrow \quad \angle APB + 90^\circ = 180^\circ$

[from statement (1)]

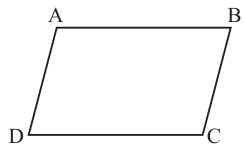
$\Rightarrow \quad \angle APB = 180^\circ - 90^\circ$

$\Rightarrow \quad \angle APB = 90^\circ$ hence proved

4. Given that

$\angle A = \angle C$

and $\angle B = \angle D$



To prove ABCD is a parallelogram

Prrof : $\because \angle A + \angle B + \angle C + \angle D = 360^\circ$

[Angle sum property in quadrilateral]

$\Rightarrow \quad \angle A + \angle B + \angle A + \angle B = 360^\circ$

$\Rightarrow \quad 2\angle A + 2\angle B = 360^\circ$

$\Rightarrow \quad 2(\angle A + \angle B) = 360^\circ$

$\Rightarrow \quad \angle A + \angle B = \frac{360^\circ}{2}$

$\Rightarrow \quad \angle A + \angle B = 180^\circ$

which is a pair of adjacent angle in parallelogram

Thus given quadri lateral is a parallelogram

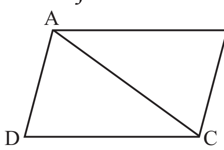
Hence proved

5. Given that ABCD is a Rhombus in which

AB = BC = CD = DA

To prove : ABCD is a parallelogram

Construction : Join A to C



Proof : in ΔABC and ΔCBA

AB = CD [given]

BC = DA [given]

and AC = CA [Common]

By Side-Side-Side (SSS) criterian,

$\Delta ABC \cong \Delta CDA$

hence $\angle BAC = \angle DCA$

and $\angle BCA = \angle DAC$

Since alternate interior angles are Equal, The opposite sides are parallel, AB || CD and AD || BC

Thus ABCD is a parallelogram.

H.

1. B **2.** D

3. C **4.** D

5. B

I. Case Study

1. Since, CD = 10 cm and AD = 24 cm and ΔADC is a Rt. angle triangle with $\angle D = 90^o$

Using, Pythagorus theorem,

$\Rightarrow \quad AC^2 = CD^2 + AD^2$

$\Rightarrow \quad AC^2 = 10^2 + 24^2$

$\Rightarrow \quad AC^2 = 100 + 576$

$\Rightarrow \quad AC^2 = 676$

$\Rightarrow \quad AC = \sqrt{676}$

$\Rightarrow \quad AC = 26$ cm

Ans. option (d)

2. Option B

3. Option C

4. Option D

5. Option B

❑❑

5. Number Play

Class Work 5.1

1. $2x$ is an even because it is multiple of 2 $4x + 2y$ is an even ($\because$ even + even = even) $4k \times 3j$ is an even because it is multiple of 2 $24 + 6v - 8$ is even because it is multiple of 2

NCERT Exercise 5.1

1. Let x, $x + 1$, $x + 2$, $x + 3$ are four consecutive numbers.

According to the question,

$x + x + 1 + x + 2 + x + 3 = 34$

$4x + 6 = 34$

$\Rightarrow 4x = 34 - 6 = 28$

$\Rightarrow x = \dfrac{28}{4} = 7$

Thus, 7, 8, 9, 10 are required consecutive numbers.

$$\begin{pmatrix} x = 7 \\ x+1 = 7+1 = 8 \\ x+2 = 7+2 = 9 \\ x+3 = 7+3 = 10 \end{pmatrix}$$

2. Since p is the greatest of five consecutive numbers. So, other numbers will be:

$(p - 1)$, $(p - 2)$, $(p - 3)$, $(p - 4)$

3. (i) The sum of two even numbers is a multiple of 3.

e.g. 2 + 4 = 6, which is a multiple of 3
2 + 6 = 8, which is not a multiple of 3

Sometimes True

(ii) If a number is not divisible by 18, then it is also not divisible by 9.
e.g. 27 is not divisible by 18
but divisible by 9

Sometimes True

(iii) If two numbers are not divisible by 6, then their sum is not divisible by 6.
e.g. 4 and 8 are not divisible by 6 but their sum 4 + 8 = 12 is divisible by 6.
Again, 2 and 5 are not divisible by 6 and their sum 2 + 5 is also not divisible by 6.

Sometimes True

(iv) The sum of a multiple of 6 and a

multiple of 9 is a multiple of 3.
e.g. multiple of 6 = 6
and multiple of 9 = 9
Their sum = 6 + 9 = 15 which is multiple of 3.
Again,
multiple of 6 = 12
multiple of 9 = 18
Their sum = 12 + 18
= 6 (2 + 3)
= 6 × 5 = 30, which is multiple of 3
Always True

(v) The sum of a multiple of 6 and a multiple of 3 is a multiple of 9.
e.g. multiple of 6 = 6
multiple of 3 = 3
Their sum = 6 + 3 = 9, which is multiple of 9.
Again,
Multiple of 6 = 12
Multiple of 3 = 9
Their sum = 12 + 9 = 21, which is not a multiple of 9.
Sometimes True

4. Let x be required number,

According to the question,

$x = 3k + 2$, (k is any whole number)

For $k = 0$, $x = 0 + 2 = 2$

$k = 1$, $x = 3 \times 1 + 2 = 5$

$k = 2$, $x = 3 \times 2 + 2 = 8$

.... and so on.

Again, when x is divided by 4, remainder is 2.

$\therefore$ $x = 4p + 2$, where p is whole number.

For $p = 0$, $x = 0 + 2 = 2$

$p = 1$, $x = 4 \times 1 + 2 = 6$

$p = 2$, $x = 4 \times 2 + 2 = 10$

$p = 3$, $x = 4 \times 3 + 2 = 14$

.... and so on.

5. According to the question,

Number leaves a remainder of 1 when divided by 3, 2 and 5.

It means if we subtract 1 from the number then it is divisible by 3, 2 and 5.

LCM of 3, 2, 5 = 3 × 2 × 5 = 30

Pebbles can be expressed as $(30n + 1)$.

Also number is perfectly divisible by 7.

For $n = 1$, $30n + 1 = 30 \times 1 + 1 = 31$, not divisible by 7.

$n = 2$, $30 \times 2 + 1 = 61$, not divisible by 7.

$n = 3$, $30 \times 3 + 1 = 91$, divisible by 7.

$\therefore$ Number of Pebbles = 91

6. Let x be the number.

According to the question,

$x = 6k + 2$, k is any whole number.

Let us consider three numbers as x_1, x_2 and x_3.

where $x_1 = 6p + 2$, p is any whole number.

$x_2 = 6q + 2$, q is any whole number.

$x_3 = 6r + 2$, r is any whole number.

Sum of these numbers = $x_1 + x_2 + x_3$

$= 6p+2 + 6q+2 + 6r+2$

$= 6(p + q + r) + 6$

$= 6[p + q + r + 1]$

$\Rightarrow$ multiple of 6

Thus Tathagat's claim is True.

7. According to the question,

$$661 = (7 \times q_1) + 3 \quad \text{... (1)}$$

and $$4779 = (7 \times q_2) + 5 \quad \text{... (2)}$$

(i) Where q_1 and q_2 are quotients, when divided by 7. Now, Adding equations (1) and (2), we get

$661 + 4779 = (7q_1 + 3) + (7q_2 + 5)$
$= 7q_1 + 7q_2 + 8$
$= 7q_1 + 7q_2 + 7 + 1$
$= 7(q_1 + q_2 + 1) + 1$

$\Rightarrow$ when 661 + 4779 is divided by 7 then remainder is 1.

(ii) On subtracting equation (i) from (ii), we get
$4779 - 661 = (7q_2 + 5) - (7q_1 + 3)$
$= 7q_2 - 7q_1 + 5 - 3$
$= 7q_2 - 7q_1 + 2$
$= 7(q_2 - q_1) + 2$

$\Rightarrow$ when 4779 – 661 is divided by 7 then remainder is 2.

8. According to the question,

Required numbers are in the form of

$3p + 2, 4q + 3, 5r + 4$

Here, we observe that If 1 is added to the number, number will be perfectly divisible by given numbers respectively.

LCM of 3, 4, 5 = 3 × 4 × 5 = 60

∴ Required number = 60 – 1 = 59

Since 60 is the smallest positive common multiples of 3, 4 and 5.

So, subtracting, from 60, gives the smallest number.

Practice Exercise 5.1

1. Let like consecutive numbers are x, $x + 1$, $x + 2$, $x + 3$ and $x + 4$

According to question

$$\because x + (x + 1) + (x + 2) + (x + 3) + (x + 4) = 60$$

$$\Rightarrow \quad 5x + 10 = 60$$

$$\Rightarrow \quad 5x = 60 - 10$$

$$\Rightarrow \quad 5x = 50$$

$$\Rightarrow \quad x = \frac{50}{}$$

$$x = 10$$

Thus, Numbers are

$$x = 10$$
$$x + 1 = 10 + 1 = 11$$
$$x + 2 = 10 + 2 = 12$$
$$x + 3 = 10 + 3 = 13$$
and $$x + 4 = 10 + 4 = 14$$

2. The smallest of six consecutive no = q

Other five consecutive numbers are

$(q + 1), (q + 2), (q + 3), (q + 4), (q + 5)$

3. (a) Always true, example product of 3 and 5 is 15

(b) Some times true, example sum of prime numbers 2 and 3 is 5 which is an odd number

(c) Always true, example number 8 is divisible by 4, it is also divisible by 2.

(d) Always true, example difference of 25 and 10 is a multiple of 5

(e) Never true, sum of an even number and an odd number is an odd number example 2 + 3 = 5

4. The number is multiple of 4 and 5. So the number is divisible by LCM of 4 and 5 = 20

Thus, the number must be in form of $20k + r$, $0 \le k < 4$

but according to condition, we have $r = 3$, so the number is $20k + 3$

5. Let the marbles are $k < 50$

Since number of marbles is multiple of 7 can be 7, 14, 21, 28, 35, 42 and 49 which are less than 50.

But according to condition, there should be 21 no of marbles.

6. No, Riya is not correct

Example : 24 and 38, both numbers leave a remainder of 3 when divided by 7. but when adding both numbers, leave remainder of 6 when divided by 7.

7. (a) The remainder when 534 + 812 is divided by 11 is the same as the remainder when 6 + 9 = 15 is divided by 11. hence Remainder is 4.

(b) The remainder when 812 – 534 is divided by 11 is same as the difference of both remainder obtained on dividing numbers 812 and 534 by 11.

Thus, answer is 9 – 6 = 3

8. Since number must leave remainder of 3 when divided by 7. So it must be in form of $7k + 3$. Then possible numbers satisfying the conditions are 52, 157, ... hence 52 is the smallest number.

NCERT Exercise 5.2

1. We know that a number is divisible by

- 2, if it has digits 0, 2, 4, 6 or 8 at ones place.
- 3, if the sum of the digits is a multiple of 3 or it is divisible by 3.
- 4, if last two digits of the number is completely divisible by 4.
- 5, if a number has 0 or 5 in its ones place.
- 6, if it is divisible by 2 and 3 both.
- 8, if last three digits of the number is completely divisible by 8.
- 9, if the sum of the digits of the number is divisible by 9.
- 10, if a number has 0 in its ones place.
- 11, if the difference of sum of the digits

at even places and sum of the digits at odd places is either 0 or multiple of 11.

Now, complete table is shown below:

No.		Divisible by								
		2	3	4	5	6	8	9	10	11
(i)	128	Yes	No	Yes	No	No	Yes	No	No	No
(ii)	990	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes
(iii)	1586	Yes	No	No	No	No	No	No	No	No
(iv)	275	Yes	No	No	Yes	No	No	No	No	Yes
(v)	6686	Yes	No	No	No	No	No	No	No	No
(vi)	639210	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes
(vii)	429714	Yes	Yes	No	No	Yes	No	Yes	No	No
(viii)	2856	Yes	Yes	Yes	No	Yes	Yes	No	No	No
(ix)	3060	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
(x)	406839	No	Yes	No	No	No	No	No	No	No

2. We know that a number is divisible by 9 if the sum of its digits is divisible by 9

(i) 123
Sum of the digits = 1 + 2 + 3
= 6, not divisible by 9
No

(ii) 405
Sum of digits = 4 + 0 + 5
= 9, divisible by 9
Yes

(iii) 8888
Sum of digits = 8 + 8 + 8 + 8
= 32, not divisible by 9
No

(iv) 93547
Sum of digits = 9 + 3 + 5 + 4 + 7
= 28, not divisible by 9
No

(v) 358095
Sum of digits = 3 + 5 + 8 + 0 + 9 + 5
= 30, not divisible by 9
No

3. We have to find the smallest multiple of 9 with no odd digits

Multiples of 9 are

9	(9 odd)
18	(1 odd)
27	(7 odd)
36	(3 odd)
45	(5 odd)
54	(5 odd)
63	(3 odd)
72	(7 odd)
81	(1 odd)
90	(9 odd)
99	(9 odd)
108	(1 odd)
117	(1 odd)
126	(1 odd)
135	(1, 3, 5 odd)
144	(1 odd)
153	(1, 5, 3 odd)
162	(1 odd)
288	(2, 8 even digits)
288	has all even digits

Sum of digits = 2 + 8 + 8 = 18, which is multiple of 9. So, the smallest multiple of 9 with no odd digits is 288.

4. To find multiple of 9 closet to 6000

$\frac{6000}{9}$ = 666 as quotient and 6 as remainder

So, we check 666 × 9 and 667 × 9

666 × 9 = 5994

667 × 9 = 6003

It is clear that 6003 is closet to 6003.

5. According to the question,

$\frac{4300}{9}$ = 477 (Quotient) + 7 (Remainder)

∴ 478 × 9 = 4302

So, 4302 is first multiple of 9 after 4300

others are 4302 + 9 = 4311

4311 + 9 = 4320
4320 + 9 = 4329
4329 + 9 = 4338
4338 + 9 = 4347
4347 + 9 = 4356
4356 + 9 = 4365
4365 + 9 = 4374
4374 + 9 = 4383
4383 + 9 = 4392

Thus total 11 multiples of 9 are there between 4300 and 4400.

6. Units place (2)

The unit place is 1 more than a multiple of 11. $[1 = 11 \times 0 + 1]$

So, the contribution of 2 units

$= 2 \times (+1) = +2$ Tens place (6)

The tens place is 1 less then a multiple of 11. $[10 = 11 \times 1 - 1\}$

So, the contribution of 6 tens $= 6 \times (-1) = -6$ Hundreds place (4)

The Hundred place is 1 more than a multiple of 11. $[100 = 11 \times 9 + 1]$

So, the contribution of 4 hundreds

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

Now, sum of these contributions

$26 + 4 = 0$

Since, the sum is 0 and 0 is divisible by 11. So, the number 462 is divisible by 11.

7. A number is divisible by 11, if the difference between the sum of the digits at odd places (from the right to left) and the sum of the digits at even places (from the right to left) of the number is either 0 or divisible by 11.

(i) We have, 158

Sum of digits at odd places $= 8 + 1 = 9$

Sum of digits at even places = 5

$\therefore$ Difference $= 9 - 5 = 4$,

which is not divisible by 11.

So, 158 is not divisible by 11.

Remainder = 4

(ii) We have, 841

Sum of digits at odd places $= 1 + 8 = 9$

Sum of digits at even places = 4

$\therefore$ Difference $= 9 - 4 = 5$, which is not divisible by 11.

$\therefore$ So, 841 is not divisible by 11.

Remainder = 5

(iii) We have, 481

Sum of digits at odd places $= 1 + 4 = 5$

Sum of digits at even places = 8

Difference $= 8 - 5 = 3$,

which is not divisible by 11.

So, 481 is not divisible by 11.

Remainder = 3

(iv) We have, 5529

Sum of digits at odd places $= 9 + 5 = 14$

Sum of digits at even places $= 5 + 2 = 7$

Difference $= 14 - 7 = 7$, which is not divisible by 11. So, 5529 is not divisible by 11.

Remainder = 7

(v) We have, 90904

Sum of digits at odd places $= 4 + 9 + 9 = 22$

Sum of digits at even places $= 0 + 0 = 0$

Difference $= 22 - 0 = 22$, which is divisible by 11. So, 90904 is divisible by 11.

Remainder =7

(vi) We have, 857076,

Sum of digits at odd places

$= 6 + 0 + 5 = 11$

Sum of digits at even places

$= 7 + 7 + 8 = 22$

$\therefore$ Difference $= 22 - 11 = 11$, which is divisible by 11. So, 857076 is divisible by 11.

Practice Exercise 5.2

1.

	Number	divisible by	
		5	10
a	4735	Yes	No
b	84970	Yes	Yes
c	65832	No	No
d	360025	Yes	No
e	9873217	No	No
f	5400010	Yes	Yes
g	843255	Yes	No
h	238226	No	No

2.

	Number	divisible by		
		2	4	8
a	2488	Yes	Yes	Yes
b	3556	Yes	Yes	No

c	6780	Yes	Yes	No
d	3668	Yes	Yes	No
e	54795	No	No	No
f	639210	Yes	No	No
g	726352	Yes	Yes	Yes
h	297144	Yes	Yes	Yes

3.

	Number	3	6	9	11
a	5412	✓	✓	✗	✓
b	6825	✓	✗	✗	✗
c	21084	✓	✓	✗	✗
d	10824	✓	✓	✗	✓
e	71232	✓	✗	✗	✗
f	438750	✓	✓	✓	✗
g	639216	✓	✓	✓	✗
h	901351	✗	✗	✗	✓
i	1790184	✓	✓	✗	✓
j	10000001	✗	✗	✗	✓

4. We know that, for a number to be divisible by 3, sum of its digits should be divisible by 3

(a) Sum of digits in 53 × 56

= 5 + 3 + * + 5 + 6

= 19 + *

If we add 2, it becomes 21, which is divisible by 3

So * is to be replaced by 2

(b) Sum of the digits in 234 * 17

= 2 + 3 + 4 + * + 1 + 7

= 17 + *

If we add 1, it becomes 18, which is divisible by 3

So * is to be replaced by 1

(c) Sum of the digits is 6 * 1054 is 6 + * + 1 + 0 + 5 + 4 = 16 + *

if we add 2, it becomes 18, which is divisible by 3

So * is to be replaced by 2.

5. (a) Sum of digits in odd places

= 1 + 8 + 4 = 13 and

Sum of digits in even places

= 3 + * + 2 = * + 5

The difference of both sum will be 0 if * is replaced by digit 8

Thus * is replaced by 8

(b) Sum of digits in odd places

= 1 + * + 6 = 7 + * and

Sum of digits in even places

= 9 + 7 + 4 = 20

difference of both sum will be multiple of 11 if * is replaced by 2

Thus * is replaced by 2

(c) Sum of digits in odd places

= 0 + 3 + 1 + 0 + 2 = 6

Sum of digits in even places

= 8 + * + 0 + 4 + 5

= 17 + *

On replaceing * by 0, we get the difference multiple of 11

Thus * should be replaced by 0.

6. We know that a number is divisible by 6 if it is divisible by 2 as well as 3.

(a) Given number 2 * 4706 is completely divisible by 2 as it has digit 6 on its one's place

Now, sum of the digits

= 2 + * + 4 + 7 + 0 + 6

= 19 + *

Thus * should be replaced by smallest No 2 or greatest number 8 to be divisible by 3

So * should be replaced by (1) smallest digit 2 and (11) greatest digit 8

(b) Given number is completely divisible by 2 as it has digit 4 on its one's place.

Now, sum of the digits

= 5 + 8 + 2 + 5 + * + 3 + 4

= 27 + *

So * should be replaced by (1) smallest no 0 or (11) greatest no 9 to be divisible by 3

(c) Given number is completely divisible 2 as it has digit on its one's place.

Now, sum of the digits

= 3 + 8 + 5 + * + 4

= 20 + *

So * should be replaced by (1) smallest number 1 or (11) greatest number 7 to be divisible by 3.

Math Talk

Page-101

1. (i) 608, 617, 626, 635, 644, 653, 662, 671, 680 etc.

(ii) 610, 619, 628, 637, 646, 655, 664, 673, 682, 691

(iii) 606, 615, 624, 633, 642, 651, 660, 678, 687, 696

2.

Number	digital Root
11	1 + 1 = 2
12	1 + 2 = 3
13	1 + 3 = 4
14	1 + 4 = 5
15	1 + 5 = 6
16	1 + 6 = 7
17	1 + 7 = 8
18	1 + 8 = 9
19	1 + 9 = 10 = 1 + 0 = 1
20	2 + 0 = 2
21	2 + 1 = 3
22	2 + 2 = 4

The digital roots of consecutive numbers repeat after 9 numbers.

NCERT Exercise 5.3

1. Let 8-digit number be x.

10 more than this number = $x + 10$

Digital root of $(x + 10)$ number

= Digital root of x number + Digital root of 10

= 5 + (1 + 0) [$\because$ Digital root of x = 5]

= 5 + 1 = 6

2. Let us consider number 7.

According to the question,

7 + 11 = 18
18 + 11 = 29
29 + 11 = 40
40 + 11 = 51
51 + 11 = 62
62 + 11 = 73
73 + 11 = 84
84 + 11 = 95
95 + 11 = 106
106 + 11 = 117
117 + 11 = 128
128 + 11 = 139
139 + 11 = 150

Now,Digital Root of 7 = 7
Digital Root of 18 = 1 + 8 = 9
Digital Root of 29 = 2 + 9 = 11 = 2
Digital Root of 40 = 4 + 0 = 4
Digital Root of 51 = 5 + 1 = 6
Digital Root of 62 = 6 + 2 = 8
Digital Root of 73 = 7 + 3 = 10 = 1
Digital Root of 84 = 8 + 4 = 12 = 3
Digital Root of 95 = 9 + 5 = 14 = 5
Digital Root of 106 = 1 + 6 = 7
Digital Root of 117 = 1 + 1 + 7 = 9
Digital Root of 128 = 1 + 2 + 8 = 11 = 2
Digital Root of 139 = 1 + 3 + 9 = 13 = 4
Digital Root of 150 = 1 + 5 = 6

$\therefore$ Sequence of the digital roots is

7, 9, 2, 4, 6, 8, 1, 3, 5, 7, 9, 2, 4, 6 ...

Hence, the digital roots repeat in a cycle of 9 *i.e.* 7, 9, 2, 4, 6, 8, 1, 3, 5.

3. Given number is $9a + 36b + 13$

Digital root of $9a$ = 9

Digital root of $36b$ = 9

Digital root of 13 = 1 + 3 = 4

$\therefore$ Digital root of the number $9a + 36b + 13$

= 9 + 9 + 4 = 22

= 4

4. (i) Let us consider number 24 and 27 and 47 24 (even number)

Digital root of 24 = 2 + 4 = 6
27 (odd number)
Digital root of 27 = 2 + 7 = 9
47 (odd number)
Digital root of 47 = 4 + 7 = 11 = 2

It is clear that there is no fixed relation between parity of a number and its digital root.

(ii) Let us consider numbers 62, 46

Digital root of 62 = 6 + 2 = 8

on dividing 62 by 9 and 3, we get remainder 8 and 2 respectively.

Again, Digital Root of 46 = 6 + 4 = 10 = 1

on dividing 46 by 9 and 3, we get remainder 1 and respectively.

Thus, The digital root is same as the remainder when the number is divided by 9.

Practice Exercise 5.3

1. The digital root of the sum of the digits of any number is the same as the digital root of the original number.

2. Let the number 123

∴ 123 × 9 = 1107

and digital root of 1107 is 1 + 1 + 0 + 7 = 9

3. Let the first number = 123 and

2nd number = 456

digital root of number 123 = 1 + 2 + 3 = 6 and digital root of number 456 = 4 + 5 + 6 = 15 = 1 + 5 = 6

So, digital root of product of Numbers 123 and 456 = (digital root of 123) × (digital root of 456)

= 6 × 6

= 36

digital root = 3 + 6

= 9

4. No, because the digital root of 9 is and adding 9 repeatedly to a number does not affect its digital root. The digital root always remains same.

5.

Multiples of 11	digtial Roots
11	1 + 1 = 2
22	2 + 2 = 4
33	3 + 3 = 6
44	4 + 4 = 8
55	5 + 5 = 10 = 1 + 0 = 1
66	6 + 6 = 12 = 1 + 2 = 3
77	7 + 7 = 14 = 1 + 4 = 5
88	8 + 8 = 16 = 1 + 6 = 7
99	9 + 9 = 18 = 1 + 8 = 9
110	1 + 1 + 0 = 2

The digital roots of multiples of 11 cycles repeat after 9 numbers.

6. (i) A number is divisible by 3 if and only if its digital root is 3, 6 or 9.

(ii) A number is divisible by 9 if and only if its digital root is 9.

Class Work 5.2

(a) We need two digit number when multiplied by 3, gives three digit number.
Now, 50 × 3 = 150
Satisfy all the required conditions.

(b) We need two digit number AB when divided by 5, gives a two digit number BC.
Now, 19 × 5 = 95 satisfies all the required conditions, hence A = 1, B = 9 and C = 5

(c) We need three digit number L2N when multiplied by digit 2, gives 3 digit number 2NP.
Now, 124 × 2 = 248 satisfies all the required conditions, hence L = 1, N = 4 and P = 8

(d) We need two digit number xy when multiplied by 4, gives two digit number.
Now, 23 × 4 = 92 satisfies all the required conditions hence x = 2, y = 3 and z = 9

(e) On multiplying two digit number PP by another two digit number QQ. We get the result with three digit number PRP. Now, 44 × 11 = 484 satisfies all the required conditions
So P = 4, Q = 1 and R = 8

(f) On multiplying two digit number JK by digit 6, we get three digit number KKK. Now we have 74 × 6 = 444 satisfies all the given conditions. So J = 7, K = 4

NCERT Exercise 5.4

1. Given, 31 z 5 is a multiple of 9.

⇒ Sum of its digit should be divisible by 9.

∴ Sum of digit = 3 + 1 + z + 5

= 9 + z

It means (9 + z) should be 0, 9, 18, 27, ...

Since z is single digit number.

So, z can be either 0 or 9.

That's why there are answers to this problem.

2. Let x_1 and x_2 are two numbers.

According to the question,

$x_1 = 12q + 8$, where q is any integer

$x_2 = 12r - 4$, where r is any integer

Their sum $= x_1 + x_2$

$= 12q + 8 + 12r - 4$

$= 12(q + r) + 4$

$= 12K + 4$, where $K = q + r$

$= 8K + 4K + 4$

$= 8K + 4(K + 1)$

If this sum is multiple of 8 then, $4(K + 1)$ should be multiple of 8.

For K = 0, Sum $x_1 + x_2 = 8 \times 0 + 4(0 + 1)$ = 4, not multiple of 8.

K = 1, $x_1 + x_2 = 8 \times 1 + 4(1 + 1)$

= 8 + 8 = 16, which is multiple of 8

K = 2, $x_1 + x_2 = 8 \times 2 + 4(2 + 1)$

= 16 + 12 = 28, not multiple of 8

K = 3, $x_1 + x_2 = 8 \times 3 + 4(3 + 1)$

= 24 + 16

= 40, which is multiple of 8

It means sum of two numbers is not always a multiple of 8.

Thus, Snehal's claim is wrong.

3. Let $3m$ and $3n$ represents two multiples of 3.

Then their sum $= 3m + 3n = 3(m + n)$

We know that a number which is multiple of 6, is a multiple of 2 and 3 both.

Sum $= 3(m + n)$, should be multiple of 2 also.

$3(m + n)$ is even if $(m + n)$ is even number which is possible, if m and n both are even and If both m and n are odd.

4. (i) We know that a number is divisible by 9 if the sum of its digits is divisible by 9.

If we reverse the digit then their sum remains the same. So, Sreelatha's conjunctive is true for any multiple of 9.

(ii) If the original number is a multiple of 9, then any number formed by shuffling its digit will also be a multiple of 9 because the sum of its digits will remain divisible by 9.

5. We know that it a number is a multiple of 18 then it is multiple of both 2 and 9.

For multiple of 2 — Last digit of $48a23b$ should be even

$\Rightarrow$ b= 0, 2, 4, 6, 8

For multiple of 9 — Sum of digit of $48a23b$ should be multiple of 9

$\Rightarrow 4 + 8 + a + 2 + 3 + b$

$\Rightarrow 17 + a + b$ must be multiple of 9

If $b = 0$ then $17 + a + 0$

$= 17 + a$ which is multiple of 9

$\Rightarrow \quad a = 1$

$\therefore \quad (a, b) = (1, 0)$

Similarly, if $b = 2$,

$= 17 + a + 2 = 19 + a$

$\Rightarrow \quad a = 8$

$(a, b) = (8, 2)$

If $b = 4$, $17 + a + 4 = 21 + a$

$\Rightarrow \quad a = 6$

$(a, b) = (6, 4)$

If $b = 6$, $17 + a + 6 = 23 + a$

$\Rightarrow \quad a = 4$

$(a, b) = (4, 6)$

If $b = 8$, $17 + a + 8 = 25 + a$

$\Rightarrow \quad a = 2$

$(a, b) = (2, 8)$

6. We know that If a number is divisible by 44 then it must be divisible by 11 and 4.

A number is divisible by 4 If its last two digit are divisible by 4.

Here given no. is $3p7q8$

So, $q8$ must be divisible by 4.

when $q = 0$, 08 is divisible by 4.

when $q = 1$, 18 is not divisible by 4.

when $q = 2$, 28 is divisible by 4.

when $q = 3$, 38 is not divisible by 4.

when $q = 4$, 48 is divisible by 4.

when $q = 5$, 58 is not divisible by 4.

when $q = 6$, 68 is divisible by 4.

when $q = 7$, 78 is not divisible by 4.

when $q = 8$, 88 is divisible by 4.

when $q = 9$, 98 is not divisible by 4.

A number which is divisible by 11 if the difference between the sum of the digit at odd places and the sum of the digit at even places of the number is either 0 or divisible by 11.

Here, Sum of its digit at odd places = 3 + 7 + 8 = 18

Sum of its digit at even places = $p + q$

Difference is sums = $18 - p - q$

So, $18 - p - q$ must be a multiple of 11

possible multiple of 11 are 0, 11, 22, ...

Maximum value of $p + q$ is 9 + 9 = 18

Maximum value of $p + q$ is 0 + 0 = 0

$\therefore$ $18 - p - q$ can only be 0 or 11.

If $18 - p - q = 0$

$\Rightarrow p + q = 18$

Also q = 0, 2, 4, 6, 8

If $q = 8$, $p = 8 = 18$

$\Rightarrow p = 10$ (impossible)

Similarly, we can find there is no solution for other values of q in this case.

If $18 - p - q = 11 \Rightarrow p + q = 7$

Also, q = 0, 2, 4, 6, 8

For $q = 0$, $p + 0 = 7 \Rightarrow p = 7$

$q = 2$, $p + 2 = 7 \Rightarrow p = 5$

$q = 4$, $p + 4 = 7 \Rightarrow p = 3$

$q = 6$, $p + 6 = 7 \Rightarrow p = 1$

$q = 8$, $p + 8 = 7 \Rightarrow p = -1$ (impossible)

$\therefore$ Possible pairs are (7, 0) (5, 2), (3, 4), (1, 6).

7. Let three consecutive numbers are x, $(x + 1)$ and $(x + 2)$

According to the question,

$x = 2m_1$, m_1 is any whole number.

$x + 1 = 2m_1 + 1 = 3m_2$, m_2 is any whole number

$\Rightarrow 2m_1 = 3m_2 - 1$

$\Rightarrow$ Number of the form $2m_1$ are one less than a multiple of 3.

$\Rightarrow m_1$ is one more than the multiple of 3.

$\therefore$ $m_1 = 3p + 1$, where p is any whole number.

Also third number is multiple of 4

So, $x + 2 = 2m_1 + 2 = 2\,(m_1 + 1)$ is a multiple of 4.

$\Rightarrow (m_1 + 1)$ is even

$\Rightarrow m_1$ is odd

$m_1 = 3p + 1$ and m_1 is odd

$\Rightarrow 3p$ is even

$\Rightarrow p$ is even

Let, $p = 2k$

Then, $m_1 = 3\,(2k) + 1 = 6k + 1$

$\therefore$ $x = 2m_1 = 2\,(6K + 1) = 12K + 2$

Thus, required consecutive numbers are

12K + 2, 12K + 3, 12K + 4, when K = 0, 1, 2 ...

Such triples exist infinitely many times and appear after every 12 numbers.

(2, 3, 4), (14, 15, 16), (26, 27, 28) ...

8. $\dfrac{45{,}000}{36} = 1250$

First multiple = 36 × (1250 + 1)

= 36 × 1251

= 45036

Second multiple = 36 × (1250 + 2)

= 36 × 1252

= 45072

Third multiple = 36 × (1250 + 3)

= 36 × 1253

= 45108

Fourth multiple = 36 × (1250 + 4)

= 36 × 1254

= 45144

Fifth multiple = 36 × (1250 + 5)

= 36 × 1255

= 45180

Required five multiples are 45036, 45072, 45108, 45144, 45180

9. The middle number in the sequence of 5 consecutive even numbers = $5p$

We know difference between two consecutive even numbers = 2

∴ Other four numbers in the sequence are $5p - 4, 5p - 2, 5p + 2, 5p + 4$.

10. We know that a number is divisible by 15 if it is divisible by both 3 and 5.

Also, a number is divisible by 6 if is divisible by both 2 and 3.

Let 6 digit number be *abcdef*.

According to the question,

abcdef is divisible by 15

$\Rightarrow f$ is 0 or 5

and $(a + b + c + d + e + f)$ must be divisible by 3

Now, the reversed number is *fedcba*.

If *fedcba* is divisible by 6,

Then a must be even and $(f + e + d + c + b + a)$ must be divisible by 3.

Let's choose $f = 0$ and $a = 2$

$(2 + b + c + d + e + 0)$ is divisible by 3

Let $b = 1, c = 1, d = 1, e = 1$

Sum of digit = 2 + 1 + 1 + 1 + 1 + 0 = 6, which is divisible by 6.

So, original number is 211110

Reversed number is 011112 i.e 11112.

11. Let $11p$ be multiple of 11.

Double of $(11p) = 2 \times 11p$

$= 11 \times (2p)$ which is multiple of 11.

Any multiple of 11, when doubled will always be a multiple of 11.

12. Let multiple of $6 = 6x_1$

(i) multiple of $3 = 3x_2$

Their product $= 6x_1 \times 3x_2$

$= 18\, x_1\, x_2$

$= 9 \times (2x_1\, x_2)$, which multiple of 9

Always True

(ii) Let $2x$, $2x + 2$ and $2x + 4$ are three even consecutive numbers.

∴ Sum $= 2x + 2x + 2 + 2x + 4$

$= 6x + 6$

$= 6(x + 1)$, which is divisible by 6

Always True

(iii) If a number is a multiple of 6, then it must be divisible by both 2 and 3.

abcdef is a multiple of 6.

$\Rightarrow f$ is even and sum of its digit must be divisible by 3 *badcef* is a multiple of 6.

$\Rightarrow f$ is even and sum of its digits must be divisible by 3

Sum $= a + b + c + d + e + f = b + a + d + c + e + f$

Always True

(iv) $8\,(7b - 3) - 4\,(11b + 1)$

$= 56b - 24 - 44b - 4$

$= 56b - 44b - 24 - 4$

$= 12b - 28$

Here $12b$ is always multiple of 12 but 28 is not a multiple of 12

$\Rightarrow 12b - 28$ is not always a multiple of 12

Never True

13. When any number is divided by 3, possible remainders are 0, 1, 2.

So any number is number either of the form $3k$, $3k + 1$ or $3k + 2$ where k is any whole number.

Case-I All three numbers give remainder 0 *e.g.* 3, 6, 9

Case-II All three numbers give remainder 1 *e.g.* 4, 7, 10

Case-III All three numbers give remainder 2 *e.g.* 5, 8, 11

Case-IV The numbers give remainder 0, 1, 2 respectively e.g. 3, 4, 5

Case V Two numbers give remainder 1 and one give 2 *e.g.* 4, 7, 5

Case VI Two numbers give remainder 2 and one give 1 *e.g.* 5, 8, 4

Case VII One gives remainder 0 and two give 1 *e.g.* 3, 4, 7

Case VIII One give remainder 0 and two give 2 *e.g.* 3, 5, 8

14. Yes,

In any pair of consecutive integers, one integer must be even and other must be odd.

When an even number is multiplied by any other integer, the result is always even and its is divisible by 2.

Yes, the product of three consecutive integers is always a multiple of 6. Among three consecutive integers, at least one is a multiple of 2 and exactly one is a multiple of 3. So it must be a multiple of 6.

The product of 4 consecutive integers is always a multiple of 24. Among any four consecutive integers, at least two are even numbers one of which is a multiple of 4.

∴ Product is multiple of 8 and at least one is multiples of 3

Since, product contains factors of 8 and 3

$\Rightarrow$ It must be multiple of 24

(∵ LCM of 8 and 3 = 24)

The product of five consecutive integers is always a multiple of 120 respectively.

Among any five consecutive numbers, at least two are even numbers, one of which is a multiple of 4, at least one is a multiple of 3 and exactly one is a multiple of 5.

∴ Product is a multiple of $2 \times 3 \times 4 \times 5 = 120$

15. (i) EF × E = GGG

Since EF × E = GGG three digit no.

$\Rightarrow$ GGG should be multiple of 111

If GGG = 111

$\Rightarrow$ Then $111 = 37 \times 3$

Here, E = 3, F = 7 and G = 1

(ii) WOW × 5 = MEOW

We know when any digit is multiple by 5 then last digit of obtained number should be 0 or 5

∴ W = 0 or 5.

If W = 0 then MEOW ends with zero but WOW start with W so W cannot be zero

So, W = 0 is not possible

Thus, W = 5

Now, 505 × 5 = ME05

Possible values of 0 are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Since, W = 5 so $0 \neq 5$

If 0 = 0, $505 \times 5 = 2525$

0 = 1, $515 \times 5 = 2575$

0 = 2, $525 \times 5 = 2625$

0 = 3, $535 \times 5 = 2675$

0 = 4, $545 \times 5 = 2725$

0 = 6, $565 \times 5 = 2825$

0 = 7, $575 \times 5 = 2875$

0 = 8, $585 \times 5 = 2925$

0 = 9, $595 \times 5 = 2975$

Here, only 2 conditions are satisfied

i.e. $525 \times 5 = 2625$

$575 \times 5 = 2875$

∴ 0 can be 2 or 7

when $525 \times 5 = 2625$

comparing with WOW × 5 = MEOW, we get,

M = 0 = 2 which is not possible (Distinct letters)

when $575 \times 5 = 2875$

comparing with WOW × 5 = MEOW, we get,

M = 2, E = 8, 0 = 7, W = 5

Thus W = 5, 0 = 7, M = 2 and E = 8 give the solution of cryptarithms WOW × 5 = MEOW

16. (i) Since, $32 = 8 \times 4$

$\Rightarrow$ Any multiple of 32 is also a multiple of 8 and 4

Also, $8 = 4 \times 2$

So, the Venn diagram (iv) captures the relationship between the multiples of 4, 8 and 32.

Chapter Innings

A. Multiple Choice Questions

1. c **2.** d

3. a **4.** c

5. a

B. Fill in the Blank

1. 69 **2.** 36

3. 6 **4.** 8

5. 75

C. Match the following

Column I	Column II
1	d
2	c
3	a
4	e
5	b

D. True of False

1. False **2.** True

3. True **4.** False

5. False

E. Very Short Answer Type Questions

1. (a) Sum of the digits of

$$9061 = 9 + 0 + 6 + 1 = 16$$

Since sum of the digits is neither

divisible by 3 Nor by 9

So, 9061 is not divisible by 3 and 9.

(b) Sum of the digits in 5712

$= 5 + 7 + 1 + 2 = 15$

Since 12 is divisible by digit 3, but not divisible by 9 hence, Number 5712 is divisible by 3, but not divisible by 9.

2. We need two digit number AB when multiplied by other two digit number A7, we get a four digit number 211 B. Now $45 \times 47 = 2115$ satisfies all the required conditions. Thus A = 4 and B = 5

3. Total conscutive odd numbers = 7

middle number = 43

Since, Middle number 43 is at the fourth position in sequence of the odd numbers. So, three odd numbers are placed consequently to the left side and right side of 43 in the sequence.

Now, sequence is 37, 39, 41, 43, 45, 47, 49 containing 7 odd numbers.

Sum = 37 + 39 + 41 + 43 + 45 + 47

= 301

4. 8m + 5

5. digital root of 8 + 23

$= 8 + 7 + 2 + 3$

$= 20$

$= 2 + 0$

$= 2$

Thus, when 8723 is divided by 9. We get remainder 2.

F. Short Answer Type Questions

1. Sum of the digits of the number is

$3 + 1 + y + 5 = 9 + y$

If we replaced y by 0, 3, 6, 9 then sum will be divisible by 3 and the number will be a multiple by 3.

2. Given 8ab4b is an odd number divisible by 3 and 5

According to divisibility rule of 5, if a number has 0 or 5 in the unit place, then number will be divisible by 5

So b is 5.

Now sum of the digits

$= 8 + a + b + 4 + b$

but we have $b = 5$

Sum $= 8 + a + 5 + 4 + 5$

$= 22 + a$

if a is replaced by 2, then sum will be divisible 3 and given number will be divisible by 3 and y if $a = 2$ and $b = 5$

3.

	Number	Sum of digits	Conclusion
a	106	1 + 0 + 6 = 7	Not divisible by 3
b	726	7 + 2 + 6 = 15	divisible by 3
c	915	9 + 1 + 5 = 15	divisible by 3
d	1008	1 + 0 + 0 + 8 = 9	divisible by 3

4. Given number 981547 ends with unit digit 7 which yields remainder of 2 when divided by 5

Thus 2 is the remainder when 981547 is divided by 5.

5. Sum of the digits = $6 + 6 + 7 + 8 + 4 + y = 31 + y$

For the possible value of $y = 5$, sum of the digits will be divisible by 59

Thus answer $1s(y = 5)$

G. Long Answer Type Questions

1.

	Number	Reversed Number	New Number = given not Revenue No	Sum of digits in odd places	Sum of digits in even places	difference	Result
a	89	98	89 + 98 = 187	7 + 1 = 8	8	8 – 8 = 0	divisible by 11
b	$10a + b$	$10b + a$	$(10a + b) + (10b + a) = 11a + 11b$				divisible by 11
b	69	96	69 + 96 = 165	5 + 1 = 6	6	6 – 6 = 0	divisible by 11
c	54	45	54 + 45 = 99	9	9	9 – 9 = 0	divisible by 11

2.

SN.	Number	Reversed Number	Difference	Conclusion
a	59	95	$95 - 59 = 36$	divisible by 9
b	$10x + y$	$10y + x$	$(10y + x) - (10x + y)$ $= 9(y - x)$	divisible by 9
c	$100x + 10y + 2$	$100z + 10y + x$	$(100z + 10y + x) - (100x + 10y + z)$ $= 99z - 99x$ $= 99(z - x)$	divisible by 9
d	203	302	$302 - 203 = 99$	divisible by 9

3.
$$abc = 100\,a + 10\,b + c$$
$$cab = 100\,c + 10\,a + b$$
$$bca = 100\,b + 10\,c + a$$
$$\therefore abc + cab + bca = 111\,a + 111\,b + 111\,c$$
$$= 111\,(a + b + c)$$

or $3 \times 37\,(a + b + c)$ which is multiple of 37.

4.

SN.	Number	Sum of digits in odd places	Sum of digits in even places	Difference	Conclusion
a	5* 9397	10 + *	23	13 + *	y * is replaced by 2, Number is divisible by 11
b	635* 722	20	5 + *	15 + *	y * is replaced by 4, Number is divisible by 11

5. (a) Given statement is sometimes true. Example : Sum of 6 and 12 is not multiple of 12 where as sum of 12 and 24 is multiple of 12.

(b) Given statement is always true. Example : Product of three consecutive inteers 1, 2 and 3 is 6 which is divisible by 6.

(c) Given statement is always true Example : Number 1728 is multiple of 9, then 8271 is also a multiple of 9.

H. Assertion – Reason Based Question

1. D
2. D
3. A
4. B
5. A

I. Case Study

1. 0 = O, N = 5, E = 6, T = 1, W = 3
2. A = 1, B = 9, C = 10
3. A = 2, B = 5, C = 1
4. 18
5. 15

❑❑

6. We distribute, yet things multiply

Class Work 6.1

1.
$$(a + 1)\,(b + 1) = (b + 1)\,(a + 1)$$
$$= b(a + 1) + 1(a + 1)$$
$$= ab + b + a + 1$$

2. No, Product will nit always increase. Three examples where the product decrease are (3 and – 2), (– 9 and 4) and (– 2 and 4).

3. If a and b are neative then $(-a) \times (-b) = +ab$ $[(-) \times (-) = +]$ in this case, product is increased.

4. (a) Now, $(a - 2)\,(b + 3)$
$$= a(b + 3) - 2(b + 3)$$
$$= ab + 3a - 2b - 6$$

but product of a and b
$$= ab$$

∵ Chane in the product
$$= (ab + 3a - 2b - 6) - ab$$
$$= 3a - 2b - 6.$$

(b) Now, $(a-3)(b-4)$

$= a(b-4) - 3(b-4)$

$= ab - 4a - 3b + 12$

Product of numbers

$= ab$

Chane in the product

$= (ab - 4a - 3b + 12)$

$- ab$

$= -4a - 3b + 12$

NCERT Exercise 6.1

1. Given that,

Middle number of 3×3 frame is pq

$\therefore$ Row number $= p$

and column number $= q$

Now,

row number above $p = p - 1$

row number below $p = p + 1$,

Similarly, column number left of $q = q - 1$

Column number right of $q = q + 1$

The expressions for the other numbers in the grid

Top left $= (p-1)(q-1)$

Top middle $= (p-1)\,q$

Top right $= (p-1)(q+1)$

Middle left $= p(q-1)$

Middle right $= p(q+1)$

Bottom left $= (p+1)(q-1)$

Bottom middle $= (p+1)\,q$

Bottom right $= (p+1)(q+1)$.

2. (i) $(3+u)(v-3)$

$= 3(v-3) + u(v-3)$

$= 3v - 9 + uv - 3u$

$= 3v + uv - 3u - 9$.

(ii) $\frac{2}{3}(15 + 6a)$

$= \frac{2}{3}\times 15 + \frac{2}{3}\times 6a$

$= 10 + 4a$

(iii) $(10\,a + b)(10\,c + d)$

$= 10a\,(10\,c + d) + b(10\,c + d)$

$= 10\,a \times 10c + 10\,a \times d + b \times 10\,c + b \times d$

$= 100\,ac + 10\,ad + 10\,bc + bd$

(iv) $(3-x)(x-6)$

$= 3(x-6) - x(x-6)$

$= 3x - 18 - x^2 + 6x$

$= -x^2 + 9x - 18$

(v) $(-5a + b)(c + d)$

$= -5a(c+d) + b(c+d)$

$= -5ac - 5ad + bc + bd$

$= -5ac + bc - 5ad + bd$

(vi) $(5+z)(y+9) = 5(y+9) + z(y+9)$

$= 5y + 45 + yz\,9z$.

3. Let us assume that two numbers be x and y

$\therefore$ Product of two numbers

$= xy$

According to question,

$xy = (x+2)(y-4)$

$\Rightarrow xy = x(y-4) + 2(y-4)$

$\Rightarrow xy = xy - 4x + 2y - 8$

$\Rightarrow 4x - 2y + 8 = 0$

$\Rightarrow 2x - y + 4 = 0$

$\Rightarrow y = 2x + 4$

e.g. 1. Assuming $x = 1$

Putting $x = 1$

In $y = 2x + 4$,

We get $y = 2 \times 1 + 4 = 6$

$\therefore$ Original Product $= xy = 1 \times 6 = 6$

New numbers are $(x+2)$ and $(y-4)$

i.e., $(1+2)$ and $(6-4)$

i.e., 3 and 2

$\therefore$ New Product $= 3 \times 2 = 6$

$\therefore$ The product remains unchanged.

e.g. 2. Assuming $x = 2$

Putting $x = 2$ in $y = 2x + 4$, we get

$y = 2 \times 2 + 4 = 8$

$\therefore$ Original Product $= xy = 2 \times 8 = 16$

New Product $= (x+2)(y-4)$

$= (2+2)(8-4)$

$= 4 \times 4 = 16$

$\therefore$ Product unchanged.

e.g. **3.** Assuming $x = 3$

Putting $x = 3$

in $y = 2x + 4$, we get

$y = 2 \times 3 + 4 = 10$

$\therefore$ Original Product $= xy = 3 \times 10 = 30$

New Product $= (x + 2)(y - 4)$

$= (3 + 2)(10 - 4)$

$= 5 \times 6$

$= 30$ (Unchanged).

4. (i) $(a + ab - 3b^2)(4 + b)$

$= (a + ab - 3b^2)(4) + (a + ab - 3b^2)(b)$

$= 4a + 4ab - 12b^2 + ab + ab^2 - 3b^3$

$= -3b^3 - 12b^2 + ab^2 + 5ab + 4a$

(ii) $(4y + 7)(y + 11z - 3)$

$= 4y(y + 11z - 3) + 7(y + 11z - 3)$

$= 4y^2 + 44y^2 - 12y + 7y + 77z - 21$

$= 4y^2 + 44yz - 5y + 77z - 21.$

5. (i) $(a - b)(a + b)$

$= a(a + b) - b(a + b)$

$= a^2 + ab - ab - b^2$

$= a^2 - b^2$

(ii) $(a - b)(a^2 + ab + b^2)$

$= a(a^2 + ab + b^2) - b(a^2 + ab + b^2)$

$= a^3 + a^2b + ab^2 - ba^2 - ab^2 - b^3$

$= a^3 - b^3$

(iii) $(a - b)(a^3 + a^2b + ab^2 + b^3)$

$= a(a^3 + a^2b + ab^2 + b^3) - b(a^3 + a^2b + ab^2 + b^3)$

$= a^4 + a^3b + a^2b^2 + ab^3 - ba^3 - a^2b^2 - ab^3 - b^4$

$= a^4 - b^4$

From above, bee see a pattern According to this Pattern,

for an integer $n \geq 2$

$(a - b)(a^n + a^{n-1}b + \ldots + ab^{n-1} + b^n)$

$= a^{n+1} - b^{n+1}$

Following this Pattern, the next identity would be for $n = 4$.

$\therefore (a - b)(a^4 + a^3b + a^2b^2 + ab^3 + b^4) = a^5 - b^5$

Check:

L.H.S.$= (a - b)(a^4 + a^3b + a^2b^3 + ab^3 + b^4)$

$= a(a^4 + a^3b + a^2b^2 + ab^3 + b^4) - b(a^4 + a^3b + a^2b^2 + ab^3 + b^4)$

$= a^5 + a^4b + a^3b^2 + a^2b^3 + ab^4 - a^4b - a^3b^2 - a^2b^3 - ab^4 - b^5$

$= a^5 - b^5$

$=$ R.H.S. **Hence Proved.**

Practice Exercise 6.1

1. (a) $7x^3 \times (-5x) = (7x - 5) \times x^3 \times x$

$= -35\, x^{3+1}$

$= -35\, x^4$

(b) $6x \times 0 = 0$

(c) $\dfrac{50}{5}\ p^2\ q \times \dfrac{3}{4}\ pq^2 \times 5\ pqr =$

$\left(\dfrac{\cancel{1}}{\cancel{3}} \times \dfrac{\cancel{3}}{\cancel{4}} \times 5\right) \times p^2 \times p \times p \times q * q^2 \times q \times r$

$= \dfrac{-5}{2}\ p^{2+1+1}\ q^{1+2+1}\ r$

$= \dfrac{-5}{2}\ p^4\ q^4\ r$

(d) $\left(\dfrac{-1}{2}x^2\right) \times \left(\dfrac{-3}{5}xy\right) \times \dfrac{2}{3}yzx \times \dfrac{5}{7}xyz$

$= \left(\dfrac{-1}{\cancel{2}} \times \dfrac{-\cancel{3}}{\cancel{5}} \times \dfrac{\cancel{2}}{\cancel{3}} \times \dfrac{\cancel{5}}{7}\right) \times x^2 \times x \times x \times y \times y \times y \times z \times z$

$= \dfrac{+1}{7}\ x^{2+1+1}\ y^{1+1+1}\ z^{1+1}$

$= \dfrac{+1}{7}\ x^4\ y^3\ z^2.$

2. (a) $(5x + 7)(3x + 4)$

$= 5x(3x + 4) + 7(3x + 4)$

$= 15x^2 + 20x + 21x + 28$

$= 15x^2 + 41x + 28$

(b) $(4x + 9)(x - 6)$

$= 4x(x - 6) + 9(x - 6)$

$= 4x^2 - 24x + 9x - 54$

$= 4x^2 - 15x - 54$

(c) $(2x + 5)(4x - 3)$

$= 2x(4x - 3) + 5(4x - 3)$

$= 8x^2 - 6x + 20x - 15$

$= 8x^2 + 14x - 15$

(d) $(3y - 8)(5y - 1)$

$= 3y(5y - 1) - 8(5y - 1)$

$= 15y^2 - 3y - 40y + 8$

$= 15y^2 - 43y + 8$

(e) $(7x + 2y)(x + 4y)$

$= 7x(x + 4y) + 2y(x + 4y)$

$= 7x^2 + 28xy + 2xy + 8y^2$

$= 7x^2 + 30xy + 8y^2$

(f) $(9x + 5y)(4x + 3y)$

$= 9x(4x + 3y) + 5y(4x + 3y)$

$= 36x^2 + 27xy + 20xy + 15y^2$

$= 36x^2 + 47xy + 15y^2$

3. (a) $(x^2 - 3x + 7)(2x + 3)$

$= 2x(x^2 - 3x + 7) + 3(x^2 - 3x + 7)$

$= 2x^3 - 6x^2 + 14x + 3x^2 - 9x + 21$

$= 2x^3 - 6x^2 + 3x^2 + 14x - 9x + 21$

$= 2x^3 - 3x^2 + 5x + 21$

(b) $(3x^2 + 5x - 9)(3x - 5)$

$= 3x(3x^2 + 5x - 9) - 5(3x^2 + 5x - 9)$

$= 9x^3 + 15x^2 - 27x - 15x^2 - 25x + 45$

$= 9x^3 + 15x^2 - 15x^2 - 27x - 25x + 45$

$= 9x^3 - 52x + 45$

(c) $(x^2 - 5x + 8)(x^2 + 2)$

$= x^2(x^2 - 5x + 8) + 2(x^2 - 5x + 8)$

$= x^4 - 5x^3 + 8x^2 + 2x^2 - 10x + 16$

$= x^4 - 5x^3 + 10x^2 - 10x + 16$

(d) $(x^3 - 5x^2 + 3x + 1)(x^2 - 3)$

$= x^2(x^3 - 5x^2 + 3x + 1) - 3(x^3 - 5x^2 + 3x + 1)$

$= x^5 - 5x^4 + 3x^3 + x^2 - 3x^3 + 15x^2 - 9x - 3$

$= x^5 - 5x^4 + 3x^3 - 3x^3 + x^2 + 15x^2 - 9x - 3$

$= x^5 - 5x^4 + 16x^2 - 9x - 3.$

4. (a) $3x(4x - 5) + 3 = 12x^2 - 15x + 3$

For, $x = 3$, we have

$12x^2 - 15x + 3$

$= 12(3)^2 - 15 \times 3 + 3$

$= 108 - 45 + 3$

$= 63 + 3$

$= 66$

(b) $x^3(3 - 2x + x^2)$

$= 3x^3 - 2x^4 + x^5$

For, $x = 1$, we have

$3x^3 - 2x^4 + x^5 = 3(1)^3 - 2(1)^4 + (1)^5$

$= 3 - 2 + 1$

$= 2$

For, $x = -1$, we have

$3x^3 - 2x^4 + x^5$

$= 3(\ 1)^3 - 2(-1)^4 + (-1)^5$

$= -3 - 2 - 1$

$= -6$

For, $x = \dfrac{2}{3}$ we have

$3x^3 - 2x^4 + x^5$

$$= 3\times\frac{8}{27} - 2\times\frac{16}{81} + \frac{1}{32}$$

$$= 3\left(\frac{2}{3}\right)^3 - 2\left(\frac{2}{3}\right)^4 + \left(\frac{1}{2}\right)^5$$

$$= 3\times\frac{8}{27} - 2\times\frac{16}{81} + \frac{1}{32}$$

$$= \frac{24}{27} - \frac{32}{81} + \frac{1}{32}$$

$$= \frac{8}{9} - \frac{32}{81} + \frac{1}{32}$$

$$= \frac{2304 - 1024 + 81}{2592}$$

$$= \frac{1361}{2592}$$

For, $x = \dfrac{-1}{2}$, we have

$3x^3 - 2x^4 + x^5 =$

$$3\left(-\frac{1}{2}\right)^3 - 2\left(\frac{-1}{2}\right)^4 + \left(\frac{-1}{2}\right)^5$$

$$= 3\times\frac{-1}{8} - 2\times\frac{1}{16} - \frac{1}{32}$$

$$= \frac{-3}{8} - \frac{1}{8} - \frac{1}{32}$$

$$= -\frac{4}{8} - \frac{1}{32}$$

$$= \frac{-1}{2} - \frac{1}{32}$$

$= \frac{-16-1}{32}$

$= \frac{-17}{32}$

Class Work 6.2

1. (a) $94 \times 11 = 94 \times (10 - 1)$
$= 940 + 94$
$= 1034$

(b) $495 \times 11 = 495 \times (10 + 1)$
$= 4950 + 495$
$= 5445$

(c) $3279 \times 11 = 3279 \times (10 + 1)$
$= 32790 + 3279$
$= 36069$

(d) $4791256 \times 11 = 4791256 \times (10 + 1)$
$= 47912560 + 4791256$
$= 52703816$

2. $3874 \times 101 = 3874 \times (100 + 1)$
$= 387400 + 3874$
$= 391274$

3. (a) $89 \times 101 = 89 \times (100 + 1)$
$= 8900 + 89$
$= 8989$

(b) $949 \times 101 = 949 \times (100 + 1)$
$= 94900 + 949$
$= 95849$

(c) 265831×1001
$= 265831 \times (1000 + 1)$
$= 265831000 + 265831$
$= 266, 096, 831$

(d) $1111 \times 1001 = 1111 \times (1000 + 1)$
$= 1111\ 000 + 1111$
$= 1, 12, 111$

(e) $9734 \times 99 = 9734 \times (100 - 1)$
$= 973400 - 9734$
$= 963, 666$

(f) $23478 \times 999 = 23478 \times (1000 - 1)$
$= 23478000 - 23478$
$= 23, 454, 522.$

Class Work 6.3

1. If we write 65^2 as $(30 + 35)^2$

We know that

$(a + b)^2 = a^2 + 2ab + b^2$

$65^2 = (30 + 35)^2$
$= (30)^2 + 2 \times 30 \times 35 + (35)^2$
$= 900 + 2100 + 1225$
$= 4225$

Fig.

area $= 30^2 + 35 \times 30 + 30 \times 35 + 35^2$
$= 900 + 1050 + 1050 + 1225$
$= 900 + 2100 + 1225$
$= 4225$

and if we write 65^2 as $(52 + 13)^2$

$65^2 = (52 + 13)^2$
$= (52)^2 + 2 \times 52 \times 13 + (13)^2$
$= 2704 + 1352 + 169$
$= 4225$

Fig.

area $= 52^2 + 13 \times 52 + 52 \times 13 + 13^2$
$= 2704 + 676 + 676 + 169$
$= 4225$

Fig.

We get same result in both condition.

2. $104^2 = (100 + 4)^2$

We know that

$(a + b)^2 = a^2 + 2ab + b^2$

$104^2 = (100 + 4)^2$
$= (100)^2 + 2 \times 100 \times 4 + (4)^2$
$= 10,000 + 800 + 16$
$= 10816$

and $37^2 = (30 + 7)^2$
$= (30)^2 + 2 \times 30 \times 7 + (7)^2$
$= 900 + 420 + 49$
$= 1369.$

3. (a) $(m + 3)^2 = m^2 + 2 \times m \times 3 + 3^2$
$[\because (a + b)^2 = a^2 + 2ab + b^2]$
$= m^2 + 6m + 9$

(b) $(6 + p)^2 = 6^2 + 2 \times 6 \times p + (p)^2$
$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= 36 + 12p + p^2.$

4. We know that

$(a + b)^2 = a^2 + 2ab + b^2$

$(3j + 2k)^2 = (3j)^2 + 2 \times 3j \times 2k + (2k)^2$

$= 9j^2 + 12jk + 4k^2$

and $(3j + 2k)^2 = (3j + 2k) \times (3j + 2k)$

Using distributive property,

$a \times (b + c) = a \times b + a \times c$

$= 3j \times (3j + 2k) + 2k \times (3j + 2k)$

$= 9j^2 + 6jk + 6jk + 4k^2$

$= 9j^2 + 12jk + 4k^2$

we find that result is same in both condition.

5. We know that $(a - b)^2 = a^2 - 2ab + b^2$

(a) $99^2 = (100 - 1)^2$

$= (100)^2 - 2 \times 100 \times 1 + (1)^2$

$= 10,000 - 200 + 1$

$= 9801.$

(b) $58^2 = (60 - 2)^2$

$= (60)^2 - 2 \times 60 \times 2 + (2)^2$

$= 3600 - 240 + 4$

$= 3364$

6. (a) We know,

$(a - b)^2 = a^2 - 2ab + b^2$

$(b - 6)^2 = (b)^2 - 2 \times 5 \times 6 + (6)^2$

$= b^2 - 12b + 36$

(b) $(-2a + 3)^2 = (-2a)^2 + 2 \times (-2a) \times 3 + (3)^2$

$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= 4a^2 - 12a + 9$

(c) $\left(7y - \dfrac{3}{4z}\right)^2$

$$= (7y)^2 - \cancel{2} \times 7y \times \frac{3}{\cancel{4}z} + \left(\frac{3}{4z}\right)^2$$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$$= 49y^2 - \frac{21}{2}\frac{y}{z} + \frac{9}{16z^2}$$

Thus $\left(7y - \dfrac{3}{4z}\right)^2$

$$= 49y^2 - \frac{21}{2}\frac{y}{z} + \frac{9}{16z^2}$$

NCERT Exercise 6.2

1. Given that

$(a - b)^2$ and $(b - a)^2$

$(a - b)^2 = a^2 - 2ab + b^2$

$(b - a)^2 = b^2 - 2ab + b^2$

$(a - b)^2 = (b - a)^2$

both are equal.

2. Let x and y be two numbers then difference of their squares

$= x^2 - y^2 = 100$

$\Rightarrow (x - y)(x + y) = 100$

$[\because (a - b)(a + b) = a^2 - b^2]$

We can write as

$(x - y)(x + y) = 2 \times 50$

$x - y = 2$ ...(i)

$x + y = 50$ ...(ii)

Adding there two equations, we get

$2x = 52$

$$\Rightarrow x = \frac{52}{2} = 26$$

From equation (i)

$x - y = 2$

$26 - y = 2$

$26 - 2 = y$

$\Rightarrow y = 24$

$\therefore 100 = 26^2 - 24^2.$

3. $406^2 = (400 + 6)^2$

$= (400)^2 + 2(400)(6) + (6)^2$

$[\because (a + b)^2 = a^2 + b^2 + 2ab]$

$= 160000 + 4800 + 36$

$= 164836$

$72^2 = (70 + 2)^2$

$= (70)^2 + 2(70)(2) + (2)^2$

$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= 4900 + 280 + 4$

$= 5184$

$$145^2 = (140 + 5)^2$$
$$= (140)^2 + 2(140)(5) + (5)^2$$
$$[\because (a + b)^2 = a^2 + 2ab + b^2]$$
$$= 19600 + 1400 + 25$$
$$= 21025$$
$$1097^2 = (1100 - 3)^2$$
$$= (1100)^2 - 2(1100)(3) + (3)^2$$
$$[\because (a - b)^2 = a^2 - 2ab + b^2]$$
$$= 1210000 - 6600 + 9$$
$$= 1203409$$
$$124^2 = (120 + 4)^2$$
$$= (120)^2 + 2(120)(4) + (4)^2$$
$$[\because (a + b)^2 = a^2 + 2ab + b^2]$$
$$= 14400 + 960 + 16$$
$$= 15376$$

4. Pattern 1 : $2(a^2 + b^2) = (a + b)^2 + (a - b)^2$ **...(1)**

Pattern 2 : $(a + b) \times (a - b)$
$= a^2 - b^2$ **...(2)**

Let us assume that $a = 1$ and $b = -2$ are two integers then

Pattern 1 : $2[1^2 + (-2)^2]$
$$= (1 - 2)^2 + [1 - (-2)]^2$$
$$2(1 + 4) = (-1)^2 + (1 + 2)^2$$
$$10 = 1 + 9$$
$$10 = 10,$$

Which is true for negative integers.

Pattern 2 : $[1 + (-2)] \times [1 - (-2)]$
$$= (1)^2 - (-2)^2$$
$$(-1)(3) = 1 - 4$$
$$-3 = -3,$$

Which is true for negative integers also.

Again,

For Fractions

Let us assume that $a = \frac{1}{3}$ and $b = \frac{1}{2}$:

Pattern 1 : $2(a^2 + b^2) = (a + b)^2 + (a - b)^2$

On substituting values of a and b, we get

$$2\left(\left(\frac{1}{3}\right)^2 + \left(\frac{1}{2}\right)^2\right) = \left[\frac{1}{3} + \frac{1}{2}\right]^2 + \left[\frac{1}{3} - \frac{1}{2}\right]^2$$

$$\Rightarrow 2\left[\frac{1}{9} + \frac{1}{4}\right] = \left[\frac{2+3}{6}\right]^2 + \left[\frac{2-3}{6}\right]^2$$

$$\Rightarrow 2\left[\frac{4+9}{36}\right] = \left(\frac{5}{6}\right)^2 + \left(-\frac{1}{6}\right)^2$$

$$\Rightarrow 2\times\frac{13}{36} = \frac{25}{36} + \frac{1}{36}$$

$$\Rightarrow \frac{26}{36} = \frac{26}{36},$$

Which is true.

Pattern 2 : $(a + b) \times (a - b) = a^2 - b^2$

On substituting values of a and b, we get

$$\left(\frac{1}{3} + \frac{1}{2}\right)\left(\frac{1}{3} - \frac{1}{2}\right) = \left(\frac{1}{3}\right)^2 - \left(\frac{1}{2}\right)^2$$

$$\left(\frac{2-3}{6}\right)\left(\frac{2-3}{6}\right) = \frac{1}{9} - \frac{1}{4}$$

$$\Rightarrow \left(\frac{5}{6}\right)\left(\frac{-1}{6}\right) = \frac{4-9}{36}$$

$$\Rightarrow \frac{-5}{36} = \frac{-5}{36},$$

Which is true.

Thus the Patterns 1 and 2 holds for negative integers as well as fractions.

5. We have, $98 \times 102 = (100 - 2) \times (100 + 2)$
$= (100)^2 = (2)^2$
$$[\because (a - b)(a + b) = a^2 - b^2]$$
$= 10000 - 4 = 9996$

and $45 \times 55 = (50 - 5)(50 + 5)$
$$= (50)^2 - (5)^2$$
$$[\because (a - b)(a + b) = a^2 - b^2]$$
$$= 2500 - 25 = 2475$$

Practice Exercise 6.2

1. (a) $(a^2 + b^2)^2$
$$= (a^2)^2 + 2 \times a^2 \times b^2 + (b^2)^2$$
$$[\because (a + b)^2 = a^2 + 2ab + b^2]$$

$= a^4 + 2a^2 b^2 + b^4$

(b) $(xy + 2z)^2$

$= (xy)^2 + 2 \times xy \times 2z + (2z)^2$

$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= x^2y^2 + 4xyz + 4z^2.$

(c) $(a^2 - b^2)^2$

$= (a^2)^2 - 2 \times a^2 \times b^2 + (b^2)^2$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$= a^4 - 2a^2 b^2 + b^4$

(d) $(4x - 5)^2$

$= (4x)^2 - 2 \times 4x \times 5 + (5)^2$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$= 16x^2 - 40x + 25$

(e) $(7x - 4)^2$

$= (7x)^2 - 2 \times 7x \times 4 + (4)^2$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$= 49x^2 - 56x + 16$

(f) $(4l + 5m)^2$

$= (4l)^2 + 2 \times 4l \times 5m + (5m)^2$

$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= 16l^2 + 40lm + 25\, m^2.$

2. (a) $(x + 5)\,(x + 5) = (x + 5)^2$

$= (x)^2 + 2 \times x \times 5 + (5)^2$

$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= x^2 + 10x + 25$

(b) $(3x - 7)\,(3x - 7) = (3x - 7)^2$

$= (3x)^2 - 2 \times 3x \times 7 - (7)^2$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$= 9x^2 - 42x + 49.$

(c) $(a - c)\,.\,(- a + c)$

$= (a - c)\,[- 1\,(a - c)]$

$= - (a - c)\,.\,(a - c)$

$= - (a - c)^2$

$= - [(a)^2 - 2 \times a \times c + (c)^2]$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$= - (a^2 - 2ac + c^2)$

$= - a^2 + 2ac - c^2$

(d) $\left(2a \frac{-1}{2}\right)\left(2a + \frac{1}{2}\right)$

$= (2a)^2 - \left(\frac{1}{2}\right)^2$

$[\because (a - b)\,(a + b) = a^2 - b^2]$

$= 4a^2 - \frac{1}{4}$

(e) $\left(\frac{2}{3}m + \frac{3}{2}n\right)\left(\frac{2}{3}m - \frac{3}{2}n\right)$

$= \left(\frac{2}{3}m\right)^2 - \left(\frac{3}{2}n\right)^2$

$[(a + b)\,(a - b) = a^2 - b^2]$

$= \frac{4}{9}m^2 - \frac{9}{4}n^2$

(f) $(2x + 5y)\,(2x - 5y)$

$= (2x)^2 - (5y)^2$

$[(a + b)\,(a - b) = a^2 - b^2]$

$= 4x^2 - 25y^2.$

3. (a) sima $(2x - 1)^2$

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

$[(a - b)^2 = a^2 - 2ab + b^2]$

$= 4x^2 - 4x + 1$

and $(x - 1)^2 = x^2 - 2 \times x + 1 + (1)^2$

$= x^2 - 2x + 1$

$(2x - 1)^2 - (x - 1)^2$

$= (4x^2 - 4x + 1) - (x^2 - 2x + 1)$

$= 4x^2 - x^2 - 4x + 2x + 1 - x$

$= 3x^2 - 2x$

(b) $(7 + 5x)\,(7 + 5x)$

$= (7 + 5x)^2$

$= (7)^2 + (5x)^2 + 2 \times 7 \times 5x$

$[(a + b)^2 = a^2 + 2ab + b^2]$

$= 49 + 25x^2 + 70x$

and $(2x - 3)\,(2x - 3)$

$= (2x - 3)^2$

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

$[(a - b)^2 = a^2 - 2ab + b^2]$

$= 4x^2 - 12x + 9$

$(7 + 5x)\,(7 + 5x) - (2x - 3)\,(2x - 3)$

$= (49 + 25x^2 + 70x) - (4x^2 - 12x + 9)$

$= 25x^2 - 4x^2 + 70x + 12x + 49 - 9$

$= 21x^2 + 82x + 40$

(c) $(6x + 3)(6x - 3)$

$= (6x)^2 - (3)^2$

$[(a + b)(a - b) = a^2 - b^2]$

$= 36x^2 - 9$

(d) $(2m - 3n)(2m + 3n) + (2m + 3n)^2$

$(2m - 3n)(2m + 3n)$

$= (2m)^2 - (3n)^2$

$[\because (a + b)(a - b) = a^2 - b^2]$

and $(2m + 3n)^2$

$= (2m)^2 + 2 \times 2m \times 3n + (3n)^2$

$[\because (a + b)^2 = a^2 + 2ab + b^2]$

$= 4m^2 + 12mn + 9n^2$

Now $(2m - 3n)(2m + 3n) + (2m + 3n)^2$

$= (4m^2 - 9n^2) + (4m^2 + 12mn + 9n^2)$

$= 4m^2 + 4m^2 - 9n^2 + 9n^2 + 12mn$

$= 8m^2 + 12mn$

(e) $(4a + 5b)(4a + 7b)$

$= 4a(4a + 7b) + 5b(4a + 7b)$

$= 16a^2 + 28ab + 20ab + 35b^2$

$= 16a^2 + 48ab + 35b^2$

and $(3a + 4b)(3a + 6b)$

$= 3a(3a + 6b) + 4b(3a + 6b)$

$= 9a^2 + 18ab + 12ab + 24b^2$

$= 9a^2 + 30ab + 24b^2$

Now, $(4a + 5b)(4a + 5b) - (3a + 5b)(3a + 6b)$

$= (16a^2 + 48ab + 35b^2) - 9a^2 + 30ab + 24b^2)$

$= 16a^2 - 9a^2 + 48ab - 30ab + 35b^2 - 24b^2$

$= 7a^2 + 18ab + 11b^2$

4. We have, $x + \frac{1}{x} = 5$

Squaring both side,

$$\left(x + \frac{1}{x}\right)^2 = 52$$

Using identity

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 \times x \times \frac{1}{x} = 25$$

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 25$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 25 - 2$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 23$$

again squaring

$$\left(x^2 + \frac{1}{x^2}\right)^2 = 232$$

$$\Rightarrow x^4 + \frac{1}{x^4} + 2 \times \cancel{x}^2 \times \frac{1}{\cancel{x}^2} = 529$$

$$\Rightarrow x^4 + \frac{1}{x^4} + 2 = 529$$

$$\Rightarrow x^4 + \frac{1}{x^4} = 529 - 2$$

$$\Rightarrow x^4 + \frac{1}{x^4} = 527$$

5. We have, $x - \frac{1}{x} = 3$

Squarin both side

$$\left(x - \frac{1}{x}\right)^2 = 3^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} - 2 \times x \times \frac{1}{x} = 9$$

$$\Rightarrow x^2 + \frac{1}{x^2} - 2 = 9$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 9 + 2$$

$$\Rightarrow \boxed{x^2 + \frac{1}{x^2} = 11}$$

again squarin, we get

$$\left(x^2 + \frac{1}{x^2}\right)^2 = 11^2$$

$\Rightarrow x^4+\frac{1}{x^4}+2\times x^2\times\frac{1}{x^2} = 121$

$\Rightarrow x^4+\frac{1}{x^4}+2 = 121$

$\Rightarrow x^4+\frac{1}{x^4} = 121-2$

$\Rightarrow x^4+\frac{1}{x^4} = 119$

6. $\therefore$ We have $a^2 + b^2 = 100$ and $ab = 48$

$(a+b)^2 = a^2 + 2ab + b^2$

$\Rightarrow (a+b)^2 = 100 + 2 \times 48$

$\Rightarrow (a+b)^2 = 196$

$\Rightarrow (a+b) = \sqrt{196}$

$\Rightarrow \boxed{a^2+b^2=14}$.

7. We have $a + b = 9$ and $ab = 4$

$\because a + b = 9$

Thus $(a+b)^2 = 9^2$

$\Rightarrow a^2 + b^2 + 2ab = 81$

$\Rightarrow a^2 + b^2 + 2 \times 4 = 81$ $[\because ab = 4]$

$\Rightarrow a^2 + b^2 + 8 = 81$

$\Rightarrow a^2 + b^2 = 81 - 8$

$\Rightarrow \boxed{a^2+b^2=73}$.

8. (a) $(81)^2 = (80 + 1)^2$

$= (80)^2 + 2 \times 80 \times 1 + (1)^2$

$[(a+b)^2 = a^2 + 2ab + b^2]$

$= 6400 + 160 + 1$

$= 6561.$

(b) $198^2 = (200 - 2)^2$

$= (200)^2 - 2 \times 200 \times 2 + (2)^2$

$[(a-b)^2 = a^2 - 2ab + b^2]$

$= 40000 - 800 + 4$

$= 39204.$

(c) $(7.25)^2 - (2.75)^2$

Using $a^2 - b^2 = (a-b)(a+b)$

$(7.25)^2 - (2.75)^2$

$= (7.25 + 2.75)(7.25 - 2.75)$

$= 10 \times 4.5$

$= 45.$

(d) $(5.6)^2 - (4.4)^2$

Using $(a^2 - b^2)$

$= (a-b)(a+b)$

$(5.6)^2 - (4.4)^2 = (5.6 + 4.4)(5.6 - 4.4)$

$= 10 \times 1.2$

$= 12.$

10. $\because \frac{36\times36-24\times24}{60} = \frac{36^2-24^2}{60}$

(a) Using identity $a^2 - b^2 = (a-b)(a+b)$

$\frac{36^2-24^2}{60} = \frac{(36-24)(36+24)}{60}$

$= \frac{12\times\cancel{60}}{\cancel{60}} = 12.$

(b) $\frac{(89)^2-(11)^2}{156}$

Using identity $a^2 - b^2 = (a-b)(a+b)$

$\frac{(89)^2-(11)^2}{156} = \frac{(89+11)(89-11)}{156}$

$= \frac{100\times\cancel{78}}{\cancel{156}}$

$= \frac{100}{2}$

$= 50.$

Maths Talk

Page-122

The expression is $(n + 2)^2 - n^2$

Maths Talk

Page-123

Area of whole rectangle

$= l \times b = p \times s$

Length of dashotregion

$= s - r$ and

The breadth of dastiregion

$= p - r$

$\because$ area $= (S - r)(p - r)$

$= S(p - r) - r(p - r)$

$= SP - Sr - Pr + r^2$

Thus area of dash region is $Sp - Sr - Pr + r^2$

We have, $p = 6,$

$r = 3.5$

and $5 = 9$

then area of region

$= 9 \times 6 - 9 \times 3.5 - 6 \times 3.5 + 3.5 \times 3.5$

$= 54 - 31.5 - 21 + 12.25$

$= 13.75$ sq. unit.

NCERT Exercise 6.3

1. (i) **Identity 1 A**

$(a + b)^2 = a^2 + 2ab + b^2$

$\therefore \quad 46^2 = (40 + 6)^2$

$= (40)^2 + 2(40)(6) + (6)^2$

$= 1600 + 480 + 36$

$= 2116$

(ii) **Identity 1 C**

$(a + b)(a - b) = a^2 - b^2$

$\therefore \ 397 \times 403 = (400 - 3)(400 + 3)$

$= (400)^2 - (3)^2$

$= 160000 - 9$

$= 159991$

(iii) **Identity 1 B**

$(a - b)^2 = a^2 - 2ab + b^2$

$\therefore \quad 91^2 = (100 - 9)^2$

$= (100)^2 - 2(100)(9) + (9)^2$

$= 10000 - 1800 + 81$

$= 10081 - 1800$

$= 8281.$

(iv) **Identity 1 C**

$(a + b)(a - b) = a^2 - b^2$

$\therefore \quad 43 \times 45 = (44 - 1)(44 + 1)$

$= (44)^2 - (1)^2$

$= 1936 - 1$

$= 1935.$

2. (i) Given, $(p - 1)(p + 1) = (p)^2 - (1)^2$, [Using identity]

$= p^2 - 1$

(ii) $(3a - 9b)(3a + 9b) = (3a)^2 - (9b)^2$

[Using identity, $(a + b)(a - b) = a^2 - b^2$]

$= 9a^2 - 81b^2$

(iii) $-(2y + 5)(3y + 4)$

$= -2y(3y + 4) - 5(3y + 4)$

(By distributive law)

$= -6y^2 - 8y - 15y - 20$

$= -6y^2 - 23y - 20$

(iv) $(6x + 5y)^2$

$= (6x)^2 + 2(6x)(5y) + (5y)^2$

[Using identity $(a + b)^2 = a^2 + 2ab + b^2$]

$= 36x^2 + 60xy + 25y^2$

(v) $\left(2x - \frac{1}{2}\right)^2 = (2x)^2 - 2(2x)\left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)^2$

[Using identity $(a - b)^2 = a^2 - 2ab + b^2$]

$= 4x^2 - 2x + \frac{1}{4}$

(vi) $(7p) \times (3r) \times (p + 2)$

$= 7 \times 3 \times pr \times (p + 2)$

$= 21\, pr\,(p + 2)$

$= 21\, p^2r + 42pr.$

3. (i) Let number be 5 then it square 5^2.

Two more than a square number

i.e., $s^2 = s^2 + 2$

Hence, $s^2 + 2$

(ii) Let one number be m then its consecutive number be $m + 1$.

Their squares are m^2 and $(m + 1)^2$.

The sum of the squares of two consecutive numbers

$= m^2 + (m + 1)^2$

Hence, $m^2 + (m + 1)^2$

4. In the given figure of calender, Let us consider first number of 2 × 2 square (left) be a then number in 2 by 2 square is

a	$a + 1$
$a + 7$	$a + 8$

Product of diagonal= $a \times (a + 8) = a^2 + 8a$

and Product of other diagonal

$= (a + 7) \times (a + 1)$

$= a^2 + a + 7a + 7$

$= a^2 + 8a + 7$

There are two products of diagonal always differ by 7 due to fixed structure of calender this pattern occurs.

5. (i) $(k + 1)(k + 2) - (k + 3)$

$\Rightarrow k(k + 2) + 1\ (k + 2) - (k + 3)$

$\Rightarrow k^2 + 2k + k + 2 - k - 3$

$\Rightarrow k^2 + 2k - 1$

If $k = 0$,

then $k^2 + 2k - 1 = 0 + 0 - 1 = -1$

If $k = 1$,

then $k^2 + 2k - 1 = 1^2 + 2 \times 1 - 1$

$= 2$

If $k = 2$,

then $k^2 + 2k - 1 = 2^2 + 2 \times 2 - 1$

$= 4 + 4 - 1 = 7$

It means, Expression is not always equal to 2. **False**

(ii) $(2q + 1)(2q - 3)$

$= 2q(2q - 3) + 1(2q - 3)$

$= 4q^2 - 6q + 2q - 3$

$= 4q^2 - 4q - 3$

$= 4q^2 - 4q - 3 - 4 + 4$

(add and Subtract 4)

$= 4q^2 - 4q - 4 + 1$

$= \dfrac{4(q^2 - q - 1)}{\text{multiple of 4}}$

$\therefore$ Given Statement is **False**.

(iii) Let even number be $2n$ and is square

be $(2n)^2 = \dfrac{4n^2}{\text{multiples of 4}}$

Let $2n + 1$ be odd number

Then square of $2n + 1$

$= (2n + 1)^2$

$= (2n)^2 + 2 \times 2n \times 1 + (1)^2$

$= 4n^2 + 4n + 1$

$= \dfrac{4n(n+1)}{\text{always even}} + 1$

Let $n(n + 1) = 2s$, when s is any integer

Then $4n(n + 1) + 1 = 4 \times 2s + 1$

$= 8s + 1$ **True**

(iv) $(6n + 2)^2 - (4n + 3)^2$

$= (6n)^2 + 2 \times 6n \times 2 + (2)^2 - [(4n)^2 + 2 \times 4n \times 3 + (3)^2]$

$= 36n^2 + 24n + 4 - (16n^2 + 24n + 9)$

$= 20n^2 - 5 = 5(4n^2 - 1)$

False

6. Let first number be x and p any whole number According to the question,

$x = 7p + 3$

Let second number be y and q any whole number According to the question,

$y = 7q + 5$

Their **Sum** $= x + y$

$= (7p + 3) + (7q + 5)$

$= 7p + 3 + 7q + 5$

$= 7p + 7q + 7 + 1$

$= 7(p + q + 1) + 1$

When sum is divided by 7, Remainder is 1.

Their **Difference** $= x - y$

$= (7p + 3) - (7q + 5)$

$= 7p + 3 - 7q - 5$

$= 7p - 7q - 2$

$= 7p - 7q - 7 + 7 - 2$

(add and Subtract 7)

$= 7(p - q - 1) + 5$

When difference is divided by 7, Remainder is 5.

Their **Product** $= xy = (7p + 3)(7q + 5)$

$= 7p(7q + 5) + 3(7q + 5)$

$= 4qpq + 35p + 21q + 15$

$= 4qpq + 35p + 21q + 14 + 1$

$= 7(7pq + 5p + 3q + 2) + 1$

When product is divided by 7, Remainder is 1.

7. Let as consider three consecutive numbers as 1, 2, 3 then according to the question,

$(2)^2 - 1 \times 3$

$= 4 - 3 = 1$

Again, let us take 3, 4, 5 as three consecutive numbers then according to the question,

$4^2 - 3 \times 5$

$= 16 - 15 = 1$

Now, we see that in each, case result is 1 in **In Algebraic expression**.

Let $x - 1$, x, $x + 1$ are three consecutive numbers then square of middle number

$= x^2$

Product of other two $= (x - 1)(x + 1)$

$= x^2 - 1$

Difference $= x^2 - (x^2 - 1)$

$= x^2 - x^2 + 1 = 1.$

8. Let x and y are two numbers, then According to the question,

$$(a + b) \times \frac{1}{2}(a+b) = \frac{1}{2}(a+b)^2$$

i.e., half of the square of the sum of two numbers.

9. (i) 14×26 or 16×24

$16 \times 24 = (14 + 2) \times (26 - 2)$

$= 14 \times 26 - 14 \times 2 + 2 \times 26 - 2 \times 2$

$= 14 \times 26 - 28 + 52 - 4$

$= 14 \times 26 + 20$

Clearly 16×24 is larger than 14×26.

(ii) 25×75 or 26×74

$26 \times 74 = (25 + 1) \times (75 - 1)$

$= 25 \times 75 - 25 \times 1 + 1 \times 75 - 1 \times 1$

$= 25 \times 75 - 25 + 75 - 1$

$= 25 \times 75 + 49$

Clearly, 26×74 is larger than 25×75.

10. Area of each plot $= g^2$ sq ft

$\therefore$ its side $= g$ ft

Length of the park $= w + g + w + w + g + w$

$= 2g + 4w$

Breadth of the park $= w + g + w$

$= g + 2w$

then **Total Area of Park**

= length × breadth

$= (2g + 4w) \times (g + 2w)$

$= 2g \times g + 2g \times 2w + 4w \times g + 4w \times 2w$

$= 2g^2 + 4gw + 4wg + 8w^2$

$= 2g^2 + 8gw + 8w^2$

$(\because gw = wg)$

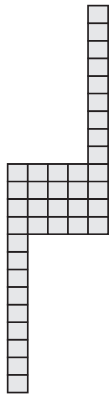
Area of the walking path

= Area of Park – 2 (area of square plot)

$= 2g^2 + 8gw + 8w^2 - 2(g^2)$

$= 8w^2 + 8gw$ sq ft.

11. (i) Next figure in the sequence (Pattern 1)



(ii) By inspection step 1 to 3, number of horizontal unit in step 10 $= (n + 2) \times n$ step n

and number of vertical unit at both sides in step 10

$$= 2 \times [3 + \frac{n(n-1)}{2}]$$

$= 6 + n(n-1)$

$\therefore$ Total number of basic units in step 10.

= Number of horizontal unit in step 10.

+ Number of vertical units at both sides in step 10.

$= (n + 2) \times n + 6 + n(n-1)$

$= (10 + 2) \times 10 + 6 + 10(10-1)$

$= 12 \times 10 + 6 + 10 \times 9$

$= 120 + 6 + 90$

$= 216$

(iii) Total number of basic units in step y

= Total number of horizontal units in step y + total number of vertical units at both side in step y

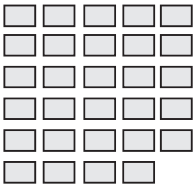
$= (y + 2) \times y + [6 + y(y-1)]$

$= y^2 + 2y + 6 + y^2 - y$

$= 2y^2 + y + 6$

$= y(2y + 1) + 6$

Pattern II

(i) 

(ii) By Inspection Step 1 to 3

It is clear that, total number of basic units in step n

$= (n + 1)^2 + n$ (step n)

$\therefore$ Total number of basic units in step 10.

$= (10 + 1)^2 + 10$

$= 11^2 + 10$

$= 121 + 10 = 131$

(iii) Total number of basic units in step y

$= (y + 1)^2 + y$

$= y^2 + 2y \times 1 + 1^2 + y$

$= y^2 + 2y + 1 + y$

$= y^2 + 3y + 1$

$= y(y + 3) + 1$

Practice Exercise 6.3

1. Number of Students

$= (x + 2)$

Cost of one ticket $=$ ₹ $(2x - 1)$

Total cost $= (x + 2)(2x - 1)$

$= x(2x - 1) + 2(2x - 1)$

$= 2x^2 - x + 4x - 2$

$= 2x^2 + 3x - 2$

Now 3 students cancil their trip.

Number of Remaining Students

$= (x + 2) - 3$

$= x - 1$

Now, total cost of tickets

$= (x - 1)(2x - 1)$

$= x(2x - 1) - 1(2x - 1)$

$= 2x^2 - x - 2x + 1$

$= 2x^2 - 3x + 1$

Difference in cost before and after cancellation

$= (2x^2 + 3x - 2) - (2x^2 - 3x + 1)$

$= 2x^2 - 2x^2 + 3x + 3x - 2 - 1$

$=$ ₹ $(6x - 3)$.

2. The length of rectangular bedroom $= (x + 8)$ Feet and the breadth

$= (x - 2)$ feet

area $=$ length $\times$ breadth

$= (x + 8)(x - 2)$

$= x(x - 2) + 8(x - 2)$

$= x^2 - 2x + 8x - 16$

area $= x^2 + 6x - 16$ sq. feet.

Now if length and the breadth both are increased by 1 feet we get

New length $= (x + 8) + 1$

$= x + 9$ feet and

New Breadth $= (x - 2) + 1$

$= x - 1$ feet

New area $=$ New length $\times$ New Breadth

$= (x + 9)(x - 1)$

$= x(x - 1) + 9(x - 1)$

$= x^2 - x + 9x - 9$

$= x^2 + 8x - 9$ Sq. feet.

Increase in area $= (x^2 + 8x - 9) - (x^2 + 6x - 16)$

$= 8x - 6x - 9 + 16$

$= (2x + 7)$ Sq. feet.

3. (a) $278 \times 101 = 278 \times (100 + 1)$

$= 27800 + 278$

$= 28078.$

(b) $3642 \times 1001 = 3642 \times (1000 + 1)$

$= 3642000 + 3642$

$= 3645642.$

(c) $635 \times 99 = 635 \times (100 - 1)$

$= 63500 - 635$

$= 62865.$

(d) $4125 \times 999 = 4125 \times (1000 - 1)$

$= 4125000 - 4125$

$= 4120875$

4. It 7 and 8 are two natural numbers sum of their squares

$= 7^2 + 8^2$

according to question,

$2(7^2 + 8^2) = (7 + 8)^2 + (8 - 7)^2.$

5. (a) Correct, from LHS $\frac{1}{2}(10x — 6) + 3$

$= \frac{1}{\cancel{2}} \times \cancel{2}(5x-3)+3$

$= 5x - \cancel{3} + \cancel{3}$

$= 5x$

Which is correct.

(b) $5m^2 + 6m$ can not be equal to $11m^2$ because both are unlike term. So this is incorrect.

(c) In correct

LHS : $2p^3 + 3p^3 + 6p^2q + 6pq^2$

here $6p^2q$ and $6pq^2$ are unlike so can not be add.

(d) In correct

$(7a + 8b)^2 = (7a)^2 + 2 \times 7a \times 8b + (8b)^2$

$= 49a^2 + 112ab + 64b^2$

(e) $\because$ $(-a + 9)^2 = (-a)^2 + 2 \times (-a) \times 9 + (9)^2$

$= a^2 - 189 + 81$

Thus, this is correct.

(f) $\therefore$ In correct

$3a(2b + 3c) = 6ab + 9ac$.

6. Let the numbers are $5a + 2$ and $5b + 3$

(a) sum $= (5a + 2) + (5b + 3)$

$= 5a + 5b + 5$

$= 5(a + b + 1) + 0$

Remainder is zero.

(b) **Subtraction :** $(5a + 3) - (5b + 2)$

$= 5a - 5b + 1$

$\because$ $= 5(a - b) + 1$

Thus, remainder is.

(c) **Multiplication :** $(5a + 2)(5b + 3)$

$= 5a(5b + 3) + 2(5b + 3)$

$= 25ab + 15qa + 10b + 6$

$= (25ab + 15a + 10b + 5) + 1$

$\because$ $= 5(5ab + 3a + 2b + 1) + 1$

Thus, remainder is.

NCERT Exercise

Chapter Innings

A. Multiple Choice Questions

1. b **2.** a
3. b **4.** a
5. c.

B. Fill in the Blank

1. 9 **2.** 39991
3. 67 **4.** 38
5. $a^4 - 1$.

C. Math the following

1. d **2.** e
3. a **4.** b
5. c.

D. True or False

1. True **2.** False
3. False **4.** True
5. False.

E. Very short answer type Questions

1. The numbers are x and y

Product $= xy$

New numbers $= x + 5$ and $y - 3$

New Product $= (x + 5)(y - 3)$

$= x(y - 3) + 5(y - 3)$

$= xy - 3x + 5y - 15$

Change in the product

$= (xy - 3x + 5y - 15) - xy$

$= -3x + 5y - 15$.

2. (a) $(3x + 5)(3x - 5)$

We know $(a + b)(a - b) = a^2 - b^2$

$(3x + 5)(3x - 5)$

$= (3x)^2 - (5)^2$

$= 9x^2 \ 25$.

(b) $(5x - 2)(4x + 3)$

$= 5x(4x + 3) - 2(4x + 3)$

$= 20x^2 + 15x — 8x - 6$

$= 20x^2 + 7x - 6$

(c) $(7x - 3)^2$

$= (7x)^2 - 2 \times 7x \times 3 + (3)^2$

$[\because (a - b)^2 = a^2 - 2ab + b^2]$

$(7x - 3)^2 = 49x^2 - 42x + 9$.

(d) $(-4x+5)^2 = (5-4x)^2$

We know,

$(a-b)^2 = a^2 - 2ab + b^2$

$(5-4x)^2 = (5)^2 - 2 \times 5 \times 4x + (4x)^2$

$= 16x^2 \;\; 40x + 25.$

3. Cost of the ticket $= ₹\,(y+20)$

a VIP ticket costs $= ₹\,(2y-8)$

Total cost of a ticket

$= (y+20) + (2y-8)$

$= ₹\,(3y+12)$

Number of people

$= y+5$

Total cost $= (y+5)(3y+12)$

$= y(3y+12) + 5(3y+12)$

$= 3y^2 + 12y + 15y + 60$

$= ₹\,(3y^2 + 27y + 60).$

4. The length of ABC

$= x$ unit

Fig.

The breadth of ABCD

= CF + BF

$= y + x - y$

$= x$

∴ The length of ABCD = The breadth of ABCD thus ABCD is a square

Now area of square ABCD

$= x \times x$

$= x^2$ Sq. units

again, the breadth of EBFP

$= x - y$ unit

length of EBFC = AB – AE

$= x - (x - y)$

$= y$ unit

area of shaded region

= (ength × breadth)

$= y\,(x-y)$

$= xy - y^2$

area of unshaded region

$= x^2 - (xy - y^2)$

$= x^2 - xy + y^2$

but, we have $x = 12$ and $y = 7$

area of shaded region

$= 12 \times 7 - 7^2$

$= 84 - 49$

$= 35$ sq. unit.

5. (a) $14 + 25 = 29$

and $16 + 23 = 39$

since 16 23 are cluser than 14 and 25

So $(16 \times 23) > (14 \times 25)$.

(b) Similarly,

$25 + 75 = 100$

and $28 \times 72 = 100$

but 28 and 72 are cluser than 25 and 75

So $(28 \times 72) > (25 \times 75)$.

F. Short answer type Questions

1. (a) $\left(\frac{2}{3}x+\frac{4}{5}y\right)\left(\frac{2}{3}x+\frac{4}{5}y\right)$

$= \left(\frac{2}{3}x+\frac{4}{5}y\right)^2$

Using identity

$(a+b)^2 = a^2 + 2ab + b^2$

$= \left(\frac{2}{3}x\right)^2 + 2\times\frac{2}{3}x\times\frac{4}{5}y + \left(\frac{4}{5}y\right)^2$

$= \frac{4}{9}x^2 + \frac{16}{15}xy + \frac{16}{25}y^2.$

(b) $\left(\frac{1}{2}y^2-\frac{1}{3}y\right)\left(\frac{1}{2}y^2-\frac{1}{3}y\right)$

$= \left(\frac{1}{2}y^2-\frac{1}{3}y\right)^2$

$= \left(\frac{1}{2}y^2\right)^2 - \cancel{2}\times\frac{1}{\cancel{2}}y^2\times\frac{1}{3}y + \left(\frac{1}{3}y\right)^2$

$= \frac{1}{4}y^4 \frac{1}{3}y^3 + \frac{1}{9}y^2$

$(x^2+7)(x^2+7)$

= (x2 + 7)2

Using, $(a+b)^2 = a^2 + 2ab + b^2$

$(x^2+7)^2 = (x^2)^2 + 2 \times x^2 \times 7 + 72$

$= x^4 + 14x^2 + 49.$

(c) $\left(\frac{5}{6}a^2+2\right)\left(\frac{5}{6}a^2+2\right)$

$$= \left(\frac{5}{6}a^2 + 2\right)^2$$

Using$(a + b)^2 = a^2 + 2ab + b^2$

$$= \left(\frac{5}{6}a^2\right)2 + \cancel{2} \times \frac{5}{\cancel{6}}a^2 \times 2 + (2)^2$$

$$= \frac{25}{36}a^4 + \frac{10}{3}a^2 + 4.$$

2. (a) $\left(x - \frac{3}{x}\right)\left(x - \frac{3}{x}\right) = \left(x - \frac{3}{x}\right)^2$

Using $(a - b)^2 = a^2 - 2ab + b^2$

$$= (x)^2 - 2 \times \cancel{x} \times \frac{3}{\cancel{x}} + \left(\frac{3}{x}\right)^2$$

$$= x^2 - 6 + \frac{9}{x^2}$$

$$= x^2 + \frac{9}{x^2} - 6 .$$

3. (a) $\left(\frac{1}{x} + \frac{1}{y}\right)\left(\frac{1}{x} - \frac{1}{y}\right)$

Using $(a + b)(a - b)$

$$= a^2 - b^2$$

$$= \left(\frac{1}{x}\right)^2 - \left(\frac{1}{y}\right)^2$$

$$= \frac{1}{x^2} - \frac{1}{y^2}.$$

(b) $\left(\frac{4x}{5} - \frac{5y}{3}\right)\left(\frac{4x}{5} + \frac{5y}{3}\right)$

$$= \left(\frac{4x}{5}\right)^2 - \left(\frac{5y}{3}\right)^2$$

$[\because (a + b)(a - b) = a^2 - b^2]$

$$= \frac{16x^2}{25} - \frac{25y^2}{9}.$$

(c) $\left(2a + \frac{3}{5}\right)\left(2a - \frac{3}{b}\right)$

$$= (2a)^2 - \left(\frac{3}{b}\right)^2$$

$[\because (a + b)(a - b) = a^2 - b^2]$

$$= 4a^2 - \frac{9}{b^2} .$$

4. We have $x + y = 12$ and $xy = 14$

$\because \quad x + y = 12$

Squaring both side we get

$(x + y)^2 = 12^2$

$\Rightarrow \quad x^2 + y^2 + 2xy = 144$

$\Rightarrow x^2 + y^2 + 2 \times 14 = 144$

$\Rightarrow \quad x^2 + y^2 + 28 = 144$

$\Rightarrow \quad x^2 + y^2 = 144 - 28$

$\Rightarrow \quad \boxed{x^2 + y^2 = 116}$.

5. We have $x - y = 7$ and $xy = 9$ squaring both side we get

$(x - y)^2 = 72$

$\Rightarrow \quad x^2 + y^2 - 2xy = 49$

$\Rightarrow x^2 + y^2 - 2 \times y = 49$

$\Rightarrow \quad x^2 + y^2 - 18 = 49$

$\Rightarrow \quad x^2 + y^2 = 49 + 18$

$\Rightarrow \quad x^2 + y^2 = 67.$

G. Long type Questions

1. (a) We have

$$x + \frac{1}{x} = 5$$

Squaring both side

$$\left(x + \frac{1}{x}\right)^2 = 5^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 25$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} = 25 - 2$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} = 23$$

(b) Again squaring we get

$$\left(x^2 + \frac{1}{x^2}\right)^2 = 23^2$$

$$\Rightarrow x^4 + \frac{1}{x^4} + 2 = 529$$

$$\Rightarrow \quad x^4 + \frac{1}{x^4} = 529 - 2$$

$$\Rightarrow \quad x^4 + \frac{1}{x^4} = 527.$$

2. We have,

$$x^4 + \frac{1}{x^4} = 47$$

adding 2 both side, we get

$$\Rightarrow \quad x^4 + \frac{1}{x^4} + 2 = 47 + 2$$

$$\Rightarrow (x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2} = 49$$

since $a^2 + b^2 + 2ab = (a + b)^2$

$$\Rightarrow \quad \left(x^2 + \frac{1}{x^2}\right)^2 = 49$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} = \sqrt{49}$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} = 7$$

again adding 2 both side, we get

$$\Rightarrow \quad x^2 + \frac{1}{x^2} + 2 = 7 + 2$$

$$\Rightarrow (x)^2 + \left(\frac{1}{x}\right)^2 + 2 \times x \times \frac{1}{x} = 9$$

We know,

$$a^2 + 2ab + b^2 = (a + b)^2$$

$$\Rightarrow \quad \left(x + \frac{1}{x}\right)^2 = 9$$

$$\Rightarrow \quad x + \frac{1}{x} = \sqrt{9}$$

$$\Rightarrow \quad \boxed{x + \frac{1}{x} = 3}.$$

3. (a) $(3p - 5q)^2 = (3p)^2 + (5q)^2 - 2 \times 3p \times 5q$

$= 9p^2 - 30\,pq + 25q^2$

and $(3p + 5q)^2 = (3p)^2 + 2 \times 3p \times 5q + (5q)^2$

Now, $= 9p^2 + 30pq + 25q^2$

$\Rightarrow (3p - 5q)^2 + (3p + 5q)^2$

$= (9p^2 - 30\,pq + 25q^2) + (9p^2 + 30pq + 25)$

$= 9p^2 + 9p^2 + 25q^2 + 25q^2$

$= 18p^2 + 50q^2.$

(b) $(2x + 5)^2 = (2x)^2 + 2 \times 2x \times 5 + (5)^2$

$= 4x^2 + 20x + 25$

and $(2x - 5)^2 = (2x)^2 - 2 \times 2x \times 5 + (5)^2$

$= 4x^2 - 20x + 25$

Now, $(2x + 5)^2 - (2x - 5)^2$

$= (4x^2 + 20x + 25) - (4x^2 - 20x + 25)$

$= 20x + 20x$

$= 40x$

Thus, $(2x + 5)^2 - (2x - 5)^2$

$= 40x.$

4. (a) $(x + 1)\,(x - 1)\,(x^2 + 1) = ?$

We know,

$(a + b)\,(a - b) = a^2 - b^2$

$(x + 1)\,(x - 1)\,(x^2 + 1)$

$= [x^2 - (1)^2]\,(r^2 + 1)$

$= (x^2 - 1)\,(x^2 + 1)$

$= (x^2)^2 - (1)^2$

$= x^4 - 1$

Thus, $(x + 1)\,(x - 1)\,(x^2 + 1)$

$= x^4 - 1.$

(b) $(x + 2)\,(x - 2)\,(x^2 + 4)$

$= (x^2 - (2)^2)\,(x^2 + 4)$

$[\because (a + b)\,(a - b) = a^2 - b^2]$

$= (x^2 - 4)\,(x^4 + 4)$

$= (x^2)^2 - (4)^2$

$= x^4 - 16$

(c) $(2m - 3)\,(2m + 3)\,(4m^2 + 9)$

$= [(2m)^2 - (3)^2]\,(4m^2 + 9)$

$[\because (a - b)\,(a + b) = a^2 - b^2]$

$= (4m^2 - 9)\,(4m^2 + 9)$

$= (4m^2)^2 - 9^2$

$= 16m^4 - 81.$

(d) $(3x + 2y)(3x - 2y)(9x^2 + 4y^2)$

$= [(3x)^2 \ (2y)^2](9x^2 + 4y^2)$

$[\because (a - b)(a + b) = a^2 - b^2]$

$= (9x^2 - 4y^2)(9x^2 + 4y^2)$

$= (9x^2)^2 - (4y^2)^2$

$= 81x^4 - 16y^4.$

5. (a) $\dfrac{(2a+b)^2 - (2ab)^2}{ab}$

We know that $(a + b)^2 \ (a - b)^2$

$= 4ab$

Thus $\dfrac{(2a+b)^2 - (2a-b)^2}{ab}$

$= \dfrac{4 \times 2a \times b}{ab}$

$= \dfrac{8\cancel{a}\cancel{b}}{\cancel{a}\cancel{b}}$

$= 8.$

(b) $\dfrac{(6a-5b)^2 - (6a+5b)^2}{ab}$

We know that,

$(a - b)^2 - (a + b)^2$

$= -4ab$

Thus $\dfrac{(6a-5b)^2 - (6a+5b)^2}{ab}$

$= \dfrac{-4 \times 6a \times 5b}{ab}$

$= \dfrac{-120\cancel{ab}}{\cancel{ab}}$

$= -120$

(c) $\dfrac{(4ab+3(d)^2 - (4ab-3cd)^2}{48}$

We know that $(a + b)^2 - (a - b)^2$

$= 4ab$

$\dfrac{(4ab+3cd)^2 - (4ab-3cd)^2}{48}$

$= \dfrac{4 \times 4ab \times 3cd}{48}$

$= \dfrac{\cancel{48} \times abcd}{\cancel{48}}$

$= abcd.$

(d) $\dfrac{(7pqr-5)^2 - (7pqr+5)^2}{(pqr+1)^2 - (pqr-1)^2}$

We know that $(a + b)^2 - (a - b)^2$

$= 4ab$

and $(a - b)^2 - (a + b)^2$

$= 4ab$

$\dfrac{(7pqr-5)^2 - (7pqr+5)^2}{(pqr+1)^2 - (pqr-1)^2}$

$= \dfrac{-4 \times 7pqr \times 5}{4 \times pqr \times 1}$

$= \dfrac{-4 \times 35 \times \cancel{pqr}}{\cancel{4} \times \cancel{pqr}}$

$= -35.$

H. Assertion – Reason Based Question

1. B **2.** A

3. D **4.** C

5. B

I. Case Study

1. C **2.** D

3. C **4.** D

5. B

❑❑

7. Proportional Reasoning – 1

Class Work 7.1

1. (a) Ratio of 24 to 56

$= \dfrac{\cancel{24}}{\cancel{56}} = \dfrac{3}{7}$

$= 3 : 7.$

(b) HCF of 36 and 90

$= 18$

$36 : 90 = \dfrac{36}{90}$

$= \dfrac{35 \div 18}{90 \div 18} = \dfrac{2}{5}$

Simplest Ratio

$= 2 : 5.$

(c) HCF of 85 and 561

$= 17$

$85 : 561 = \frac{85}{561} = \frac{85 \div 17}{561 \div 17}$

$= \frac{5}{33}$

Simplest Ratio

= 5 : 33.

(d) HCF of 186 and 403

= 31

$186 \div 403 = \frac{186}{403} = \frac{186 \div 31}{403 \div 31}$

$= \frac{6}{13}$

Simplest Ratio

= 6 : 13.

(e) 324 : 144

HCR of 324 and 144

= 36

$324 : 144 = \frac{324}{144} = \frac{324 \div 36}{144 \div 36}$

$= \frac{9}{4}$

Simplest Ratio

= 9 : 4.

(f) HCF of 480 and 384 = 96

$480 : 384 = \frac{480}{384} = \frac{480 \div 96}{384 \div 96}$

$= \frac{5}{4}$

Simplest Ratio

= 5 : 4.

2. (a) ₹ 4 = (4 × 100)

Paise = 400 Paise

∴ Ratio of 50 Paise to ₹ 4

$= \frac{50}{400} = \frac{50 \div 50}{400 \div 50}$

$= \frac{1}{8}$

Ratio = 1 : 8.

(b) 50 minutes = (50 × 60) seconds

= 3000 seconds

∴ Ratio of 40 seconds to 50 minutes

$= \frac{40}{3000}$

$= \frac{40 \div 40}{3000 \div 40}$

$= \frac{1}{75}$

Ratio = 1 : 75

(c) Ratio of 3.2 m to 56 m

$= \frac{3.2}{56} = \frac{32 \div 16}{560 \div 16}$

$= \frac{2}{25}$

Ratio = 2 : 35.

(d) 3kg = (3 × 1000)g

= 3000 g

∴ Ratio of 150g to 3kg

$= \frac{150}{3000} = \frac{150 \div 150}{3000 \div 150}$

$= \frac{1}{20}$

Ratio is 1 : 20.

(e) 1 metre = 100 cm

Ratio of 240 cm to a metre

$= \frac{240}{100} = \frac{240 \div 20}{100 \div 20}$

$= \frac{12}{5}$

Ratio is 12 : 5.

(f) Ratio of 10 litres to 0.25 litres

$= \frac{10}{0.25} = \frac{10,00}{5}$

$= \frac{1000 \div 25}{25 \div 25}$

$= \frac{40}{1}$

Ratio is 40 : 1.

3. (a) Rahul larms = ₹ 5400

and kalpana larms

= ₹ 9750

Then ratio of rahul's income to kalpana's income

$= \frac{5400 \div 150}{9750 \div 150}$

$= \frac{36}{65}$

Ratio is 36 : 65.

(b) Their total income

= ₹ 5400 + ₹ 9750

= ₹ 15, 150

Ratio of rahul's income to their total income

$= \frac{5400}{15150}$

$= \frac{5400 \div 150}{15150 \div 150}$

$= \frac{36}{101}$

Ratio is 36 : 101.

4. Total students = 93

Number of passed students

= 31

(a) Ratio of students passed to the total students

$= \frac{31 \div 31}{93 \div 31} = \frac{1}{3}$

Ratio is 1 : 3.

(b) Number of taited students

= 93 – 31

= 62

Ratio of laiked students to the number of passed students

$= \frac{62 \div 31}{31 \div 31}$

$= \frac{2}{1}$

Ratio is 2 : 1.

Class Work 7.2

1. Do it your self.

2. Do it your self.

3. Do it your self.

4. Do it your self.

Maths Talk

Page-133 (Filter Coffee)

1. The coffee decoction in first coffee = 15mL and coffee decoction in lator coffee = 20mL.

Since, 20mL > 15mL, so later coffee is stronger.

2. Because it contein low quantity of coffee decoction.

3. (a) Strong coffee.

(b) Lighter coffee.

(c) Strong coffee.

(d) Regular.

(e) Lighter.

NCERT Exercise 7.1

1. (i) Given that,

4 : 7 : : 12 : 21

$\Rightarrow \frac{4}{7} = \frac{12}{21}$

$\Rightarrow \frac{4}{7} = \frac{\frac{12}{3}}{\frac{21}{3}}$ [HCF of 12 and 21 = 3]

$\Rightarrow \frac{4}{7} = \frac{4}{7}$, which is true.

(ii) Given that,

8 : 3 : : 24 : 6

$\Rightarrow \frac{8}{3} = \frac{24}{6}$

$\Rightarrow \frac{8}{3} = \frac{\frac{24}{6}}{\frac{6}{6}}$ [HCF of 24 and 6 = 6]

$\Rightarrow \frac{8}{3} = \frac{4}{1}$, which is not true.

(iii) Given that,

7 : 12 : : 12 : 7

$\Rightarrow \frac{7}{12} = \frac{12}{7}$, which is not true.

(iv) Given that,

21 : 6 : : 35 : 10

$$\Rightarrow \frac{21}{6} = \frac{35}{10}$$

$$\Rightarrow \frac{\frac{21}{3}}{\frac{6}{3}} = \frac{\frac{35}{5}}{\frac{10}{5}}$$

$$\left[\begin{array}{l} \because \text{HCF of } 21 \text{ and } 6 = 3 \\ \text{HCF of } 35 \text{ and } 10 = 5 \end{array}\right]$$

$$\Rightarrow \frac{7}{2} = \frac{7}{2}$$, which is true.

(v) Given that,

12 : 18 : : 28 : 12

$$\Rightarrow \frac{12}{18} = \frac{28}{12}$$

$$\Rightarrow \frac{\frac{12}{6}}{\frac{18}{6}} = \frac{\frac{28}{4}}{\frac{12}{4}}$$

$$\left[\begin{array}{l} \because \text{HCF of } 12 \text{ and } 18 = 6 \\ \text{HCF of } 28 \text{ and } 12 = 4 \end{array}\right]$$

$$\Rightarrow \frac{2}{3} = \frac{7}{3}$$, which is not true.

(vi) Given that,

24 : 8 : : 9 : 3

$$\Rightarrow \frac{24}{8} = \frac{9}{3}$$

$$\left[\begin{array}{l} \because \text{HCF of } 24 \text{ and } 8 = 8 \\ \text{HCF of } 9 \text{ and } 3 = 3 \end{array}\right]$$

$$\Rightarrow \frac{\frac{24}{8}}{\frac{8}{8}} = \frac{\frac{9}{3}}{\frac{3}{3}}$$

$$\Rightarrow \frac{3}{1} = \frac{3}{1}$$, which is true.

2. We have, 4 : 9

$$\frac{4\times1}{9\times1} = \frac{4}{9}$$

$$\frac{4\times2}{9\times2} = \frac{8}{18}$$

$$\frac{4\times3}{9\times3} = \frac{12}{27}$$

$$\frac{4\times4}{9\times4} = \frac{16}{36}$$

Thus, three ratios proportional to 4 : 9 are 8 : 18, 12 : 27 and 16 : 36.

3. 18 : 24

$$\Rightarrow \frac{18}{24} = \frac{\frac{18}{6}}{\frac{24}{6}} = \frac{3}{4}$$

[$\because$ HCF of 18 and 24 = 6]

For 3 : —

Let x be missing term, then

$$\therefore \quad \frac{3}{x} = \frac{3}{4}$$

$\Rightarrow \quad 3x = 3 \times 4$

$\Rightarrow \quad x = 4$

$\therefore$ Required Ratio = 3 : 4

For 12 : —

Let x be missing term, then

$$\frac{12}{x} = \frac{3}{4}$$

$\Rightarrow \quad 3x = 12 \times 4$

$$\Rightarrow \quad x = \frac{12\times4}{3} = 16$$

$\therefore$ Required ratio = 12 : 16

for 20 : ______

Let x be missing term, then

$$\frac{20}{x} = \frac{3}{4}$$

$\Rightarrow \quad 3x = 20 \times 4$

$\Rightarrow \quad x = \frac{80}{3}$

$\therefore$ Required ratio = $\frac{20}{1} : \frac{80}{3}$

$= 20 \times 3 : \frac{80}{3} \times 3$

= 60 : 80

For ratio 27 : _______

Let missing term be x

$\therefore \quad \frac{27}{x} = \frac{3}{4} \Rightarrow 3x = 27 \times 4$

$\Rightarrow \quad x = \frac{27 \times 4}{3}$

$\Rightarrow \quad x = 36$

$\therefore$ Required ratio= 27 : 36

4. Do yourself.

5. Do yourself.

6. From figure (a), It is clear that

(a) Number of grey bricks = 33

and number of coloured bricks = 18

$\therefore$ Ratio of grey bricks to coloured bricks

= 33 : 18

$= \frac{33}{18} = \frac{\frac{33}{3}}{\frac{18}{3}}$

[$\because$ HCF of 33 and 18 = 3]

$= \frac{11}{6}$

(b) Number of grey bricks = 71

Number of coloured bricks = 48

$\therefore$ Ratio of grey bricks to coloured bricks

= 71 : 48

7. Do yourself.

8. Number of days in 1 year = 365

The Earth travels distance = 940 million km

= 940 × 1000000 km

= 940000000 km

Let x km be the distance travelled by earth in one week (7 days).

According to the question,

940000000 : 365 : : x : 7

$\Rightarrow x = \frac{940000000}{365} \times 7$

$\Rightarrow x = 18027397.26$

Thus, Earth will travel 18027397.26 km in a week.

9. From the given figure,

Total length of wall of house

= 12 + 9 + 15 + 12 + 9 + 6 + 9 + 9 + 6 + 9 + 12

= 108 ft.

Let us assume that number of bricks = x

Then according to question,

10 : 1450 : : 108 : x

$\Rightarrow \quad \frac{10}{1450} = \frac{108}{x}$

$\Rightarrow \quad 10 \times x = 1450 \times 108$

$\Rightarrow \quad x = \frac{1450 \times 108}{10}$

$\Rightarrow \quad x = 15660$

Thus, required number of bricks = 15660

Practice Exercise 7.1

1.

S.N.	Given Ratios	Product of Extremes terms	Product of Middle terms	Product of Extreme terms = Product of Middle terms	Result given rations are in

a	12 : 18 and 28 : 12	12 × 12 = 144	28 × 18 = 504	No	No Proportion
b	14 : 4 and 18 : 6	14 × 6 = 84	18 × 4 = 72	No	No Proportion
c	4 : 6 and 12 : 18	4 × 18 = 72	6 × 12 = 72	Yes	Proportion
d	15 : 45 and 40 : 120	15 × 120 = 1800	45 × 40 = 1800	Yes	Proportion

2.

S.N.	Numbers	Product of Extreme terms	Product of Middle terms	Product of Extreme terms = Productor Middle terms	Result given numbers are in
a	12, 16, 6, 8	12 × 8 = 96	16 × 6 = 96	Yes	Proportion
b	2, 3, 4, 5	2 × 5 = 10	3 × 4 = 12	No	No Proportion
c	18, 10, 9, 5	18 × 5 = 90	10 × 9 = 90	Yes	Proportion
d	18, 9, 10, 5	18 × 5 = 90	9 × 10 = 90	Yes	Proportion

3. Since, 1m = 100 cm

⇔ 2m = 2 × 100

= 200 cm

Ratio of 15 cm to 2m

$$= \frac{15}{200} = \frac{15 \div 5}{200 \div 5}$$

Ratio $= 3 : 40 = \frac{3}{40}$

and 3 minutes = 3 × 60

= 180 seconds

Ratio of 24 seconds to 3 minutes

$$= \frac{24}{180} = \frac{24 \div 12}{180 \div 12}$$

$$= \frac{2}{15}$$

Ratio = 2 : 15.

Now Product of Extreme terms = 3 × 15 = 45 and product of middle terms = 40 × 2 = 80 since, product of extreme terms ≠ product of middle terms thus the given ratois are not in proportion.

4. Number of boys = 1200 and

Number of girls = 800

Ratio of Number of boys to that of girls

$$= \frac{1200 \div 400}{800 \div 400}$$

$$= \frac{42 \div 14}{14 \div 14}$$

Simplest Ratio = 3 : 2.

5. Present age of father

= 42 years and

Present age of son = 14 years

(a) Ratio of Present age of father to the present age of son

$$= \frac{42 \div 14}{14 \div 14}$$

$$= \frac{3}{1}$$

Ratio = 3 : 1.

(b) Age of father after 10 years

= 42 + 10

= 52

and age of son after 10 years

= 14 + 10 = 24

Ratio of age of father to age of son

$$= \frac{52 \div 4}{24 \div 4}$$

$$= \frac{13}{6}$$

Ratio = 13 : 6.

(c) Age of father when son was 12 years old

= 42 – 2

= 40 years

Ratio $= \frac{40 \div 4}{12 \div 4}$

$$= \frac{10}{3}$$

Ratio = 10 : 3.

(d) Present age of father

= 42 years

given age of father

= 30 years

12 years ago,

Age of son = 14 – 12

= 2 years

$$\text{Ratio} = \frac{30 \div 2}{2 \div 2}$$

$$= \frac{15}{1}$$

Thus, Ratio is 15 : 1.

6. We have, cost of a dozen pens

= ₹ 180

and 1 dozen pens = 12 pens

$$\text{cost of 1 pen} = \frac{180}{12} = ₹\ 15$$

and cost of 8 ball pens

= ₹ 56

$$\text{cost of 1 ball pen} = \frac{56}{8}$$

= 27

Ratio of the cost of a pen to cost of a ball pen

$$= \frac{15}{7}$$

Ratio = 15 : 7.

7. Let the cost of 15 soaps is x and 1 dozen = 12 soap since the ratio of number of soap to the cost of soap ios proportional

So, 12 : 153.60 : : 15 : x

$\Rightarrow$ $12 \times x = 153.60 \times 15$

$\Rightarrow$ $12x = 2304$

$\Rightarrow$ $x = \frac{2304}{12}$

$\Rightarrow$ $x = 192$

Thus the cost of 15 soaps is ₹ 192.

8. $\therefore$ Since the Ratio of men to the number of parcel packed is propotional

So, No of men : No of parcel packed :: No of men : No of parcel packed

6 : 312 :: 11 : 2

Here, x is the number of parcels packed

$\Rightarrow$ $6 \times x = 312 \times 11$

$\Rightarrow$ $6x = 3432$

$\Rightarrow$ $x = \frac{3432}{6}$

$\Rightarrow$ $x = 572$

Thus, 572 parcels packed by 11 men per day.

9. Let, mutortrike covers x km of distance since. Ratio of covered distance to the consumed petrol be proportional

So, 220 : 5 = x : 1.5

$\Rightarrow$ $220 \times 1.5 = 5 \times x$

$\Rightarrow$ $5x = 330$

$\Rightarrow$ $x = \frac{330}{5}$

$\Rightarrow$ $x = 66$

Thus, motorbike will cover 66km.

NCERT Exercise 7.2

1. We have,

Amount = ₹ 4500

and ratio = 2 : 3

$$\therefore \quad \text{First Part} = m \times \frac{x}{m+n}$$

[where ratio m : n and amount x)

$$= 2 \times \frac{4500}{(2+3)}$$

$$= \frac{2 \times 4500}{5}$$

= 2 × 900 = ₹ 1800

$$\text{and Second Part} = n \times \frac{x}{m+n}$$

(where ratio m : n and amount x)

$$= 3 \times \frac{4500}{(2+3)}$$

$$= 3 \times \frac{4500}{5}$$

= 3 × 900

= ₹ 2700

2. Given, ratio of acid and water in solution is 1 : 5 and quantity of solution = 240 mL

$\therefore$ Quantity of acid

$$= m \times \frac{x}{m+n}$$

[where ratio m : n and total quantity x]

$$= 1 \times \frac{240}{1+5}$$

$= 1 \times \frac{240}{6}$

= 40 mL

and quantity of water

$= n \times \frac{x}{m+n}$

$= 5 \times \frac{240}{1+5}$

$= 5 \times \frac{240}{6}$

= 5 × 40

= 200 mL

3. Ratio of blue and yellow paint = 3 : 5

Amount of green paint produced = 40 mL

∴ Quantity of blue paint

$= m \times \frac{x}{m+n}$

$= 3 \times \frac{40}{3+5}$

[∵ Ratio = *m* : *n*, Total amount = *x*]

$= 3 \times \frac{40}{8}$

= 3 × 5 = 15 mL

and Quantity of yellow paint

$= n \times \frac{x}{m+n}$

$= 5 \times \frac{40}{3+5}$

$= 5 \times \frac{40}{8}$

= 5 × 5 = 25 mL

when 20 mL of yellow paint is added in the mixture.

Then, New Quantity of Yellow paint = 25 + 20

= 45 mL

∴ New Ratio = 15 : 45

$= \frac{15/15}{45/15}$

[∵ HCF of 15 and 45 = 15]

$= \frac{1}{3}$

= 1 : 3

4. We have,

Quantity of mixture = 6 cups

Ratio of Rice and *urad dal*= 2 : 1

∴ Quantity of Rice $= m \times \frac{x}{m+n}$

[Ratio = *m* : *n*, Total amount = *x*]

$= 2 \times \frac{6}{2+1}$

$= 2 \times \frac{6}{3}$

= 2 × 2 = 4 cups

Quantity of *urad dal*

$= n \times \frac{x}{m+n}$

$= 1 \times \frac{6}{2+1}$

$= 1 \times \frac{6}{3}$

= 1 × 2 = 2 cups

5. Given that, one bucket of orange paint is made by mixing red and yellow paints in the ratio of 3 : 5.

⇒ 3 part of red paint + 5 part of yellow paint given 8 part of orange paint.

After adding another bucket of yellow paint to this mixture. New quantity of yellow paint = 8 part + 5 parts

= 13 parts

∴ New ratio of red paint to yellow paint in new mixture = 3 : 13

Practice Exercise 7.2

1. ∴ Total money = ₹ 1200

and ratio = 2 : 3 : 5

sum of ratio $= 2 + 3 + 5 = 10$

A's share $= ₹\left(\frac{2}{10}\times 1200\right)$

$= \frac{2400}{10} = ₹\ 240$

B's share $= ₹\left(\frac{3}{10}\times 1200\right)$

$= \frac{3600}{10} = ₹\ 360$

C's share $= ₹\left(\frac{5}{10}\times 1200\right)$

$= \frac{6000}{10} = ₹\ 600.$

2. Total money $= ₹\ 1575$

and ratio $= 7:2$

sum of ratio $= 7 + 2 = 9$

satyajit's share $= ₹\left(\frac{7}{9}\times 1575\right)$

$= \frac{11.025}{9}$

$= ₹\ 1, 225$

Rohan's share $= ₹\left(\frac{2}{9}\times 1575\right)$

$= \frac{3150}{9}$

$= ₹\ 350.$

3. Total money $= ₹\ 3450$

and ratio $= 3 : 5 : 7$

sum of ratio $= 3 + 5 + 7 = 15$

mayank's share $= ₹\left(\frac{3}{15}\times \cancel{3450}\right)$

$= ₹\ 690$

Rahul's share $= ₹\left(\frac{5}{\cancel{15}}\times \cancel{3450}\right)$

$= ₹\ 1150$

Kanav's share $= ₹\left(\frac{7}{\cancel{15}}\times \cancel{3450}\right)$

$= ₹\ 1610.$

4. Ratio of copper and zinc

$= 5 : 3$

The weight of copper

$= 30.5g$

Let weight of the alloy

$= x$ gram

sum of ratio $= 5 + 3 = 8$

copper weight $= \frac{5}{8} \times$ weight of the alloy

$30.5 = \frac{5}{8}\times x$

$\Rightarrow \quad x = \frac{30.5\times 8}{5}$

$= \frac{244}{5}$

$x = 48.8g$

Thus weight of the alloy is 48.8g

Now, the weight of the zinc

$= \frac{3}{8} \times$ weight of the alloy

$= \frac{3}{8}\times \cancel{48.8}$

$= 18.3g.$

5. Ratio of the length to width

$= 5 : 3$

and The width $= 42$ metres

sum of ratio $= 5 + 3 = 8$

and let the length of field is x metres

Since, Ratio of the length to the width be proportion

So, $5 : 3 = x : 42$

$\Rightarrow \quad 5 \times 42 = 3x$

$\Rightarrow \quad x = \frac{210}{3} = 70$ metres

Thus, the lenth is 70 metres.

NCERT Exercise 7.3

1. We have, Quantity of orange juice

$= 600$ mL

and Quantity of apple juice

$= 900$ mL

Ratio of orange juice to apple juice

$$= \frac{600}{900}$$

$$= \frac{\frac{600}{300}}{\frac{900}{300}}$$

[HCF of 600 and 900 = 300]

$$= \frac{2}{3} = 2 : 3$$

2. Let the required number of buses = x

According to the question

3 : 162 : : x : 204

$$\Rightarrow \quad \frac{3}{162} = \frac{x}{204}$$

$$\Rightarrow \quad 162 \times x = 3 \times 204$$

$$\Rightarrow \quad x = \frac{3 \times 204}{162}$$

$$\Rightarrow \quad x = 3.77$$

$$\Rightarrow \quad x = 4 \text{ (approx)}$$

$$\Rightarrow \quad x = 4 \text{ buses}$$

So, Capacity of 1 bus = $\frac{162}{3}$ = 54

∴ Capacity of 4 buses = 4 × 54 = 216

Since, 216 > 204

∴ All the buses will not be full.

3. We have,

Population of Delhi = 30 million (approx)

and Area of Delhi = 1,484 sq km

∴ Population Density of Delhi

$$= \frac{30 \text{ million}}{1484}$$

$$= \frac{30 \times 1000000}{1484}$$

= 20215.6 people / sq km

Again, population of Mumbai = 20 million

and Area of Mumbai = 550 sq km

∴ Population Density of Mumbai

$$= \frac{20 \text{ million}}{550}$$

$$= \frac{20 \times 1000000}{550}$$

= 36363.6 people / sq km

Since, 36363.6 > 20215.6

⇒ Hence, Mumbai is more crowded.

4. Do yourself.

5. Let required quantity of saffron be x palas.

Then, according to the question,

$2\frac{1}{2} : \frac{3}{7} : : x : 9$

$$\Rightarrow \quad \frac{2\frac{1}{2}}{\frac{3}{7}} = \frac{x}{9}$$

$$\Rightarrow \quad \frac{\frac{5}{2}}{\frac{3}{7}} = \frac{x}{9}$$

$$\Rightarrow \quad \frac{5 \times 7}{2 \times 3} = \frac{x}{9}$$

$$\Rightarrow \quad 2 \times 3 \times x = 5 \times 7 \times 9$$

$$\Rightarrow \quad x = \frac{5 \times 7 \times 9}{2 \times 3}$$

$$\Rightarrow \quad x = \frac{105}{2} = 52\frac{1}{2}$$

Hence, $52\frac{1}{2}$ palas can be bought.

6. Let Harmain's age be x, when the ratio of her age to her brother's age is 1 : 2

According to the question,

Harmain's brother age = x + 4

$$\therefore \quad \frac{x}{x+4} = \frac{1}{2}$$

$$\Rightarrow \quad 2x = x + 4$$

$$\Rightarrow \quad 2x - x = 4$$

$\Rightarrow \quad x = 4$

$\therefore$ Harmain's age is 4 yrs.

7. Given, mass of equal volumes of gold and water are in the ratio 37 : 2

1 Litre of water = 1 kg in mass

Let, 1 Litre of gold = x kg in mass

According to the question,

$$\frac{x}{1} = \frac{37}{2}$$

$\Rightarrow \quad 2 \times x = 1 \times 37$

$\Rightarrow \quad x = \frac{37}{2} = 18.5$

Thus, mass of 1 litre of gold = 18.5 kg

8. We have,

Length of Plot = 500 ft

and Breadth of Plot= 200 ft

$\therefore$ Area of rectangular Plot

= Length × Breadth

= 500 × 200

= 100000 sq. ft

$= \left(\frac{100000}{43560}\right)$ acre

[$\because$ 1 acre = 43,560 sq. ft]

= 2.295 acre

So, required cow manure

= 2.295 × 10

= 22.95 tonnes

9. We have,

Volume of mug = 500 mL

Time taken to fill a mug of water = 15 seconds

Capacity of bucket = 10 litre

= 10 × 1000 mL

[$\because$ 1 L = 1000 mL]

= 10000 mL

Let, Required time = x seconds

Then, according to the question,

15 : 500 : : x : 10000

$\Rightarrow \quad \frac{15}{500} = \frac{x}{10000}$

$\Rightarrow \quad 500 \times x = 15 \times 10000$

$\Rightarrow \quad x = \frac{15 \times 10000}{500}$

$\Rightarrow \quad x = 15 \times 20$

$\Rightarrow \quad x = 300$

Thus, required time = 300 sec.

10. We know that 1 acre= 43560 sq. feet

Given that, cost of 1 acre land = ₹ 15,00,000

Let, Required cost be ₹ x.

According to the question,

43560 : 1500000 = 2400 : x

$\Rightarrow \quad \frac{43560}{1500000} = \frac{2400}{x}$

$\Rightarrow \quad 43560 \times x = 1500000 \times 2400$

$\Rightarrow \quad x = \frac{1500000 \times 2400}{43560}$

$\Rightarrow \quad x = 82644.62$

Thus, required cost is ₹ 82644.62

11. Given that,

Time taken by an oxen to plough 1 acre of land = 6 hrs

Let Time taken to plough 20 acres = x hrs

According to the question,

1 : 6 : : 20 : x

$\Rightarrow \quad \frac{1}{6} = \frac{20}{x}$

$\Rightarrow \quad 1 \times x = 6 \times 20$

$\Rightarrow \quad x = 120$

Thus, Time taken to plough by oxen 20 acres = 120 hrs

Given that, A tractor can plough the same area of field 4 times faster than a pair of oxen.

$\therefore$ Time taken by a Tractor to plough 20 acres of field $= \frac{120}{4}$ = 30 hrs

12. Given, Ratio of copper and nickel in ₹ 10 coin is 3 : 1.

and mass of the coin = 7.74 gms

Cost of copper = ₹ 906 per kg

Cost of Nickel = ₹ 1,341 per kg

Ratio = 3 : 1

Mass of copper = $7.74 \times \frac{3}{3+1}$

$= 7.74 \times \frac{3}{4}$

= 5.805 gm

$= \frac{5.805}{1000}$ Kg

[∵ 1 kg = 1000 gm]

= 0.005805 kg

Mass of Nickel = $7.74 \times \frac{1}{3+1}$

$= 7.74 \times \frac{1}{4}$

= 1.935 gm

$= \frac{1.935}{1000}$ kg

[∵ 1 kg = 1000 gm]

= 0.001935 kg

Cost of copper in ₹ 10 coin

= 0.005805 × 906

= ₹ 5.25933

and cost of nickel in ₹ 10 coin

= 0.001935 × 1341

= ₹ 2.594835

∴ Total cost of these metals in ₹ 10 coin

= Cost of copper + Cost of nickel

= ₹ 5.25933 + ₹ 2.594835

= ₹ 7.854165

Practice Exercise 7.3

1. We have, $F = \left(\frac{9C}{5}\right) + 32$

S.N.	Temprature in C	Farentieit $F = \frac{9C}{5} + 32$
a	20°C	$\left(\frac{9 \times 20}{5}\right)$ + 32 = 36 + 32 = 68°F
b	45°C	$\left(\frac{9 \times 45}{5}\right)$ + 32 = 81 + 32 = 113°F
c	100°C	$\left(\frac{9 \times 100}{5}\right)$ + 32 = 180 + 32 = 212°F
d	95.5°C	$\left(\frac{9 \times 95.5}{5}\right)$ + 32 = 9 × 19.1 + 32 = 203.9°F

2. We have $C = \frac{5}{9} \times (F - 32)$

S.N.	Temprature in F	$C = \frac{5}{9} \times (F - 32)$

a	95°F	$\frac{5}{9} \times (95 - 32) = \frac{5}{\cancel{9}} \times \cancel{63} = 35°C$
b	104°F	$\frac{5}{9} \times (104 - 32) = \frac{5}{\cancel{9}} \times \cancel{72} = 40°C$
c	122°F	$\frac{5}{9} \times (122 - 32) = \frac{5}{9} \times 90 = 50°C$
d	176.9°F	$\frac{5}{9} \times (176.9 - 32) = \frac{5}{9} \times 144.9 = \frac{724.5}{9} =$ 80.5°C

3. Since, the normal temprature of human body = 98.6°F.

So, the body temprature of patient

$= (98.6 + 4.5)°F$

$= 103.1°F$

temprature in calcius

$$= \frac{5}{9} \times (103.1 - 32)$$

$$= \frac{5}{9} \times 71.1$$

$$= \frac{355.5}{9}$$

$= 39.5°C.$

4. The maximum temprature was 40°C and the minimum temprature was 25°C.

So, difference $= 40°C - 25°C$

$= 15°C$

$$\text{difference in F°} = \left(\frac{9}{5} \times C\right) + 32$$

$$= \left(\frac{9}{\cancel{5}} \times \cancel{15}\right)$$

$= 27 + 32$

$= 59°C.$

NCERT Exercise

Chapter Innings

A. Multiple Choice Questions

1. b **2.** b

3. a **4.** a

5. c

B. Fill in the blank

1. 2 : 3 **2.** Proportion

3. Extreme terms **4.** $\frac{35}{12}$

5. 25 : 49

C. Match the following

1. b **2.** c

3. a **4.** e

5. d

D. True/False

1. True **2.** True

3. True **4.** False

5. True

E. Very Short answer type Questions

1. Ratio of 40 cm to 1.5 m

$$= \frac{40}{1.5 \times 100} = \frac{40}{150}$$

$$= \frac{4}{15}$$

Ratio is 4 : 15.

2. since, 1m = 100 cm

1.5m = 150 cm

Ratio of 90 cm to 1.5 m

$$= \frac{90}{150} = \frac{90 \div 30}{150 \div 30}$$

$$= \frac{3}{5}$$

Ratio = 3 : 5.

3. $\therefore$ Product of extreme terms

$= 45 \times 48$

$= 2160$

and product of middle terms

$= 60 \times 36$

$= 2160$

since, both products are equal.

Thus given Ratios are in proportion.

4. We have, $36 : 81 :: x : 63$

$\Rightarrow \quad 36 \times 63 = 81 \times x$

$\Rightarrow \quad x = \dfrac{\cancel{36} \times \cancel{63}}{\cancel{81}\ \cancel{9}}$

$\boxed{x = 28}$.

5. W have $36 : x :: x : 16$

$\Rightarrow \quad 36 \times 16 = x \times x$

$\Rightarrow \quad x^2 = 576$

$\Rightarrow \quad x = \sqrt{576}$

$\boxed{x = 24}$.

F. Short answer type Questions

1. Let, the length of the pole is x

Since, this is case of proportion

So, $\quad 20 : x :: 8 : 6$

$\Rightarrow \quad 20 \times 6 = 8 \times x$

$\Rightarrow \quad 8x = 120$

$\Rightarrow \quad x = \dfrac{120}{8}$

$\boxed{x = 15m}$

Thus the length of the pole is 15 m.

2. Let Atruck can run x km

$492 : 36 :: x : 33$

$\Rightarrow \quad 492 \times 33 = 36 \times x$

$\Rightarrow \quad 36x = 492 \times 33$

$\Rightarrow \quad x = \dfrac{492 \times 33}{36}$

$\Rightarrow \quad x = \dfrac{16236}{36}$

$\boxed{x = 451}$

Thus, truck can run 451 km.

3. Given the ratio of the angles is $3 : 1 : 2$

sum of the ratio $= 3 + 1 + 2 = 6$

We know that sum of the angles in a triangle is 180°.

So $\quad$ First angle $= \left(\dfrac{3}{6} \times 180\right) = 90°$

Second angle $= \left(\dfrac{1}{6} \times 180\right) = 30°$

and third angle $= \left(\dfrac{2}{6} \times 180\right)$

$= 60°$

Thus angles are 90°, 30° and 60°.

4. Total money $=$ ₹ 760

and ratio $= 8 : 11$

sum of ratio $= 8 + 11 = 19$

A's share $=$ ₹ $\left(\dfrac{8}{\cancel{19}} \times \cancel{760}\right)$

$=$ ₹ 320

B's share $=$ ₹ $\left(\dfrac{11}{\cancel{19}} \times \cancel{760}\right)$

$=$ ₹ 440

Thus share of B is ₹ 440.

5. Given perimeter of triangle

$= 90$ cm and

Ratio of sides of triangle

$= 1 : 3 : 5$

sum of ratio $= 1 + 3 + 5$

$= 9$

the length of the longest side

$= \dfrac{5}{\cancel{9}} \times \cancel{90}$

$= 50$ cm

Thus, the longest side of triangle is 50 cm.

G. Long Answer Type Questions

1. Given cost of coffee is ₹ 24 per 100 g

$= \dfrac{24 \times 1000}{100}$

$=$ ₹ 240 per kilogram

and cost of tea $=$ ₹ 180 per kilogram

Ratio of price of coffee to the cost of tea

$= \dfrac{240}{180}$

$= \dfrac{240 \div 60}{180 \div 60} = \dfrac{4}{3}$

Ratio = 4 : 3.

2. Given that the height of tower A
= 1480 cm and
The height of tower B
= 1560 cm
and weight of tower A
= 480 kg
since weigght of towers are proportional and let weight of the tower B is x kg
so, 1480 : 480 :: 1560 : x
$\Rightarrow$ $1480 \times x = 480 \times 1560$
$\Rightarrow$ $x = \frac{480 \times 1560}{1480}$
$x = 505.94$ kg
or $\boxed{x = 506 \text{ kg Approx}}$.

3. Given with scale of 1 cm
= 500 kg and
distance between two places on map
= 2.5 cm
let actual distance between places is x.
So, 1 : 500 = 2.5 : x
$\Rightarrow$ $1 \times x = 500 \times 2.5$
$\Rightarrow$ $x = 1250$ km
Thus, the actual distance between two places is 1250 km.

4. Total students in school
= 1800
No of students who opted basket ball
= 750
No of students who opted cricket
= 800
and No of students who opted table tennis
= 1800 – (750 + 800)
= 1800 – 1550
= 250

(a) Ratio $= \frac{750}{250}$
$= \frac{750 \div 250}{250 \div 250} = \frac{3}{1}$
Ratio is 3 : 1.

(b) Ratio $= \frac{300}{750}$
$= \frac{300 \div 150}{750 \div 150} = \frac{2}{5}$
Ratio is 2 : 5.

(c) Ratio $= \frac{750}{1800}$
$= \frac{750 \div 150}{1800 \div 150} = \frac{5}{12}$
Ratio is 5 : 12.

5. (a) Given ragios are 25 cm : 1 m and ₹ 40 : ₹ 160
since 1 m = 100 cm
So, Now ratios are 25 cm : 100 cm and ₹ 40 : ₹ 160.
The product of extreme terms
= 25 × 160
= 4000 and
The product of middle terms
= 100 × 40
= 4000
Since both product are equal.
Thus given ratios are in proportion.
Middle terms are 100 cm and ₹ 40 and extreme terms are 25 cm and ₹ 160.

(b) Given ratios are 39L : 65L and 6 bottles : 10 bottles product of extreme terms
= 39 × 10 = 390
and product of the middle terms
= 65 × 6 = 390
since both products are equal
So, given ratios are in proportion.

(c) Given ratios are 2 kg : 80 kg and 30 sec : 5 minutes
$\because$ 5 minutes = 5 × 60
= 300 seconds
ratios are 2 kg : 80 kg and 30 sec : 300 seconds
Product of extreme terms
= 2 × 300
= 600 and
Product of Middle terms
= 80 × 30 = 2400
since, both products are not equal

So, given numbers are in not proportion.

(d) Given ratios are 200 g : 2.5 kg and ₹ 4 : ₹ 50

$\because$ 2.5 kg = 2.5 × 1000

= 2500 g

Now ratios are 200g : 2500 g and ₹ 4 : ₹ 50

Product of extreme terms

= 200 × 50

= 10,000 and

Product of the middle term

= 2500 × 4

= 10,000

Since, both products are equal

So, given ratios are in proportion.

Extreme terms are 200 g and ₹ 50 and

Middle terms are 2500 g and ₹ 4.

H. Assertion – Reason Based Question

1. D **2.** A

3. D **4.** A

5. B.

I. Case study

1. a **2.** a

3. b **4.** d.

❑❑