5 | Power and Exponent

◆ **Let us remember :**

Dear friends, in earlier classes we have studied that multiplication is recurring addition. So, let us recall the knowledge.

$$4 + 4 + 4 + 4 + 4 = 20$$

Here, 4 is added five times.

It is written as 4×5 in short.

See the following Table, understand it and complete it :

Recurring addition	Meanings	Multiplicative form
5 + 5 + 5	Addition of 5, three times	5 × 3
3 + 3 + 3 + 3 + 3	Addition of 3, five times	3 × 5
7 + 7 + 7 + 7	Addition of 7, four times	7 × ....
8 + 8 + 8 + 8 + 8 + 8 + 8	....	.... × 7
....	Addition of 1, ten times	.... × ....
9 + 9 + 9 + 9 + 9 + 9	....	.... × ....

Thus, addition of a number with same number is called recurring addition. Recurring addition of numbers means multiplication.

◆ **Let us learn new :**

Form of Power :

As recurring addition is called multiplication, same way recurring multiplication is called exponent form.

$$4 = 2 \times 2 = 2^2$$
$$8 = 2 \times 2 \times 2 = 2^3$$
$$16 = 2 \times 2 \times 2 \times 2 = 2^4$$
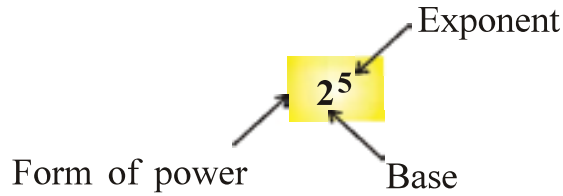$$32 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$$

The number, which multiplies many times is written as base and the number multiply how many times is written as its power.

e.g. $32 = 2 \times 2 \times 2 \times 2 \times 2$ is written in power form as 2^5.

where,

$$2^5$$

Exponent

Form of power   Base

2^5 **is a form of power, where 2 is base and 5 is exponent. (Read : Two raised to five) e.g. $10^2 \rightarrow$ Ten raised to two or Ten square.**

$5^3 \rightarrow$ **Five raised to three or five cube.**

Thus, recurring multiplication of a number with same number is called form of power. If a number repeats only one time then its exponent is not written.

e.g. $5 = 5^1 = 5$

Table 1 : Read, understand and complete :

Recurring multiplication	Form of power	Base	Exponent	Read as
$3 \times 3 \times 3 \times 3$	3^4	3	4	Three raised to 4
$5 \times 5 \times 5 \times 5 \times 5 \times 5$	5^6	....	....	Five raised to 6
....	6^5	....	....	....
....	....	7	6	....
$1 \times 1 \times 1 \times 1 \times 1$	....	....	....	....

Illustration 1 : Convert into form of power : $2 \times 2 \times 2 \times 5 \times 5$

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

$= 2^3 \times 5^2$

Illustration 2 : Convert into form of power : $2 \times 2 \times 3 \times 3 \times 7 \times 7 \times 2 \times 7 \times 7$

$\underline{2 \times 2 \times 2} \times \underline{3 \times 3} \times \underline{7 \times 7 \times 7 \times 7}$

$= 2^3 \times 3^2 \times 7^4$

Practice 1

1. **Write the following recurring multiplication into form of power :**
   (1) $2 \times 2 \times 5 \times 5 \times 12 \times 12$
   (2) $5 \times 5 \times 5 \times 14 \times 14 \times 14 \times 3 \times 3 \times 3$
   (3) $4 \times 4 \times 6 \times 6 \times 6 \times 7 \times 7 \times 7 \times 7$
   (4) $3 \times 3 \times 5 \times 3 \times 5 \times 3$

2. **Fill in the blanks, to make the statement correct :**
   (1) $8 \times 8 \times 8 \times 8 \times 8 \times 8$ is written as .... in form of power.
   (2) In 5^9, base is .... and exponent is ....
   (3) 'Ten raised to four' is written as .... in form of power.

To find the value of the form of power :

We have seen that, how recurring multiplication is written in the form of power. Now, we have to find the value of the form of power.

Illustration 1 : Find the value of 4^3.

$$4^3 = 4 \times 4 \times 4$$
$$= 16 \times 4$$
$$= 64$$

Same way, we have to find the value of the form of power :

Illustration 2 : Find the value of 10^3.

$$10^3 = 10 \times 10 \times 10$$
$$= 100 \times 10$$
$$= 1000$$

Illustration 3 : Find the value of 1^4.

$$1^4 = 1 \times 1 \times 1 \times 1$$
$$= 1$$

Illustration 4 : Find the value of 1^{10}.

$$1^{10} = 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1$$
$$= 1$$

Illustration 5 : Find the value of 1^{100}.

$$1^{100} = 1 \times 1 \times 1... \text{ hundred times}$$

Thus, if base is 1 and for any number in exponent, the answer is always 1.

Find mistake

Tick mark ✓ against the right sum and tick mark ✗ against the wrong sum :

(1)
$2^3 = 2 \times 3$
$= 6$

$2^3 = 2 \times 2 \times 2$
$= 8$

(2)
$1^5 = 1 \times 1 \times 1 \times 1 \times 1$
$= 1$

$1^5 = 1 \times 5$
$= 5$

(3)
$3^3 = 9$

$3^3 = 27$

Illustration : Find the value of following form of power :

(1) $4^2 \times 2^2$
$= 4 \times 4 \times 2 \times 2$
$= 16 \times 4$
$= 64$

(2) $3^4 \times 5^2$
$= 3 \times 3 \times 3 \times 3 \times 5 \times 5$
$= 81 \times 25$
$= 2025$

(3) $2^3 \times 3^2$
$= 2 \times 2 \times 2 \times 3 \times 3$
$= 8 \times 9$
$= 72$

(4) $2^3 \times 9^2$
$= 2 \times 2 \times 2 \times 9 \times 9$
$= 8 \times 81$
$= 648$

Practice 2

Find value :

1. (1) 3^4 (2) 10^3 (3) 11×9^2 (4) $1^5 \times 4^3 \times 5$ (5) 6^3
(6) $7^2 \times 3^4$ (7) $2^4 \times 3^2$ (8) $8^3 \times 6^2$ (9) $2^3 \times 4^3$ (10) $2^5 \times 4$

2. (1) $2^4 \times 3^2$ (2) $3^2 \times 7^2$ (3) $2^2 \times 3^2 \times 4^2$

   (4) $1^7 \times 5^2 \times 6$ (5) $2^2 \times 3^4 \times 4^2$ (6) $3^2 \times 5^3 \times 6^2$

◆ **Know these :**

Here, some figures are given differently in the form of power :

(1) $64 = 8 \times 8 = 8^2$

$64 = 4 \times 4 \times 4 = 4^3$

$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$

(2) $16 = 4 \times 4 = 4^2$

$16 = 2 \times 2 \times 2 \times 2 = 2^4$

(3) $125 = 5 \times 5 \times 5 = 5^3$

(4) $216 = 6 \times 6 \times 6 = 6^3$

$216 = 2 \times 3 \times 2 \times 3 \times 2 \times 3 = 2^3 \times 3^3$

(5) $343 = 7 \times 7 \times 7 = 7^3$

(6) Show 81 in different ways as form of power :

$81 = ... \times .... = ...^2$

$81 = ... \times .... \times .... \times .... = ...^4$

Dear friends, think about more than 7 number.

When recurring multiplication is written in short, then it is called form of power.

Exponent

$$2^5$$

Form of power   Base

Exercise
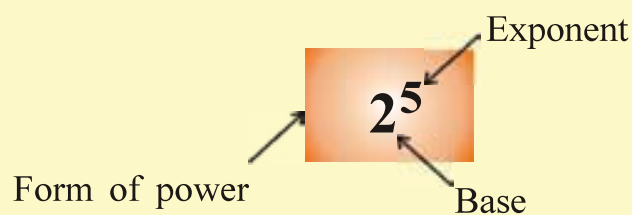
1. **Write the following recurring multiplication into the form of power :**

   (1) $13 \times 13 \times 13 \times 13 \times 13 \times 13 \times 13$

   (2) $27 \times 27 \times 27 \times 27 \times 27 \times 27 \times 27 \times 27$

   (3) $11 \times 11 \times 6 \times 6 \times 6 \times 11 \times 7 \times 7 \times 7$

2. **Find value :**

(1) 4^4 (2) $6^3 \times 1^6$ (3) $2^3 \times 8^2$ (4) $2^5 \times 3^2 \times 5$

(5) $2^4 \times 5^2$ (6) $7^2 \times 5^2$ (7) $8^2 \times 9^2$ (8) $5^3 \times 2^4$

(9) $3^3 \times 5^3$ (10) $6^3 \times 3^2$ (11) $3^3 \times 2^4 \times 5^2$ (12) $3^2 \times 6^2 \times 5^2$

☞ Answers ☜

Practice 1

1. (1) $2^2 \times 5^2 \times 12^2$ (2) $5^3 \times 14^3 \times 3^3$ (3) $4^2 \times 6^3 \times 7^4$ (4) $3^4 \times 5^2$

2. (1) 8^6 (2) 5, 9   (3) 10^4

Practice 2

1. (1) 81 (2) 1000 (3) 891 (4) 320 (5) 128 (6) 144 (7) 216 (8) 512 (9) 3969 (10) 18432

1. (1) 144   (2) 441   (3) 576   (4) 150   (5) 5184   (6) 40500

Exercise

1. (1) 13^7 (2) 27^8 (3) $11^3 \times 6^3 \times 7^3$

2. (1) 256   (2) 216   (3) 512   (4) 1440   (5) 400   (6) 1225

(7) 5184   (8) 2000   (9) 3375   (10) 1944   (11) 10800   (12) 8100

Extra knowledge :

◆ If difference between two consecutive numbers is same, then to know addition of those numbers :

$$\frac{(\text{First number} + \text{Last number}) \times \text{Total numbers}}{2}$$

e.g., Find sum of $3 + 6 + 9 + ... + 90$:

As per formula :

$= \dfrac{(3+90) \times 30}{2}$ │ $\text{Total numbers} = \dfrac{\text{Last number}}{\text{Difference between two numbers}}$

$= \dfrac{93 \times 30}{2}$

$= 1395$

◆ Think... with the help of this formula, sum of consecutive numbers, consecutive odd numbers and consecutive even numbers is possible ?