BAL BHARATI PUBLIC SCHOOL, PITAMPURA DELHI – 110034

SUBJECT:-MATHEMATICS

CHAPTER: - EXPONENTS AND POWERS

TOPIC: Introduction to Exponents

STEP 1: Guidelines

Dear Students

We have studied very large numbers like the distance between Sun and Saturn is 1,433,500,000,000m. It is difficult to read these numbers. In this topic, we will study about Exponents so that we can read, understand and compare these largenumbers.

Kindly refer to the following link to get the NCERT pdf of this chapter:

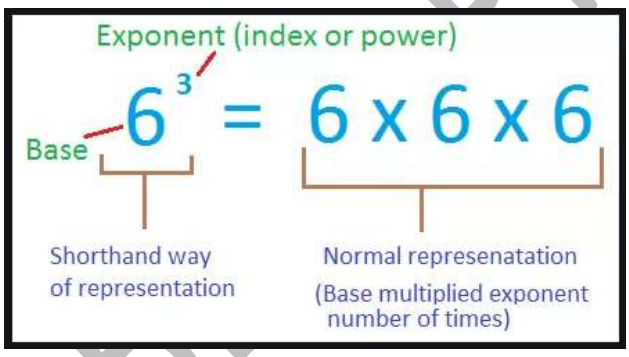
http://ncert.nic.in/textbook/textbook.htm?gemh1=13-15

STEP 2: Introduction to Exponents

We can write large numbers in shorter form using exponents.

Observe that: 10000 = 10x10x10x10 = 10^4

Here 10 is called the base and 4 is called the exponent. It is read as ten raised to the power 4 or the fourth power of ten.



For a negative integer $(-3)^4 = (-3) \times (-3) \times (-3) \times (-3) = 81$

Instead of taking any fixed number ,let us take any integer b as the base and write the numbers as :

b x b = b^2 (Read as 'b square')

b xb xb = b^3 (Read as ' b cube')

b xb xb xb = b^4 (Read as ' b raised to the power 4')

Refer to the following link to understand more about Exponents:
INTRODUCTION- https://www.examfear.com/free-video-lesson/Class-7/Maths/Exponents-and-Powers/part-1/Maths_Exponents_and_Powers_part_1_(Introduction).htm

READING EXPONENTS- https://www.examfear.com/free-video-lesson/Class-7/Maths/Exponents-and-Powers/part-2/Maths_Exponents_and_Powers_part_2_(Reading_Exponents).htm

STEP 3:Exponents of 1 and (-1)

We know that 1 multiplied by itself any number of times is 1 only.So:

$1^2 = 1$, $1^3 = 1$, $1^{10} = 1$……, $1^n = 1$ for any whole number n.

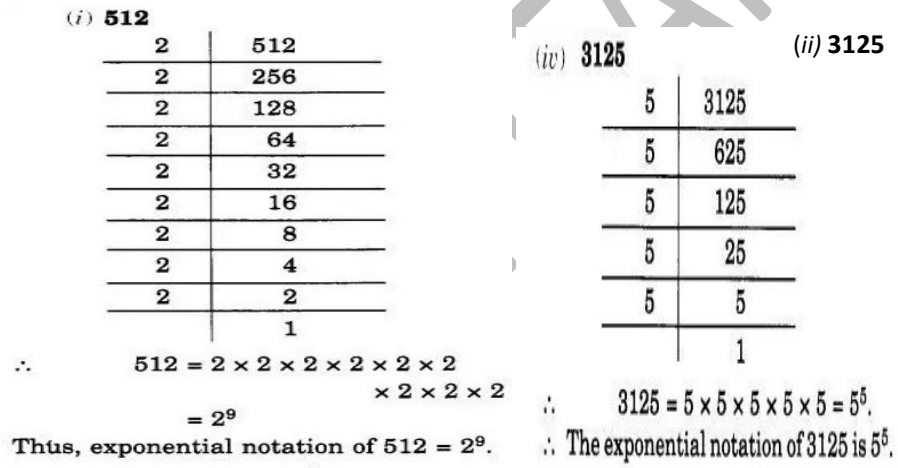
Also observe that

$(-1)^2 = 1$, $(-1)^3 = (-1)$, $(-1)^4 = 1$, $(-1)^5 = (-1)$ ……

$(-1)^{(\text{odd number})} = -1(-1)^{(\text{even number})} = 1$

STEP 4:Expressing a number in Exponential form

To express a number in exponential form we do its prime factorisation.



(i) **512**

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore$ $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 2^9$

Thus, exponential notation of $512 = 2^9$.

(ii) **3125**

(iv) **3125**

5	3125
5	625
5	125
5	25
5	5
	1

$\therefore$ $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$.

$\therefore$ The exponential notation of 3125 is 5^5.

Refer to the following link to understand more about expressing numbers in their exponential forms:https://www.examfear.com/free-video-lesson/Class-7/Maths/Exponents-and-Powers/part-3/Maths_Exponents_and_Powers_part_3_(Number_as_Product_of_Prime_Factors).htm

Step 5 : Learning about Laws of Exponents when the bases are same

The numbers in exponential form obey certain laws. These help us to simplify the expressions with exponents in a easier way.

For example: Observe the expression

$2^4 \times 2^3 = (2X2X2X2) \times (2X2X2) = 2^7$

So we can write the first Law of exponents with the same bases as

$a^m \times a^n = a^{m+n}$ (If bases are same and we multiply, then add the exponents)

Similarly ,$3^7 \div 3^4 = \frac{3X3X3X3X3X3X3}{3X3X3X3} = 3^3$

So we can write the second Law of exponents with the same bases as

$a^m \div a^n = a^{m-n}$ (If the bases are same and we divide, then subtract the exponents)

Also , $(5^2)^3 = (5x5)^3 = 5x5X5X5X5x5 = 5^6$

$(a^m)^n = a^{mXn}$(If a number has two exponents, then multiply them)

Step 6 : Learning Laws of Exponents when the exponents are same

Observe that $5^2 \times 7^2 = 5X5X7X7 = 35 \times 35 = (35)^2$

So we can write first Law of Exponent with the same exponents as

$a^m \times b^m = (a \times b)^m$

Similarly ,$a^m \div b^m = (a \div b)^m$

Step 7 : Learning Numbers with exponent zero and one

Observe that $7^5 \div 7^5 = 1$

Also $7^5 \div 7^5 = 7^{5-5} = 7^0$(using Laws of Exponents)

Therefore $7^0 = 1$

So we can write it as a law

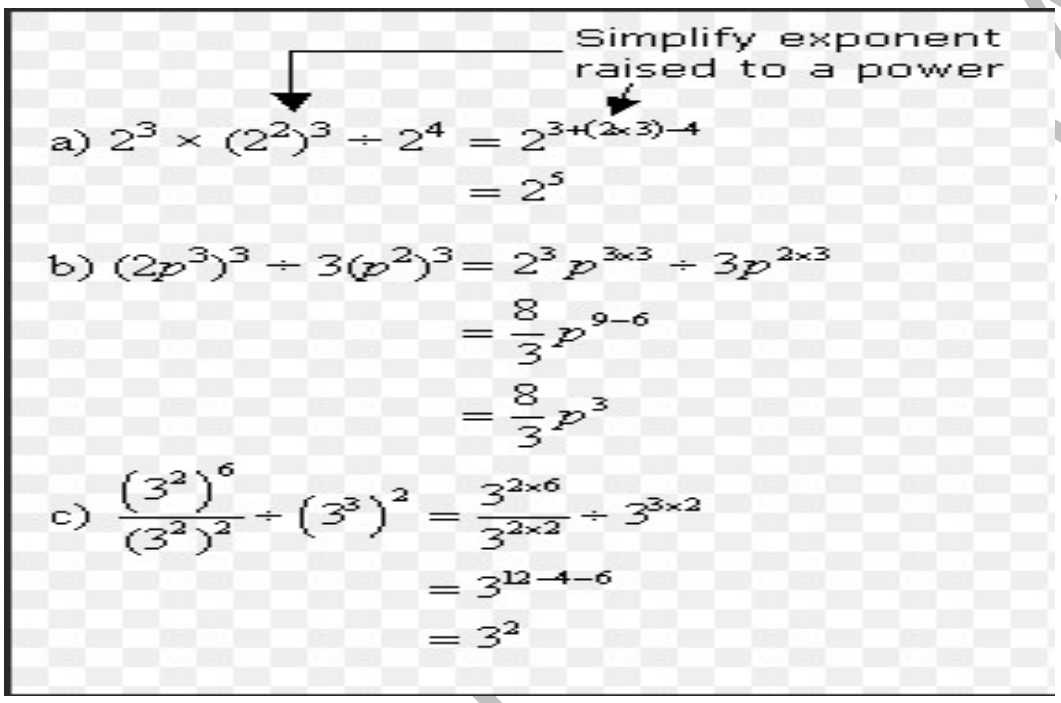
$a^0 = 1$

Also ,$a^1 = a$ **for any integer a**

Step 8: Learning Application of laws of exponents

To apply Laws of Exponents in solving expressions we should try to convert the numbers in the expression into same bases.

Observe the following example :



To learn more about application of laws of exponents refer to the following links:

DIFFERENT POWER WITH SAME BASE-https://www.examfear.com/free-video-lesson/Class-7/Maths/Exponents-and-Powers/part-5/Maths_Exponents_and_Powers_part_5_(Laws_of_Exponents,_Power_of_Same_Base).htm

SAME POWER WITH DIFFERESENT BASE-https://www.examfear.com/free-video-lesson/Class-7/Maths/Exponents-and-Powers/part-6/Maths_Exponents_and_Powers_part_6_(Power_with_same_component).htm

Step 9 : Expressing large numbers in Standard form

Observe the following :

34 = 3.4 X 10

$340 = 3.4 \times 10^2$

$3400 = 3.4 \times 10^3$

$34000 = 3.4 \times 10^4$ and so on.....

We have expressed these numbers in the standard form by expressing the decimal number between 1 and 10 multiplied by a power of 10.

Such forms of numbers are called Standard Forms.

Example 1 : Write in standard form of decimals : 3241000

Solution : Standard form of 3241000 = 3.241×10^6

Example 2: Write in expanded form : 567892

Solution : $567892 = 5 \times 10^5 + 6 \times 10^4 + 7 \times 10^3 + 8 \times 10^2 + 9 \times 10^1 + 2 \times 10^0$

Example 3 : Find the number from the following expanded form

$4 \times 10^6 + 3 \times 10^4 + 2 \times 10^3 + 5 \times 10^2 + 7 \times 10^1$

Solution : Number formed is 4032570

To understand more about standard form of exponents refer to the following link- (https://www.examfear.com/free-video-lesson/Class-7/Maths/Exponents-and-Powers/part-9/Maths_Exponents_and_Powers_part_9_(Large_Number_in_Standard_Form).htm)

Step 10 :Assignment

Attempt the following questions of NCERT in your Maths notebook

Ex 13.1

Q1 (i,ii) , Q2 (v,vi) , Q3 (iii,iv) , Q4 (i ,ii) , Q5(iii,iv) , Q6 (vi,vii,viii) , Q7 (iii,iv), Q8(i)

Ex 13.2

Q1 (all odd parts) , Q2 (all even parts) , Q3(i,ii,iv) , Q4 (i,iii) , Q5

Ex 13.3

Q1 , Q2 , Q 3 (all even parts) , Q 4 (all even parts)

STEP 11: Practice Questions

Do the following questions in your Practice notebook:

1. For any two non-zero rational numbers x and y, $x^5 \div y^5$ is equal to

(a) $(x \div y)^1$ (b) $(x \div y)^0$ (c) $(x \div y)^5$ (d) $(x \div y)^{10}$

2 $a^m \times a^n$ is equal to

(a) $(a^2)^{mn}$ (b) a^{m-n} (c) a^{m+n} (d) a^{mn}

3 $(1^0 + 2^0 + 3^0)$ is equal to

(a) 0 (b) 1 (c) 3 (d) 6

4 Value of $\frac{10^{22} + 10^{20}}{10^{20}}$ is

(a) 10 (b) 10^{42} (c) 101 (d) 10^{22}

5 The standard form of the number 12345 is

(a) 1234.5×10^1 (b) 123.45×10^2

(c) 12.345×10^3 (d) 1.2345×10^4