

# CLASS NOTES

Class: VII

Topic: CH-13 – EXPONENT AND POWERS

Subject: MATHEMATICS

## NOTES:

- **Exponents:** Exponents are used to express large numbers in shorter form to make them easy to read, understand, compare and operate upon.
- Very large numbers are difficult to read, understand, compare and operate upon. To make all these easier, we use exponents, converting many of the large numbers in a shorter form.
- Repeated multiplication of the same number can be expressed in the form of exponents

Example:  $10 \times 10 \times 10 \times 10 = 10,000 = 10^4$  (read as 10 raised to 4)

$3 \times 3 \times 3 \times 3 \times 3 = 243 = 3^5$  (read as 3 raised to 5)

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128 = 2^6$  (read as 2 raised to 6)

Here, 10, 3 and 2 are the bases, whereas 4, 5 and 6 are their respective exponents. We also say, 10,000 is the 4th power of 10, 243 is the 5th power of 3, etc.

- **Expressing Large Numbers in the Standard Form:** Any number can be expressed as a decimal number between 1.0 and 10.0 (including 1.0) multiplied by a power of 10. Such form of a number is called its standard form or scientific notation.

## EXERCISE 13.1

**Q1: Find the value of:**

(i)  $2^6$                       (ii)  $9^3$                       (iii)  $11^2$                       (iv)  $5^4$

**Solution:** (i)  $2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$

(ii)  $9^3 = 9 \times 9 \times 9 = 729$

(iv)  $5^4 = 5 \times 5 \times 5 \times 5 = 625$

**Q2: Express the following in exponential form:**

(i)  $6 \times 6 \times 6 \times 6$                       (ii)  $t \times t$

(iii)  $b \times b \times b \times b$                       (iv)  $5 \times 5 \times 7 \times 7 \times 7$

(v)  $2 \times 2 \times a \times a$                       (vi)  $a \times a \times a \times c \times c \times c \times c \times d$

**Solution:** (i)  $6 \times 6 \times 6 \times 6 = 6^4$

(ii)  $t \times t = t^2$

(iii)  $b \times b \times b \times b = b^4$

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

(vi)  $a \times a \times a \times c \times c \times c \times c \times d = a^3 c^4 d$

**Q3: Express the following numbers using exponential notation:**

(i) 512                      (ii) 343                      (iii) 729                      (iv) 3125

**Solution:** (i)  $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^9$

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

(iii)  $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

(iv)  $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$

**Q4: Identify the greater number, wherever possible, in each of the following?**

(i)  $4^3$  or  $3^4$                       (ii)  $5^3$  or  $3^5$                       (iii)  $2^8$  or  $8^2$

(iv)  $100^2$  or  $2^{100}$                       (v)  $2^{10}$  or  $10^2$

**Solution:** (i)  $4^3 = 4 \times 4 \times 4 = 64$

$3^4 = 3 \times 3 \times 3 \times 3 = 81$

- Therefore,  $3^4 > 4^3$
- (ii)  $5^3 = 5 \times 5 \times 5 = 125$   
 $3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$   
 Therefore,  $3^5 > 5^3$
- (iii)  $2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$   
 $8^2 = 8 \times 8 = 64$   
 Therefore,  $2^8 > 8^2$
- (iv)  $100^2$  or  $2^{100}$   
 $2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 1024$   
 $2^{100} = 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024$   
 $100^2 = 100 \times 100 = 10000$   
 Therefore,  $2^{100} > 100^2$
- (v)  $2^{10}$  and  $10^2$   
 $2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 1024$   
 $10^2 = 10 \times 10 = 100$   
 Therefore,  $2^{10} > 10^2$

**Q5: Express each of the following as product of powers of their prime factors:**

- (i) 648                      (ii) 405                      (iii) 540                      (iv) 3,600

- Solution:** (i)  $648 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 = 2^3 \times 3^4$   
 (iii)  $540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5 = 2^2 \times 3^3 \times 5$   
 (iv)  $3600 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5 = 2^4 \times 3^2 \times 5^2$

**Q6. Simplify**

- (i)  $2 \times 10^3$                       (ii)  $7^2 \times 2^2$                       (iii)  $2^3 \times 5$                       (iv)  $3 \times 4^4$   
 (v)  $0 \times 10^2$                       (vi)  $5^2 \times 3^3$                       (vii)  $2^4 \times 3^2$                       (viii)  $3^2 \times 10^4$

- Solution:** (i)  $2 \times 10^3 = 2 \times 10 \times 10 \times 10 = 2 \times 1000 = 2000$   
 (ii)  $7^2 \times 2^2 = 7 \times 7 \times 2 \times 2 = 49 \times 4 = 196$   
 (iii)  $2^3 \times 5 = 2 \times 2 \times 2 \times 5 = 8 \times 5 = 40$   
 (iv)  $3 \times 4^4 = 3 \times 4 \times 4 \times 4 \times 4 = 3 \times 256 = 768$   
 (v)  $0 \times 10^2 = 0 \times 10 \times 10 = 0$   
 (vi)  $5^2 \times 3^3 = 5 \times 5 \times 3 \times 3 \times 3 = 25 \times 27 = 675$   
 (vii)  $2^4 \times 3^2 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 = 16 \times 9 = 144$   
 (viii)  $3^2 \times 10^4 = 3 \times 3 \times 10 \times 10 \times 10 \times 10 = 9 \times 10000 = 90000$

**Q7: Simplify:**

- (i)  $(-4)^3$                       (ii)  $(-3) \times (-2)^3$   
 (iii)  $(-3)^2 \times (-5)^2$                       (iv)  $(-2)^3 \times (-10)^3$

- Solution:** (iii)  $(-3)^2 \times (-5)^2 = (-3) \times (-3) \times (-5) \times (-5) = 9 \times 25 = 225$   
 (iv)  $(-2)^3 \times (-10)^3 = (-2) \times (-2) \times (-2) \times (-10) \times (-10) \times (-10) = (-8) \times (-1000) = 8000$

**ASSIGNMENT:**

**EXERCISE-13.1 – Q1- iii, Q2- v, Q5- ii, Q.6 -i, ii**