**Chapter-3**

**Surds and indices**

1. **Laws of Indices**

i. amx an = am+n

ii. am/an = am-n
iii. (am)n =amn
iv. (ab)n= anbn
v. (a/b)n = an/bn
vi. a0= 1

1. **Surds:** Let a be a rational number and n be a positive integer such that a1/n = n√a is irrational. Then, n√a is called a surd of order n.
2. **Laws of Surds:**

 (i) n√a = a1/2

(ii) n √ab = n √a \* n √b

(iii) n √a/b = n √a / n √b

(iv) (n √a)n = a

(v) m√(n√(a)) = mn√(a)

(vi) (n√a)m = n√am

**Example**: If 5x+3 = (25)3x–4, Then x = ?

**Answer:** 5x+3 = (25)3x–4 = 56x–8

 x+3 = 6x – 8

 5x = 11

x = 11/5

**Example**: If 2x - 1 + 2x + 1 = 1280, then find the value of x.

**Answer:** 2x - 1 + *2X+* 1 = 1280 ⬄ 2x-1 (1 +22) = 1280

 ⬄ 2x-1 = 1280 / 5 = 256 = 28 ⬄ x -1 = 8 ⬄ x = 9.

 Hence, x = 9

**Example**: Find the Value of {(16)3/2 + (16)-3/2}

**Answer:** [(16)3/2 + (16)-3/2 = (42)3/2 + (42)-3/2 = 4(2 x 3/2) + 4{ 2 x (-3/2)}

 = 43 + 4-3 = 43 + (1/43) = (64 + (1/64)) = 4097/64.

**Example**: Find the largest from among 4√6, √2 and 3√4*.*

**Answer:** Given surds are of order 4, 2 and 3 respectively. Their L.C.M. is 12, changing each to a surd of order 12, we get:

4√6 = 61/4 = 6((1/4) x (3/3)) = 63/12 = (63)1/12 = (216)1/12.

√2 = 21/2 = 2((1/2) x (6/6)) = 26/12 = (26)1/12 = (64)1/12.

3√4 = 41/3 = 4((1/3) x (4/4)) = 44/12 = (44)1/12 = (256)1/12.

Clearly, (256)1/12 > (216)1/12 > (64)1/12

Largest one is (256)1/12. i.e. 3√4

**Example**: Simplify [(xa / xb)^(a2+b2+ab)] X [(xb / xc )^ b2+c2+bc)] X [(xc/xa)^(c2+a2+ca)]

**Answer:** Given Expression

= [{x(a - b)}^(a2 + b2 + ab)].[ (x(b - c)}^ (b2 + c2 + bc)].[(x(c - a)}^(c2 + a2 + ca])

= [x(a - b)(a2 + b2 + ab) . x(b - c) (b2 +c2+ bc).x(c- a) (c2 + a2 + ca)]

= [x^(a3-b3)].[x^(b3-e3)].[x^(c3-a3)] = x^(a3-b3+b3-c3+c3-a3) = x0 = 1.

**Example**: If (1/5)3y = 0.008, then find the value of(0.25)y.

**Answer:** (1/5)3y = 0.008 = 8/1000 = 1/125 = (1/5)3 ⬄ 3y = 3 ⬄ Y = 1.

 ∴ (0.25)y = (0.25)1 = 0.25.