

# SURDS & INDICES (घातांक एवं करणी)



एक Sheets 140 प्रश्न

(7-8 class)

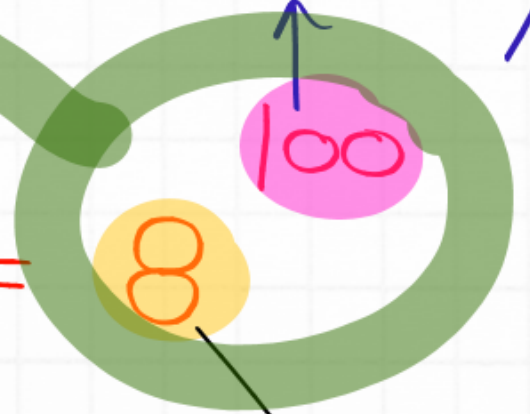


indices घातक

$8 \times 8 \times 8 \times 8 \dots$

100 घात

=



power/exponent  
/ घात

100

8

Base



## LAW OF INDICES:-

## (घातांक के नियम)

▪  $a \times a \times a \times \dots \dots \dots n \text{ बार} = a^n$

▪  $7 \times 7 \times 7 \times 7 \times 7 \times \dots \dots \dots 40 \text{ बार} = 7^{40}$

Power (घात)  $\uparrow$

Base (आधार)  $\rightarrow$

▪  $a^m \times a^n = a^{m+n} \quad (a \neq 0)$

$6^3 \times 6^2 = 6^5$

$\frac{a^m}{a^n} = a^{m-n}$

$6 \times 6 \times 6 \times 6 \times 6 = 6^5$



## LAW OF INDICES:-

## (घातांक के नियम)

When  $a \neq 0$

$$a^0 = 1$$

$$a^{-1} = \frac{1}{a} \quad (a \neq 0)$$

$$a^{-n} = \frac{1}{a^n} \gg a^n = \frac{1}{a^{-n}} \rightarrow \left(\frac{a}{b}\right)^n = \left(\frac{b}{a}\right)^{-n}$$

$$(-1)^n \rightarrow \begin{cases} +1 & (n = \text{even}) \\ -1 & (n = \text{odd}) \end{cases}$$

$$(-1)^{10} = +1$$

$$(-1)^5 = -1$$



$$(a^m)^n = (a^n)^m = a^{m \cdot n}$$

$$(5^4)^3 = 5^4 \times 5^4 \times 5^4 = 5^{12}$$



- $(a^m)^n = (a^n)^m = a^{m \times n}$  ✓
- $(a^m)^n \neq a^{mn}$



- $(2^3)^4 \neq 2^{3^4}$
- $2^{12} \neq 2^{81}$

- $(a \times b \times c)^n = a^n \times b^n \times c^n$

- $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad (b \neq 0)$

$$15^8 = (5 \times 3)^8 \\ = 5^8 \times 3^8$$

$$\left(\frac{13}{9}\right)^4 = \frac{13^4}{9^4} \checkmark$$





LAW OF INDICES:-

(घातांक के नियम)

If,  $a^m = a^n$  then  $m = n$

If,  $a^m = b^m$  then  $a = b$

$x-7$   
 $5 = 3/25$   
 $x-7 = 5$   
 $\Rightarrow x-7=5$   
 $x=12$   
 $x=6$



# शुद्ध संख्या

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

$$2^5 = 32 \Rightarrow 2 = 32^{\frac{1}{5}} = \sqrt[5]{32}$$

order of root/index

Radical

$$\sqrt[5]{32} = 2$$

$$\sqrt[4]{81} = 3$$

$$\sqrt[3]{216} = 6$$

$$\sqrt{25} = \sqrt{25} = 5$$

$$\sqrt{15} \rightarrow \text{irrational no} \\ \approx 3.9 \dots$$

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

$$a^{\frac{1}{2}} = \sqrt{a}$$

$$a^{\frac{1}{3}} = \sqrt[3]{a}$$

$$a^{\frac{1}{8}} = \sqrt[8]{a}$$

# SURDS

# करणी

❖ Ex :-

$$3^4 = 81$$

$$\Rightarrow 3 = 81^{\frac{1}{4}}$$

$$x^n = a \Rightarrow x = a^{\frac{1}{n}} = \sqrt[n]{a}$$

- ❖  $81^{\frac{1}{4}} = 3$
- ❖  $125^{\frac{1}{3}} = 5$
- ❖  $32^{\frac{1}{5}} = 2$
- ❖  $196^{\frac{1}{2}} = 14$





## LAW OF SURDS:-

## करणी का नियम

1)  ${}^n\sqrt{a} = a^{\frac{1}{n}}$  ✓

2)  ${}^n\sqrt{ab} = {}^n\sqrt{a} \times {}^n\sqrt{b} = a^{\frac{1}{n}} \times b^{\frac{1}{n}} = (ab)^{\frac{1}{n}}$

3)  $\frac{{}^n\sqrt{a}}{\sqrt[n]{b}} = \frac{{}^n\sqrt{a}}{{}^n\sqrt{b}} = \left(\frac{a}{b}\right)^{\frac{1}{n}}$

4)  $({}^n\sqrt{a})^m = {}^n\sqrt{a^m} = a^{\frac{m}{n}}$  ✓

5)  ${}^n\sqrt{{}^m\sqrt{a}} = {}^n\sqrt{a^{\frac{1}{m}}} = a^{\frac{1}{mn}} = {}^{mn}\sqrt{a}$  ✓



$$\left(\sqrt[n]{a}\right)^m = \left(a^{\frac{1}{n}}\right)^m = \left(a^m\right)^{\frac{1}{n}} = \sqrt[n]{a^m}$$

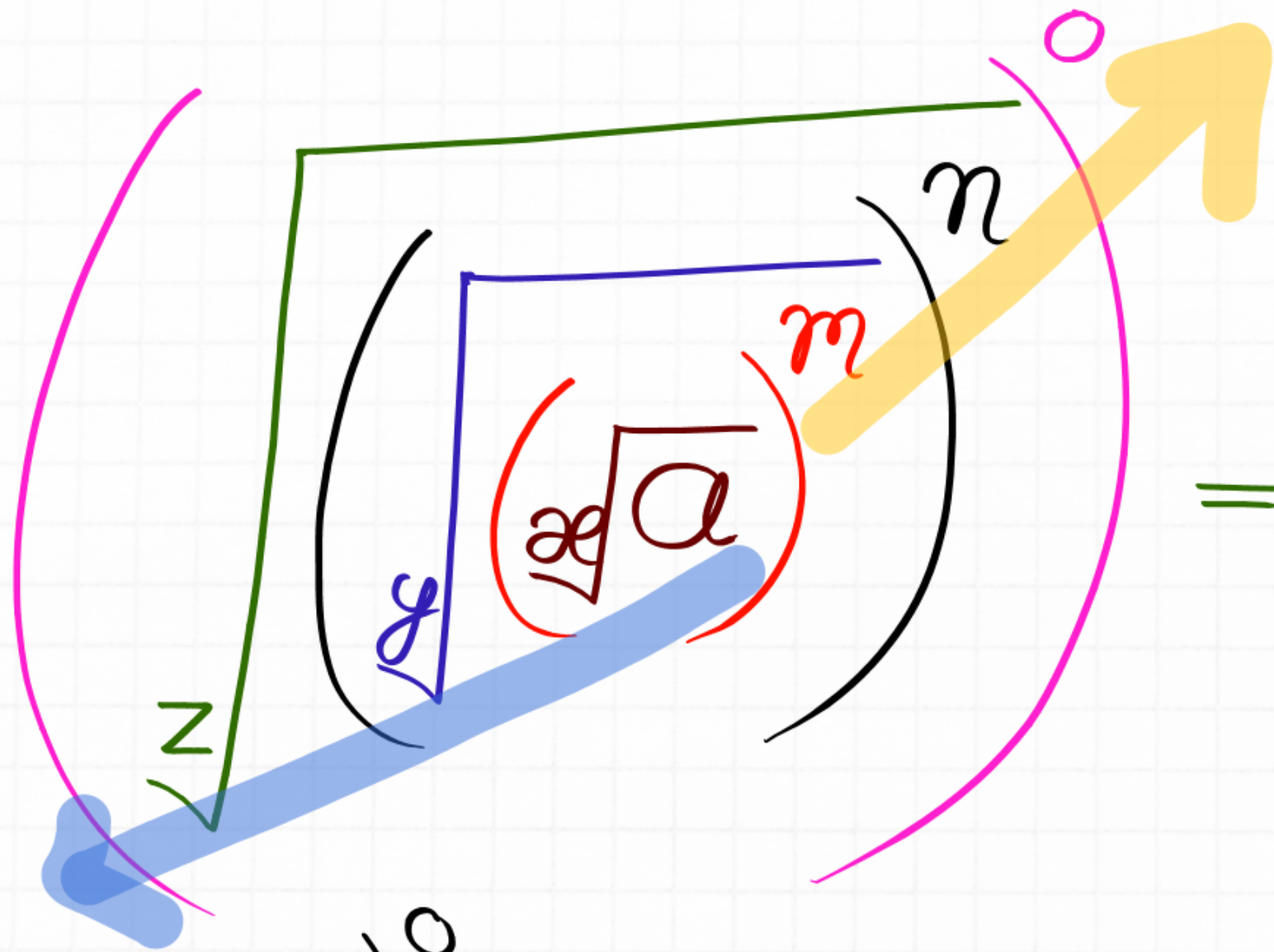
$$\left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m} = a^{\frac{m}{n}}$$

$$\sqrt[3]{19^7} = \left(\sqrt[3]{19}\right)^7$$

$$53^{\frac{9}{4}} = \left(\sqrt[4]{53}\right)^9 = \sqrt[4]{53^9}$$

$$\sqrt[n]{\sqrt[m]{a}} = \left(a^{\frac{1}{m}}\right)^{\frac{1}{n}} = a^{\frac{1}{mn}} = \sqrt[nm]{a}$$

$$\sqrt[n]{\sqrt[m]{a}} = \sqrt[nm]{a}$$



$$= a^{\frac{mno}{zyz}}$$

$$\left( a^m \right)^n = a$$

$$\sqrt{z \sqrt{y \sqrt{a}}} = a^{\frac{1}{zyz}}$$

$$\sqrt[3]{\sqrt{17}} = \sqrt{17}$$

$$\sqrt[5]{\sqrt[4]{\sqrt[3]{\sqrt{13}}}} = \sqrt[120]{13}$$

1. The value of  $(0.04)^{-1.5}$  is?

$(0.04)^{-1.5}$  का मान है?

**(RRB ALP 2024)**

[A] 25

[C] 625

[B] 250

[D] 125

$$\begin{aligned} (0.04)^{-1.5} &= \left(\frac{1}{0.04}\right)^{1.5} \\ &= 25^{\frac{3}{2}} \\ &= \left(25^{\frac{1}{2}}\right)^3 \\ &= 5^3 = 125 \end{aligned}$$



2. If  $3x - y = 12$ , then find  $\frac{8^x}{2^y}$ ?

यदि  $3x - y = 12$  है, तो  $\frac{8^x}{2^y}$  ज्ञात कीजिये?

[A] 2021

[C] 8192

$$= \frac{2^{3x}}{2^y}$$

[B] 4096

[D] 2048

$$= 2^{3x-y}$$

$$= 2^{12} = 4096$$



3. If  $8^{3x-5} = \frac{1}{32^{7-4x}}$  then  $x=?$

[A]  $\frac{16}{9}$

[B]  $\frac{20}{11}$  ✓

[C]  $\frac{25}{13}$

[D] 2

$(2^3)^{3x-5}$

$8^{3x-5} = 32^{4x-7}$

$(2^5)^{4x-7}$

$2^{3x-15} = 2^{4x-35}$

$3x-15 = 4x-35$

$11x = 20$

$x = \frac{20}{11}$



4. If  $625^{2x-3} = 25^{6148}$  then  $x=?$

(UPSI exam 2011)

[A] 2

[C] 4

[B] 3

[D] 5

$$625^{2x-3} = 25^6$$

$$25^{2(2x-3)} = 25^6$$

$$2x-3 = 3$$



5. If  $\left(\frac{x}{y}\right)^{5a-3} = \left(\frac{y}{x}\right)^{17-3a}$ , what is the value of a?

यदि  $\left(\frac{x}{y}\right)^{5a-3} = \left(\frac{y}{x}\right)^{17-3a}$  तो a का मान क्या है?

[A] -6

[B] -5

[C] ~~-7~~

[D] -8

$$\left(\frac{x}{y}\right)^{5a-3} = \left(\frac{y}{x}\right)^{3a-17}$$

$$5a-3 = 3a-17$$

$$a = -7$$

6. If  $x^{x\sqrt{x}} = (\underbrace{x\sqrt{x}})^x$ , then x equal to?

[A] 4/9

[B] 16/9

[C] 3/2

[D] 9/4

$$\cancel{x} \sqrt{\cancel{x}} = \sqrt[3]{\cancel{x}}$$

Handwritten diagram showing the simplification of the equation  $x^{x\sqrt{x}} = (x\sqrt{x})^x$ . The terms  $x$  and  $\sqrt{x}$  are crossed out with red lines. A red arrow points from the  $\sqrt{x}$  term to the  $x$  term in the denominator of the cube root, indicating the simplification of the exponent. The result is  $x = \sqrt[3]{x}$ , with the  $x$  terms circled in yellow.

$$\sqrt{x} = \frac{3}{2}$$
$$x = \frac{9}{4}$$

$$x \sqrt{x} = x^1 \times x^{\frac{1}{2}}$$
$$= x^{\frac{3}{2}}$$



7. If  $x$  and  $y$  are natural numbers such that  $x + y = 2021$ , then what is the value of  $(-1)^x + (-1)^y$  ?  
यदि  $x$  तथा  $y$  प्राकृतिक संख्याएँ इस प्रकार हैं कि  $x + y = 2021$  है; तो  $(-1)^x + (-1)^y$  का मान क्या है?

[A] 2

[B] -2

[C] 0

[D] 1

$0 \in \text{odd} = -1 + 1 = 0$



Given that  $87^{0.27} = x$ ,  $87^{0.15} = y$  and  $x^z = y^6$ , then the value of  $z$  is close to:

यह देखते हुए कि  $87^{0.27} = x$ ,  $87^{0.15} = y$  &  $x^z = y^6$ , तो  $z$  का मान करीब है:

(RRB RPF SI 2024)

[A] 5.77

[C] 3.16

~~[B] 2.15~~

~~[D] 3.33~~

$$87^{.27z} = 87^{.9}$$

$$\Rightarrow .27z = .9$$

$$z = \frac{10}{3}$$

$$\approx 3.33$$



**31. The value of  $\frac{1}{(9-4\sqrt{5})^2} + \frac{1}{(9+4\sqrt{5})^2}$  is:**

$\frac{1}{(9-4\sqrt{5})^2} + \frac{1}{(9+4\sqrt{5})^2}$  का मान ज्ञात करें।

[A] 322

[B] 424

[C] 246

[D] 286

