



SURDS & INDICES



क़रणी

पैंकल



INDICES (घातांक)

8 × 8 × 8 × 8 100 बार =

**Power/ Exponent
घात**

8¹⁰⁰

Base

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

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

Power (घात)

Base (आधार)

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

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



$$7^3 \times 7^2 = 7^5$$

$$\underline{7 \times 7 \times 7 \times 7 \times 7}$$

$$\frac{7^8}{7^5} =$$

$$7^3$$

$$\underline{\cancel{7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7} \quad 7 \times 7 \times 7}$$

$$\frac{93^{16}}{93^{29}} = \frac{1}{93^{29-16}} = \frac{1}{93^{13}}$$



LAW OF INDICES (घातांक के नियम):-

When, $a \neq 0$

$$a^0 = 1$$

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

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

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

$$1^n = 1$$

$$\frac{1}{14} = 14^{-1}$$

$$27 = \frac{1}{27^{-1}}$$

$$\frac{1}{5^{11}} = 5^{-11}$$

$$\left(\frac{300}{2}\right)^{10} = \left(\frac{2}{300}\right)^{-10}$$

$$8^6 = \frac{1}{8^{-6}}$$

LAW OF INDICES:-

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

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

$$(21^{10})^9 = (21^9)^{10} = 21^{90}$$

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

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

- $(a^m)^n \neq a^{m^n}$

Example

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

- $2^{12} \neq 2^{81}$

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

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

$$35^{||} = (5 \times 7)^{||} = 5^{||} \times 7^{||}$$



$$(2^3)^4 \neq 2^3{}^4$$

$$2^{12} \neq 2^{81}$$

$$2^{(3^4)} = 2^{81}$$

LAW OF INDICES:-

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

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

$$5^5 = 3125$$

EXAMPLE

$$5^{2x-7} = 3125$$

$$5^{2x-7} = 5^5$$

$$2x-7=5$$

$$2x=12$$

$$x=6$$

1. $\frac{(a^7 \times b^8 \times c^7)}{(a^9 \times b^5 \times c^4)}$ in simplified form is:

$\frac{(a^7 \times b^8 \times c^7)}{(a^9 \times b^5 \times c^4)}$ का सरलीकृत रूप ज्ञात कीजिए।

(SSC CGL MAINS 2024) (RRB RPF SI 2024)

[A] ~~$(a^0) \times (b^2) \times (c^1)$~~

[B] ~~$(a^{-7}) \times (b^2) \times (c^{-4})$~~

☒ [C] $(a^{-2}) \times (b^3) \times (c^3)$

[D] ~~$(a^{-5}) \times (b^{-8}) \times (c^0)$~~

$\rightarrow a^{-2} \times b^3 \times c^3$

2. The simplified value of $\frac{(98^6 \times 18^{14} \times 2^{15})}{(98^5 \times 18^{13} \times 2^{13})}$ is.

$\frac{(98^6 \times 18^{14} \times 2^{15})}{(98^5 \times 18^{13} \times 2^{13})}$ का सरलीकृत मान ज्ञात कीजिए।

(RRB Section Controller 2025)

[A] 7058 ~~X~~

[C] 7051 ~~X~~

[B] 7056 ✓

[D] 7055 ~~X~~

$a^1 = a$

$98 \times 18 \times 4$

3. Find the value of $57^{-8} \div 57^{17} \times 57^{-18}$.

$57^{-8} \div 57^{17} \times 57^{-18}$ का मान ज्ञात कीजिए।

(RRB NTPC 12th LEVEL CBT-1 2025)

[A] 57^{-36}

[B] 57^{-46}

[C] 57^{-43}

[D] 57^{-45}

$$57^{-25} \times 57^{-18}$$

$$\frac{57^{-8}}{57^{17}} = 57^{-25}$$

$$= 57^{-43}$$

4. 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

$$87^{.27Z} = 87^{.15 \times 6}$$

$$.27Z = .15 \times 6$$

$$Z = \frac{10}{3} \approx 3.33$$

5. Given that $95^{0.53} = x$, $95^{0.83} = y$ and $x^z = y^8$, then the value of z is close to:
 दिया गया है कि $95^{0.53} = x$, $95^{0.83} = y$ और $x^z = y^8$ है, तो z का मान _____ के निकटतम होगा।

(RRB NTPC 12th LEVEL 2025)

[A] 13.4

[B] 15.92

[C] 12.53

[D] 11.75

$$95^{0.53z} = 95^{0.83 \times 8}$$

$$95 = 95$$

$$z = \frac{664}{53}$$

12.53

Surds (करणी) :

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

Base

Order of Surd / index

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

Radicand

$$2^5 = 32 \Rightarrow (2^5)^{\frac{1}{5}} = 32^{\frac{1}{5}}$$

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

Surd

$$\sqrt{25} = 25^{\frac{1}{2}} = 5$$

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

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

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

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

$$\sqrt[3]{15} = (\text{irrational No.}) \text{ अपरिमेय} \\ \approx 3.9 \dots \dots \dots$$

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



■ $a^{\frac{1}{n}} = \sqrt[n]{a}$

■ $a^{\frac{1}{2}} = \sqrt{a}$

■ $a^{\frac{1}{3}} = \sqrt[3]{a}$

■ $a^{\frac{1}{8}} = \sqrt[8]{a}$

Surds (करणा) :

Example:-

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

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

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

$$125^{\frac{1}{3}} = 5$$

$$32^{\frac{1}{5}} = 2$$

$$196^{\frac{1}{2}} = 14$$

Law of Surds (करणी का नियम) :

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

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

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

$$4) \quad \left(\sqrt[n]{a}\right)^m = a^{\frac{m}{n}}$$

$$5) \quad \sqrt[n]{\sqrt[m]{a}} = \sqrt[n]{a^{\frac{1}{m}}} = a^{\frac{1}{mn}} = \sqrt[mn]{a}$$




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

$$\left(\sqrt[3]{7}\right)^4 = \sqrt[3]{7^4}$$

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

$$(a^m)^n = a^{mn}$$

$$\sqrt[5]{\sqrt[4]{\sqrt[3]{\sqrt[2]{37}}}} = \sqrt[120]{37}$$

~~$$\left\{ \left(37^{\frac{1}{2}} \right)^{\frac{1}{3}} \right\}^{\frac{1}{4}} \right\}^{\frac{1}{5}} = 37^{\frac{1}{120}}$$~~

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

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



$$\sqrt[4]{\sqrt[3]{\sqrt[2]{5}}} = \sqrt[24]{5}$$

$$\frac{5^{\frac{1}{24}}}{5^{\frac{1}{24}}} = 1$$

$$\sqrt[4]{5} \sqrt[3]{5} \sqrt[2]{5} = 5^{\frac{1}{4}} \times 5^{\frac{1}{3}} \times 5^{\frac{1}{2}}$$

$$= 5^{\frac{1}{24} + \frac{1}{12} + \frac{1}{4}}$$

$$= 5^{\frac{1+2+6}{24}}$$

$$= 5^{\frac{9}{24}} = \sqrt[8]{125}$$



$$\sqrt[5]{\sqrt[4]{\sqrt[3]{\sqrt[2]{13}}}} = \sqrt[120]{13}$$



$$\left(\sqrt[z]{\left(\sqrt[y]{\left(\sqrt[x]{a} \right)^m} \right)^n} \right)^o = a^{\frac{mno}{xyz}}$$

$$\left((a^m)^n \right)^o = a^{mno}$$

$$\sqrt[z]{\sqrt[y]{\sqrt[x]{a}}} = a^{\frac{1}{xyz}}$$



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

$(0.04)^{-1.5}$ का मान है?

(RRB ALP 2024)

[A] 25

[B] 250

[C] 625

[D] 125