

General instructions for Students: Whatever be the notes provided, everything must be copied in the Mathematics copy and then do the HOMEWORK in the same copy.

Class – IX

8. INDICES (Part-I)

MATHS

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

$$\text{Base} \longrightarrow a^n \longleftarrow \text{Exponent or index}$$

a^n is the exponential form.

LAWS OF EXPONENTS FOR REAL NUMBERS

For any positive real numbers a and b , and m, n are rational numbers, then

- (i) $a^m \cdot a^n = a^{m+n}$
- (ii) $(a^m)^n = a^{mn}$
- (iii) $\frac{a^m}{a^n} = a^{m-n}$
- (iv) $a^m \cdot b^m = (ab)^m$
- (v) $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
- (vi) $a^{-n} = \left(\frac{1}{a}\right)^n = \frac{1}{a^n}$
- (vii) $a^n = b^n, n \neq 0 \Rightarrow a = b$
- (viii) $a^m = a^n \Rightarrow m = n, a \neq 1$

EXERCISE – 8

PART – I

Simplify the following:

2. (ii) $\frac{a^{-1}+b^{-1}}{(ab)^{-1}}$

Solution: $\frac{a^{-1}+b^{-1}}{(ab)^{-1}} = \frac{\frac{1}{a}+\frac{1}{b}}{\frac{1}{ab}} = \frac{\frac{b+a}{ab}}{\frac{1}{ab}} = \frac{b+a}{ab} \div \frac{1}{ab} = \frac{b+a}{ab} \times \frac{ab}{1} = b + a$ **Ans.**

5. (ii) $(0.027)^{-\frac{1}{3}}$

Solution: $(0.027)^{-\frac{1}{3}} = \left(\frac{27}{1000}\right)^{-\frac{1}{3}} = \left\{\left(\frac{3}{10}\right)^3\right\}^{-\frac{1}{3}} = \left(\frac{3}{10}\right)^{3 \times \left(-\frac{1}{3}\right)} = \left(\frac{3}{10}\right)^{-1} = \frac{10}{3} = 3\frac{1}{3}$ **Ans.**

$$7(ii) \quad \frac{5 * (25)^{n+1} - 25 * (5)^{2n}}{5 * (5)^{2n+3} - (25)^{n+1}}$$

$$\begin{aligned} \text{Solution: } \frac{5 * (25)^{n+1} - 25 * (5)^{2n}}{5 * (5)^{2n+3} - (25)^{n+1}} &= \frac{5 * (5^2)^{n+1} - 5^2 * (5)^{2n}}{5 * (5)^{2n+3} - (5^2)^{n+1}} \\ &= \frac{5 * 5^{2n} * 5^2 - 5^2 * (5)^{2n}}{5 * 5^{2n} * 5^3 - 5^{2n} * 5^2} \\ &= \frac{5^{2n} * 5^2 (5 - 1)}{5^{2n} * 5^2 (5^2 - 1)} = \frac{4}{24} = \frac{1}{6} \quad \text{Ans.} \end{aligned}$$

$$10.(i) \quad (3^2)^0 + 3^{-4} \times 3^6 + \left(\frac{1}{3}\right)^{-2}$$

$$\text{Solution: } (3^2)^0 + 3^{-4} \times 3^6 + \left(\frac{1}{3}\right)^{-2} = 3^0 + 3^{-4+6} + 3^2 = 1 + 3^2 + 3^2 = 19 \quad \text{Ans.}$$

$$12(i) \quad \left(\frac{64}{125}\right)^{\frac{2}{3}} \div \frac{1}{\left(\frac{256}{625}\right)^{\frac{1}{4}}} + \left(\frac{\sqrt{25}}{3\sqrt{64}}\right)^0$$

$$\begin{aligned} \text{Solution: } \left(\frac{64}{125}\right)^{\frac{2}{3}} \div \frac{1}{\left(\frac{256}{625}\right)^{\frac{1}{4}}} + \left(\frac{\sqrt{25}}{3\sqrt{64}}\right)^0 &= \left\{\left(\frac{4}{5}\right)^3\right\}^{\frac{-2}{3}} \div \frac{1}{\left\{\left(\frac{4}{5}\right)^4\right\}^{\frac{1}{4}}} + 1 \\ &= \left(\frac{4}{5}\right)^{-2} \times \left(\frac{4}{5}\right)^1 + 1 \\ &= \left(\frac{4}{5}\right)^{-2+1} + 1 \\ &= \left(\frac{4}{5}\right)^{-1} + 1 \\ &= \frac{5}{4} + 1 \\ &= \frac{9}{4} = 2\frac{1}{4} \quad \text{Ans.} \end{aligned}$$

$$13.(ii) \quad 3^n \times 9^{n+1} \div (3^{n-1} \times 9^{n-1})$$

$$\begin{aligned} \text{Solution: } 3^n \times 9^{n+1} \div (3^{n-1} \times 9^{n-1}) &= 3^n \times (3^2)^{n+1} \div 3^{n-1} \times (3^2)^{n-1} \\ &= 3^n \times 3^{2n+2} \div 3^{n-1} \times 3^{2n-2} \\ &= 3^{n+2n+2} \div 3^{n-1+2n-2} \\ &= 3^{3n+2} \div 3^{3n-3} \\ &= 3^{3n+2-3n+3} = 3^5 = 243 \quad \text{Ans.} \end{aligned}$$

16. (i) $\frac{7^{2n+3} - (49)^{n+2}}{((343)^{n+1})^{\frac{2}{3}}}$

Solution: $\frac{7^{2n+3} - (49)^{n+2}}{((343)^{n+1})^{\frac{2}{3}}} = \frac{7^{2n} \cdot 7^3 - (7^2)^{n+2}}{((7^3)^{n+1})^{\frac{2}{3}}}$
 $= \frac{7^{2n} \cdot 7^3 - 7^{2n} \cdot 7^4}{7^{2n} \cdot 7^2}$
 $= \frac{7^{2n} \cdot 7^3 (1-7)}{7^{2n} \cdot 7^2}$
 $= 7^{3-2} \cdot (-6) = 7 \cdot (-6) = -42$ **Ans.**

18 (ii) $\left(\frac{x^{a+b}}{x^c}\right)^{a-b} \cdot \left(\frac{x^{b+c}}{x^a}\right)^{b-c} \cdot \left(\frac{x^{c+a}}{x^b}\right)^{c-a}$

Solution: $\left(\frac{x^{a+b}}{x^c}\right)^{a-b} \cdot \left(\frac{x^{b+c}}{x^a}\right)^{b-c} \cdot \left(\frac{x^{c+a}}{x^b}\right)^{c-a}$
 $= \frac{x^{a^2-b^2}}{x^{c(a-b)}} \cdot \frac{x^{b^2-c^2}}{x^{a(b-c)}} \cdot \frac{x^{c^2-a^2}}{x^{b(c-a)}}$
 $= \frac{x^{a^2-b^2+b^2-c^2+c^2-a^2}}{x^{ca-bc+ab-ac+bc-ba}} = \frac{x^0}{x^0} = 1$ **Ans.**

20 (ii) $\frac{1}{1+a^{m-n}} + \frac{1}{1+a^{n-m}}$

Solution: $\frac{1}{1+a^{m-n}} + \frac{1}{1+a^{n-m}} = \frac{1}{1+\frac{a^m}{a^n}} + \frac{1}{1+\frac{a^n}{a^m}}$
 $= \frac{a^n}{a^n+a^m} + \frac{a^m}{a^m+a^n}$
 $= \frac{a^n+a^m}{a^n+a^m} = 1$ **Ans.**

HOMEWORK

EXERCISE: 8

QUESTION NUMBERS: 1(i), (ii); 3(i), 4(ii), 8(ii), 11(ii), 14 (i), (ii);

17(ii), 19(ii) and 20(i)