

1. Express the following in power notation:

(i) $\frac{-2}{7} \times \frac{-2}{7} \times \frac{-2}{7}$

(ii) $-1 \times -1 \times -1 \times -1$

(iii) $\frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3}$

Ans. (i) $\frac{-2}{7} \times \frac{-2}{7} \times \frac{-2}{7}$

$$= \left(\frac{-2}{7}\right)^3$$

(ii) $-1 \times -1 \times -1 \times -1$

$$= (-1)^4$$

(iii) $\frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3} \times \frac{5}{3}$

$$= \left(\frac{5}{3}\right)^7$$

2. Multiplying powers with same base

$$5^3 \times 5^6$$

Ans. $5^3 \times 5^6$

$$= (5 \times 5 \times 5) \times (5 \times 5 \times 5 \times 5 \times 5 \times 5)$$

$$= 5^{3+6}, \text{ [here the exponents are added]}$$

$$= 5^9$$

3. Dividing powers with the same base

$$7^{10} \div 7^8 = \frac{7^{10}}{7^8}$$

Ans. $7^{10} \div 7^8 = \frac{7^{10}}{7^8}$

$$= \frac{7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7}{7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7}$$

$$= 7^{10-8}, \text{ [here exponents are subtracted]}$$

$$= 7^2$$

4. Power of a power

$$(2^3)^4$$

Ans. $(2^3)^4$

Now, $(2^3)^4$ means 2^3 is multiplied four times

$$\text{i.e. } (2^3)^4 = 2^3 \times 2^3 \times 2^3 \times 2^3 \quad [\text{since } a^m \times a^n = a^{m+n}]$$

$$= 2^{3+3+3+3}$$

$$= 2^{12}$$

5. Multiplying powers with the same exponents

$$(i) 4^2 \times 3^2$$

Ans. $4^2 \times 3^2$ [here the powers are same and the bases are different]

$$= (4 \times 4) \times (3 \times 3)$$

$$= (4 \times 3) \times (4 \times 3)$$

$$= 12 \times 12$$

$$= 12^2$$

Here, we observe that in 12^2 , the base is the product of bases 4 and 3.

6. Negative Exponents

$$10^{-3}$$

Ans. $= 10^{-3}$, [here we can see that 1 is in the numerator and in the denominator 10^3 as we know that negative exponent is the reciprocal]

$$= \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \quad [\text{here 10 is multiplied to itself 3 times}]$$

$$= \frac{1}{1000}$$

7. Power with exponent zero

$$\left(\frac{2}{3}\right)^3 \times \left(\frac{2}{3}\right)^{-3}$$

Ans $\left(\frac{2}{3}\right)^3 \times \left(\frac{2}{3}\right)^{-3}$

$$= \left(\frac{2}{3}\right)^{3+(-3)}, \quad [\text{here we know that } a^m \times a^n = a^{m+n}]$$

$$= \left(\frac{2}{3}\right)^{3-3}$$

$$= \left(\frac{2}{3}\right)^0$$

$$= 1.$$

8. Fractional Exponent $a^{\frac{1}{n}}$

Ans. $a^{\frac{1}{n}}$, [Here a is called the base and $\frac{1}{n}$ is called the exponent or power] = $\sqrt[n]{a}$ [nth root of a]

9. Find $(125)^{\frac{2}{3}}$

Ans. $(125)^{\frac{2}{3}}$

125 can be expressed as $5 \times 5 \times 5 = 5^3$

So, we have $(125)^{\frac{2}{3}} = (5^3)^{\frac{2}{3}} = 5^{3 \times \frac{2}{3}} = 5^2 = 25$

10. Find $\left(\frac{8}{27}\right)^{\frac{4}{3}}$

Ans. $\left(\frac{8}{27}\right)^{\frac{4}{3}}$

$8 = 2^3$ and $27 = 3^3$

So, we have $\left(\frac{8}{27}\right)^{\frac{4}{3}} = \left(\frac{2^3}{3^3}\right)^{\frac{4}{3}}$

$$= \left[\left(\frac{2}{3}\right)^3\right]^{\frac{4}{3}}$$

$$= \left(\frac{2}{3}\right)^{3 \times \frac{4}{3}}$$

$$= \left(\frac{2}{3}\right)^4$$

$$= \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$$

$$= \frac{16}{81}$$

11. Find $9^{\frac{1}{2}}$

Ans. $9^{\frac{1}{2}}$

$$= \sqrt{9 \& 2}$$

$$= [(3)^2]^{\frac{1}{2}}$$

$$= (3)^{2 \times \frac{1}{2}}$$

$$= 3$$

12. Evaluate the exponent:

(i) 5^{-3}

(ii) $\left(\frac{1}{3}\right)^{-4}$

(iii) $\left(\frac{5}{2}\right)^{-3}$

(iv) $(-2)^{-5}$

(v) $\left(\frac{-3}{4}\right)^{-4}$

Ans. (i) $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$

(ii) $\left(\frac{1}{3}\right)^{-4} = \left(\frac{3}{1}\right)^4 = 3^4 = 81$

(iii) $\left(\frac{5}{2}\right)^{-3} = \left(\frac{2}{5}\right)^3 = \frac{2^3}{5^3} = \frac{8}{125}$

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

(v) $\left(\frac{-3}{4}\right)^{-4} = \left(\frac{4}{-3}\right)^4 = \left(-\frac{4}{3}\right)^4 = \frac{(-4)^4}{3^4} = \frac{4^4}{3^4} = \frac{256}{81}$

13. Evaluate: $\left(\frac{-2}{7}\right)^{-4} \times \left(\frac{-5}{7}\right)^2$

Ans. $\left(\frac{-2}{7}\right)^{-4} \times \left(\frac{-5}{7}\right)^2$

$$= \left(\frac{7}{-2}\right)^4 \times \left(\frac{-5}{7}\right)^2$$

$$= \left(\frac{-7}{2}\right)^4 \times \left(\frac{-5}{7}\right)^2 \left[\text{Since, } \left(\frac{7}{-2}\right) = \left(\frac{-7}{2}\right) \right]$$

$$= \frac{-7^4}{2^4} \times \frac{(-5)^2}{7^2}$$

$$= \{7^4 \times (-5)^2\} / \{2^4 \times 7^2\} \left[\text{Since, } (-7)^4 = 7^4 \right]$$

$$= \{7^2 \times (-5)^2\} / 2^4$$

$$= \frac{[49 \times (-5) \times (-5)]}{16}$$

$$= \frac{1225}{16}$$

14. Evaluate: $\left(\frac{-1}{4}\right)^{-3} \times \left(\frac{-1}{4}\right)^{-2}$

Ans. $\left(\frac{-1}{4}\right)^{-3} \times \left(\frac{-1}{4}\right)^{-2}$
 $= \left(\frac{4}{-1}\right)^3 \times \left(\frac{4}{-1}\right)^2$
 $= (-4)^3 \times (-4)^2$
 $= (-4)^{(3+2)}$
 $= (-4)^5$
 $= -45$
 $= -1024.$

15. Evaluate: $\left\{\left[\frac{-3}{2}\right]^2\right\}^{-3}$

Ans. $\left\{\left[\frac{-3}{2}\right]^2\right\}^{-3}$
 $= \left(\frac{-3}{2}\right)^{2 \times (-3)}$
 $= \left(\frac{-3}{2}\right)^{-6}$
 $= \left(\frac{2}{-3}\right)^6$
 $= \left(\frac{-2}{3}\right)^6$
 $= \frac{(-2)^6}{3^6}$
 $= \frac{2^6}{3^6}$
 $= \frac{64}{729}$

16. Simplify:

(i) $(2^{-1} \times 5^{-1})^{-1} \div 4^{-1}$

(ii) $(4^{-1} + 8^{-1}) \div \left(\frac{2}{3}\right)^{-1}$

Ans. (i) $(2^{-1} \times 5^{-1})^{-1} \div 4^{-1}$
 $= \left(\frac{1}{2} \times \frac{1}{5}\right)^{-1} \div \left(\frac{4}{1}\right)^{-1}$
 $= \left(\frac{1}{10}\right)^{-1} \div \left(\frac{1}{4}\right)$

$$\begin{aligned}
 &= \frac{10}{1} \div \frac{1}{4} \\
 &= (10 \div \frac{1}{4}) \\
 &= (10 \times 4) \\
 &= 40.
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad &(4^{-1} + 8^{-1}) \div \left(\frac{2}{3}\right)^{-1} \\
 &= \left(\frac{1}{4} + \frac{1}{8}\right) \div \left(\frac{3}{2}\right) \\
 &= \frac{2 + 1}{8} \div \frac{3}{2} \\
 &= \left(\frac{3}{8} \div \frac{3}{2}\right) \\
 &= \left(\frac{3}{8} \div \frac{2}{3}\right) \\
 &= \frac{1}{4}
 \end{aligned}$$

17. Simplify: $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$

Ans. $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$

$$\begin{aligned}
 &= \left(\frac{2}{1}\right)^2 + \left(\frac{3}{1}\right)^2 + \left(\frac{4}{1}\right)^2 \\
 &= (22 + 32 + 42) \\
 &= (4 + 9 + 16) \\
 &= 29.
 \end{aligned}$$

18. The value of $\left(\frac{2}{5}\right)^{-3}$ is

Ans. $\left(\frac{2}{5}\right)^{-3}$

$$\begin{aligned}
 &= \left(\frac{5}{2}\right)^3 \\
 &= \frac{5 \times 5 \times 5}{2 \times 2 \times 2} \\
 &= \frac{125}{8}
 \end{aligned}$$

19. The value of $(-3)^{-4}$ is

Ans. $= \frac{1}{(-3)^4}$

$$= \frac{1}{(-3) \times (-3) \times (-3) \times (-3)}$$

$$= \frac{1}{81}$$

20. The value of $\{-3/8\}^{-3} \times (4/9)^{-2}$ is

Ans. $\left(\frac{-3}{8}\right)^{-3} \times \left(\frac{4}{9}\right)^{-2}$

$$= \left(\frac{-8}{3}\right)^3 \times \left(\frac{9}{4}\right)^2$$

$$= \left(\frac{(8) \times (8) \times (8)}{(3) \times (3) \times (3)}\right) \times \left(\frac{(9) \times (9)}{(4) \times (4)}\right)$$

$$= -96$$