

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

Exercise 2.2

Question 1: Assuming that x, y, z are positive real numbers, simplify each of the following:

$$(i) \left(\sqrt{(x^{-3})} \right)^5 \quad (ii) \sqrt{x^3 y^{-2}} \quad (iii) \left(x^{-\frac{2}{3}} y^{-\frac{1}{2}} \right)^2$$

$$(iv) (\sqrt{x})^{-\frac{2}{3}} \sqrt{y^4} \div \sqrt{xy^{\frac{1}{2}}} \quad (v) \sqrt[5]{243x^{10}y^5z^{10}}$$

$$(vi) \left(\frac{x^{-4}}{y^{-10}} \right)^{\frac{5}{4}} \quad (vii) \left(\frac{\sqrt{2}}{\sqrt{3}} \right)^5 \left(\frac{6}{7} \right)^2$$

Solution:

$$(i) \left(\sqrt{(x^{-3})} \right)^5 = \left(\sqrt{\frac{1}{x^3}} \right)^5$$
$$\left(\frac{1}{x^{\frac{3}{2}}} \right)^5 = \frac{1}{x^{\frac{15}{2}}}$$

$$(ii) \sqrt{x^3 y^{-2}} = \frac{x^{\frac{3}{2}}}{y^{2 \times \frac{1}{2}}} = \frac{x^{\frac{3}{2}}}{y}$$

$$(iii) \left(x^{-\frac{2}{3}} y^{-\frac{1}{2}} \right)^2$$
$$= \left(x^{-\frac{2}{3}} y^{-\frac{1}{2}} \right)^2 = \left(\frac{1}{x^{\frac{2}{3}} y^{\frac{1}{2}}} \right)^2$$
$$= \left(\frac{1}{x^{\frac{2}{3} \times 2} y^{\frac{1}{2} \times 2}} \right)$$
$$= \frac{1}{x^{\frac{4}{3}} y}$$

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$\begin{aligned} \text{(iv)} \quad & (\sqrt{x})^{-\frac{2}{3}} \sqrt{y^4} \div \sqrt{xy^{\frac{1}{3}}} \\ &= \left(x^{\frac{1}{2}}\right)^{-\frac{2}{3}} (y^2) \div \sqrt{xy^{\frac{1}{3}}} \\ &= \frac{x^{-\frac{1}{2}} y^2}{x^{\frac{1}{2}} y^{-\frac{1}{2} \times \frac{1}{2}}} \\ &= \left(x^{-\frac{1}{2}} \times x^{-\frac{1}{2}}\right) \times \left(y^2 \times y^{\frac{1}{4}}\right) \\ &= \left(x^{-\frac{1}{2}-\frac{1}{2}}\right) \left(y^{2+\frac{1}{4}}\right) \\ &= \left(x^{-\frac{2+1}{2}}\right) \left(y^{\frac{8+1}{4}}\right) \\ &= \left(x^{-\frac{3}{2}}\right) \left(y^{\frac{9}{4}}\right) \\ &= \frac{y^{\frac{9}{4}}}{x^{\frac{3}{2}}} \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & \sqrt[5]{243x^{10}y^5z^{10}} \\ &= (243x^{10}y^5z^{10})^{\frac{1}{5}} \\ &= (243)^{\frac{1}{5}} x^{\frac{10}{5}} y^{\frac{5}{5}} z^{\frac{10}{5}} \\ &= (3^5)^{\frac{1}{5}} x^2 y z^2 \\ &= 3x^2 y z^2 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & \left(\frac{x^{-4}}{y^{-10}}\right)^{\frac{5}{4}} \\ &= \left(\frac{y^{10}}{x^4}\right)^{\frac{5}{4}} \\ &= \left(\frac{y^{10 \times \frac{5}{4}}}{x^{4 \times \frac{5}{4}}}\right) \\ &= \left(\frac{y^{\frac{25}{2}}}{x^5}\right) \end{aligned}$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$\begin{aligned}
 \text{(vii)} \quad & \left(\frac{\sqrt{2}}{\sqrt{3}}\right)^5 \left(\frac{6}{7}\right)^2 \\
 &= \left(\sqrt{\frac{2}{3}}\right)^5 \left(\frac{6}{7}\right)^{\frac{4}{2}} \\
 &= \left(\frac{2}{3}\right)^{\frac{5}{2}} \left(\frac{6}{7}\right)^{\frac{4}{2}} \\
 &= \left(\frac{2^5}{3^5}\right)^{\frac{1}{2}} \left(\frac{6^4}{7^4}\right)^{\frac{1}{2}} \\
 &= \left(\frac{2^5}{3^5} \times \frac{6^4}{7^4}\right)^{\frac{1}{2}} \\
 &= \left(\frac{2 \times 2 \times 2 \times 2 \times 2}{3 \times 3 \times 3 \times 3 \times 3} \times \frac{6 \times 6 \times 6 \times 6}{7 \times 7 \times 7 \times 7}\right) \\
 &= \left(\frac{512}{7203}\right)^{\frac{1}{2}}
 \end{aligned}$$

Question 2: Simplify

(i) $(16^{-1/5})^{5/2}$

(ii) $\sqrt[5]{(32)^{-3}}$

(iii) $\sqrt[3]{(343)^{-2}}$

(iv) $(0.001)^{1/3}$

(v) $\frac{(25)^{3/2} \times (243)^{3/5}}{(16)^{5/4} \times (8)^{4/3}}$

(vi) $\left(\frac{\sqrt{2}}{5}\right)^8 \div \left(\frac{\sqrt{2}}{5}\right)^{13}$

(vii) $\left(\frac{5^{-1} \times 7^2}{5^2 \times 7^{-4}}\right)^{\frac{7}{2}} \times \left(\frac{5^{-2} \times 7^3}{5^3 \times 7^{-5}}\right)^{\frac{-5}{2}}$

Solution:

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$(i) \left(16^{-\frac{1}{5}}\right)^{\frac{5}{2}}$$

$$= (16)^{-\frac{1}{5} \times \frac{5}{2}} = (16)^{-\frac{1}{2}}$$

$$= (4^2)^{-\frac{1}{2}} = \left(4^{2 \times -\frac{1}{2}}\right) = \frac{1}{4}$$

$$(ii) \sqrt[5]{(32)^{-3}} = \left[(2^5)^{-3}\right]^{\frac{1}{5}} = (2^{-15})^{\frac{1}{5}}$$

$$= 2^{-3} = \frac{1}{2^3} = \frac{1}{8}$$

$$(iii) \sqrt[3]{(343)^{-2}} = \left[(343)^{-2}\right]^{\frac{1}{3}} = (343)^{-2 \times \frac{1}{3}}$$

$$= (7^3)^{-\frac{2}{3}} = (7^{-2}) = \left(\frac{1}{7^2}\right) = \left(\frac{1}{49}\right)$$

$$(iv) (0.001)^{\frac{1}{3}}$$

$$= \left(\frac{1}{10^3}\right)^{\frac{1}{3}} = \frac{1}{10^{3 \times \frac{1}{3}}}$$

$$= \frac{1}{10} = 0.1$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$\begin{aligned}
 \text{(v)} \quad & \frac{(25)^{\frac{3}{2}} \times (243)^{\frac{2}{5}}}{(16)^{\frac{5}{4}} \times (8)^{\frac{4}{3}}} \\
 &= \frac{((5^2))^{\frac{3}{2}} \times ((3^5))^{\frac{2}{5}}}{((4^2))^{\frac{5}{4}} \times ((2^3))^{\frac{4}{3}}} \\
 &= \frac{5^3 \times 3^2}{2^5 \times 2^4} \\
 &= \frac{125 \times 27}{32 \times 16} \\
 &= \frac{3375}{512}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad & \left(\frac{\sqrt{2}}{5}\right)^8 \div \left(\frac{\sqrt{2}}{5}\right)^{13} = \left(\frac{\sqrt{2}}{5}\right)^{8-13} \\
 &= \left(\frac{\sqrt{2}}{5}\right)^{-5} = \frac{5^5}{2^{\frac{5}{2}}} = \frac{3125}{4\sqrt{2}}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad & \left(\frac{5^{-1} \times 7^2}{5^2 \times 7^{-4}}\right)^{\frac{7}{2}} \times \left(\frac{5^{-2} \times 7^3}{5^3 \times 7^{-5}}\right)^{\frac{-5}{2}} \\
 &= \frac{5^{-1 \times \frac{7}{2}} \times 7^{2 \times \frac{7}{2}}}{5^{2 \times \frac{7}{2}} \times 7^{-4 \times \frac{7}{2}}} \times \frac{5^{-2 \times \left(\frac{-5}{2}\right)} \times 7^{3 \times \left(\frac{-5}{2}\right)}}{5^{3 \times \left(\frac{-5}{2}\right)} \times 7^{-5 \times \left(\frac{-5}{2}\right)}} \\
 &= \frac{5^{\frac{-7}{2}} \times 7^7}{5^7 \times 7^{-14}} = \frac{5^5 \times 7^{\frac{-15}{2}}}{5^{\frac{-15}{2}} \times 7^{\frac{25}{2}}} \\
 &= 5^{\frac{-7}{2} + 5 - 7 + \frac{15}{2}} \times 7^{7 - \frac{15}{2} + 14 - \frac{25}{2}} \\
 &= 5^{\frac{25}{2} - \frac{21}{2}} \times 7^{21 - \frac{40}{2}} = 5^{\frac{4}{2}} \times 7^{\frac{2}{2}} \\
 &= 5^2 \times 7^1 = 25 \times 7 = 175
 \end{aligned}$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

Question 3: Prove that

$$(i) \left(\sqrt{3 \times 5^{-3}} \div \sqrt[3]{3^{-1} \sqrt{5}} \right) \times \sqrt[6]{3 \times 5^6} = \frac{3}{5}$$

$$(ii) 9^{\frac{3}{2}} - 3 \times 5^0 - \left(\frac{1}{81} \right)^{-\frac{1}{2}} = 15$$

$$(iii) \left(\frac{1}{4} \right)^{-2} - 3 \times 8^{\frac{2}{3}} \times 4^0 + \left(\frac{9}{16} \right)^{-\frac{1}{2}} = \frac{16}{3}$$

$$(iv) \frac{2^{\frac{1}{2}} \times 3^{\frac{1}{3}} \times 4^{\frac{1}{4}}}{10^{-\frac{1}{5}} \times 5^{\frac{3}{5}}} \div \frac{4^{\frac{4}{3}} \times 5^{-\frac{7}{5}}}{4^{-\frac{3}{5}} \times 6} = 10$$

$$(v) \sqrt{\frac{1}{4}} + (0.01)^{-\frac{1}{2}} - (27)^{\frac{2}{3}} = \frac{3}{2}$$

$$(vi) \frac{2^n + 2^{n-1}}{2^{n+1} - 2^n} = \frac{3}{2}$$

$$(vii) \left(\frac{64}{125} \right)^{-\frac{2}{3}} + \frac{1}{\left(\frac{256}{625} \right)^{\frac{1}{4}}} + \left(\frac{\sqrt{25}}{\sqrt[3]{64}} \right)^0 = \frac{61}{16}$$

$$(viii) \frac{3^{-3} \times 6^2 \times \sqrt{98}}{5^2 \times \sqrt[3]{\frac{1}{25}} \times (15)^{-\frac{4}{3}} \times 3^{\frac{1}{3}}} = 28\sqrt{2}$$

$$(ix) \frac{(0.6)^0 - (0.1)^{-1}}{\left(\frac{3}{8} \right)^{-1} \left(\frac{3}{2} \right)^3 + \left(\frac{1}{3} \right)^{-1}} = \frac{-3}{2}$$

Solution:

(i) L.H.S.

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$\begin{aligned}& \left(\sqrt{3 \times 5^{-3}} \div \sqrt[3]{3^{-1}} \sqrt{5} \right) \times \sqrt[6]{3 \times 5^6} \\&= \left((3 \times 5^{-3})^{\frac{1}{2}} \div (3^{-1})^{\frac{1}{3}} (5)^{\frac{1}{2}} \right) \times (3 \times 5^6)^{\frac{1}{6}} \\&= \left((3)^{\frac{1}{2}} (5^{-3})^{\frac{1}{2}} \div (3^{-1})^{\frac{1}{3}} (5)^{\frac{1}{2}} \right) \times (3 \times 5^6)^{\frac{1}{6}} \\&= \left((3)^{\frac{1}{2}} (5)^{-\frac{3}{2}} \div (3)^{-\frac{1}{3}} (5)^{\frac{1}{2}} \right) \times \left((3)^{\frac{1}{6}} \times (5)^{\frac{6}{6}} \right) \\&= \left((3)^{\frac{1}{2} - (-\frac{1}{3})} \times (5)^{-\frac{3}{2} - \frac{1}{2}} \right) \times \left((3)^{\frac{1}{6}} \times (5) \right) \\&= \left((3)^{\frac{3+2}{6}} \times (5)^{-\frac{4}{2}} \right) \times \left((3)^{\frac{1}{6}} \times (5) \right) \\&= \left((3)^{\frac{5}{6}} \times (5)^{-2} \right) \times \left((3)^{\frac{1}{6}} \times (5) \right) \\&= \left((3)^{\frac{5}{6} + \frac{1}{6}} \times (5)^{-2+1} \right) \\&= \left((3)^{\frac{6}{6}} \times (5)^{-1} \right) \\&= \left((3)^1 \times (5)^{-1} \right) \\&= \left((3) \times (5)^{-1} \right) \\&= \left((3) \times \left(\frac{1}{5} \right) \right) \\&= \left(\frac{3}{5} \right)\end{aligned}$$

=R.H.S.

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$\begin{aligned} \text{(ii)} \quad & 9^{\frac{3}{2}} - 3 \times 5^0 - \left(\frac{1}{81}\right)^{-\frac{1}{2}} \\ &= (3^2)^{\frac{3}{2}} - 3 - \left(\frac{1}{9^2}\right)^{-\frac{1}{2}} \\ &= 3^{2 \times \frac{3}{2}} - 3 - (9^{-2})^{-\frac{1}{2}} \\ &= 3^3 - 3 - (9)^{-2 \times -\frac{1}{2}} \\ &= 27 - 3 - 9 \\ &= 15 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & \left(\frac{1}{4}\right)^{-2} - 3 \times 8^{\frac{2}{3}} \times 4^0 + \left(\frac{9}{16}\right)^{-\frac{1}{2}} \\ &= \left(\frac{1}{2^2}\right)^{-2} - 3 \times 8^{\frac{2}{3}} \times 1 + \left(\frac{3^2}{4^2}\right)^{-\frac{1}{2}} \\ &= 2^4 - 3 \times 2^{3 \times \frac{2}{3}} + \frac{4}{3} \\ &= 16 - 3 \times 4 + \frac{4}{3} \\ &= \frac{12+4}{3} \\ &= \frac{16}{3} \end{aligned}$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$\begin{aligned}
 \text{(iv)} \quad & \frac{2^{\frac{1}{2}} \times 3^{\frac{1}{3}} \times 4^{\frac{1}{4}}}{10^{-\frac{1}{5}} \times 5^{\frac{3}{5}}} \div \frac{4^{\frac{4}{3}} \times 5^{-\frac{7}{5}}}{4^{-\frac{3}{5}} \times 6} \\
 &= \frac{2^{\frac{1}{2}} \times 3^{\frac{1}{3}} \times (2^2)^{\frac{1}{4}} (2^2)^{-\frac{3}{5}} \times (2 \times 3)}{(2 \times 5)^{-\frac{1}{5}} \times 5^{\frac{3}{5}} \times 3^{\frac{4}{3}} \times 5^{-\frac{7}{5}}} \\
 &= \frac{2^{\frac{1}{2}} \times 2^{\frac{1}{2}} \times (2^2)^{-\frac{6}{5}} \times 2^1 \times 3^{\frac{1}{3}} \times 3}{2^{-\frac{1}{5}} \times 5^{-\frac{1}{5}} \times 5^{\frac{3}{5}} \times 3^{\frac{4}{3}} \times 5^{-\frac{7}{5}}} \\
 &= \frac{2^{\frac{1}{5}} \times 2^{\frac{1}{2}} \times 2^{\frac{1}{2}} \times 2^{-\frac{6}{5}} \times 2 \times 3^{\frac{1}{3}} \times 3 \times 3^{-\frac{4}{3}}}{5^{-\frac{1}{5}} \times 5^{\frac{3}{5}} \times 5^{-\frac{7}{5}}} \\
 &= \frac{(2)^{\frac{1}{2} + \frac{1}{2} - \frac{6}{5} + 1 + \frac{1}{5}} \times (3)^{\frac{1}{3} + 1 - \frac{4}{3}}}{5^{-\frac{1}{5}} \times 5^{\frac{3}{5}} \times 5^{-\frac{7}{5}}} \\
 &= \frac{(2)^{\frac{1}{5} + 2 - \frac{6}{5}} \times (3)^{1-1}}{5^{-1}} \\
 &= \frac{(2)^1 \times (3)^0}{5^{-1}} \\
 &= 2 \times 1 \times 5 \\
 &= 10
 \end{aligned}$$

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$\begin{aligned} \text{(v)} \quad & \sqrt{\frac{1}{4}} + (0.01)^{-\frac{1}{2}} - (27)^{\frac{2}{3}} \\ &= \frac{1}{2} + \frac{1}{(0.01)^{\frac{1}{2}}} - (3^3)^{\frac{2}{3}} \\ &= \frac{1}{2} + \frac{1}{(0.1)^{2 \times \frac{1}{2}}} - (3)^{3 \times \frac{2}{3}} \\ &= \frac{1}{2} + \frac{1}{(0.1)^1} - (3)^2 \\ &= \frac{1}{2} + \frac{1}{(0.1)} - 9 \\ &= \frac{3}{2} \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & \frac{2^n + 2^{n-1}}{2^{n+1} - 2^n} \\ &= \frac{2^n + 2^n \times 2^{-1}}{2^n \times 2^1 - 2^n} \\ &= \frac{2^n[1 + 2^{-1}]}{2^n[2 - 1]} \\ &= 1 + \frac{1}{2} \\ &= \frac{3}{2} \end{aligned}$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$\begin{aligned}
 \text{(vii)} \quad & \left(\frac{64}{125}\right)^{-\frac{2}{3}} + \frac{1}{\left(\frac{256}{625}\right)^{\frac{1}{4}}} + \left(\frac{\sqrt{25}}{\sqrt[3]{64}}\right)^0 \\
 &= \left(\frac{125}{64}\right)^{\frac{2}{3}} + \frac{1}{\left(\frac{4^4}{5^4}\right)^{\frac{1}{4}}} + 1 \\
 &= \left(\frac{5^3}{4^3}\right)^{\frac{2}{3}} + \frac{1}{\left(\frac{4}{5}\right)} + 1 \\
 &= \left(\frac{5}{4}\right)^2 + \frac{5}{4} + 1 \\
 &= \frac{25}{16} + \frac{9}{4} \\
 &= \frac{25}{16} + \frac{36}{16} \\
 &= \frac{61}{16}
 \end{aligned}$$

$$\begin{aligned}
 \text{(viii)} \quad & \frac{3^{-3} \times 6^2 \times \sqrt{98}}{5^2 \times \sqrt[3]{\frac{1}{25}} \times (15)^{-\frac{4}{3}} \times 3^{\frac{1}{3}}} \\
 &= \frac{3^{-3} \times 36 \times \sqrt{7 \times 7 \times 2}}{5^2 \times \left(\frac{1}{25}\right)^{\frac{1}{3}} \times (15)^{-\frac{4}{3}} \times 3^{\frac{1}{3}}} \\
 &= \frac{3^{-3} \times 2^2 \times 3^2 \times 2^{\frac{1}{2}} \times (7^2)^{\frac{1}{2}}}{5^2 \times (5^2)^{\frac{-1}{3}} \times 3^{\frac{-4}{3}} \times 5^{\frac{-4}{3}} \times 3^{\frac{1}{3}}} \\
 &= 2^2 \cdot 2^{\frac{1}{2}} \cdot 3^{-3+2+\frac{4}{3}} \cdot 5^{\frac{2}{3}-2+\frac{4}{3}} \cdot 7^1 \\
 &= 4\sqrt{2} \times 3^0 \times 5^0 \times 7^1 \\
 &= 4\sqrt{2} \times 1 \times 1 \times 7 \\
 &= 28\sqrt{2}
 \end{aligned}$$

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$(ix) \frac{(0.6)^0 - (0.1)^{-1}}{\left(\frac{3}{8}\right)^{-1} \left(\frac{3}{2}\right)^3 + \left(\frac{1}{3}\right)^{-1}}$$

$$= \frac{1 - \frac{1}{0.1}}{\frac{8}{3} \times \left(\frac{3}{2}\right)^3 - 3}$$

$$= \frac{1 - 10}{\frac{8}{3} \times \frac{3^3}{2^3} - 3}$$

$$= \frac{-9}{3^2 - 3}$$

$$= -3/2$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

Question 4.

Show that:

$$(i) \frac{1}{1+x^{a-b}} + \frac{1}{1+x^{b-a}} = 1$$

$$(ii) \left[\left(\frac{x^{a(a-b)}}{x^{a(a+b)}} \right) \div \left(\frac{x^{b(b-a)}}{x^{b(b+a)}} \right) \right]^{a+b} = 1$$

$$(iii) \left(x^{\frac{1}{a-b}} \right)^{\frac{1}{a-c}} \left(x^{\frac{1}{b-c}} \right)^{\frac{1}{b-a}} \left(x^{\frac{1}{c-a}} \right)^{\frac{1}{c-b}} = 1$$

$$(iv) \left(\frac{x^{a^2+b^2}}{x^{ab}} \right)^{a+b} \left(\frac{x^{b^2+c^2}}{x^{bc}} \right)^{b+c} \left(\frac{x^{c^2+a^2}}{x^{ac}} \right)^{a+c} = x^{2(a^3+b^3+c^3)}$$

$$(v) \left[\left(x^{a-a^{-1}} \right)^{\frac{1}{a-1}} \right]^{\frac{a}{a+1}} = x$$

$$(vi) \left[\frac{a^{x+1}}{a^{y+1}} \right]^{x+y} \left[\frac{a^{y+2}}{a^{z+2}} \right]^{y+z} \left[\frac{a^{z+3}}{a^{x+3}} \right]^{z+x} = 1$$

$$(vii) \left(\frac{3^a}{3^b} \right)^{a+b} \left(\frac{3^b}{3^c} \right)^{b+c} \left(\frac{3^c}{3^a} \right)^{c+a} = 1$$

Solution:

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$\begin{aligned}
 (i) \quad & \frac{1}{1+x^{a-b}} + \frac{1}{1+x^{b-a}} \\
 &= \frac{1}{1+\frac{x^a}{x^b}} + \frac{1}{1+\frac{x^b}{x^a}} \\
 &= \frac{x^b}{x^b+x^a} + \frac{x^a}{x^a+x^b} \\
 &= \frac{x^b+x^a}{x^a+x^b} \\
 &= 1
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & \left[\left(\frac{x^{a(a-b)}}{x^{a(a+b)}} \right) \div \left(\frac{x^{b(b-a)}}{x^{b(b+a)}} \right) \right]^{a+b} \\
 &= \left[\left(\frac{x^{a^2-ab}}{x^{a^2+ab}} \right) \div \left(\frac{x^{b^2-ab}}{x^{b^2+ab}} \right) \right]^{a+b} \\
 &= \left[x^{(a^2-ab)-(a^2+ab)} \div x^{(b^2-ab)-(b^2+ab)} \right]^{a+b} \\
 &= \left[x^{-2ab-(-2ab)} \right]^{a+b} \\
 &= \left[x^0 \right]^{a+b} = [1]^{a+b} = 1
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad & \left(x^{\frac{1}{a-b}} \right)^{\frac{1}{a-c}} \left(x^{\frac{1}{b-c}} \right)^{\frac{1}{b-a}} \left(x^{\frac{1}{c-a}} \right)^{\frac{1}{c-b}} \\
 &= \left(x^{\frac{1}{(a-b)(a-c)}} \right) \left(x^{\frac{1}{(b-c)(b-a)}} \right) \left(x^{\frac{1}{(c-a)(c-b)}} \right) \\
 &= x^{\left(\frac{1}{(a-b)(a-c)} + \frac{-1}{(b-c)(a-b)} + \frac{1}{(a-c)(b-c)} \right)} \\
 &= x^{\left(\frac{b-c-a+c+a-b}{(a-b)(a-c)(b-c)} \right)} \\
 &= x^0 = 1
 \end{aligned}$$

Solutions for Class 9 Maths Chapter 2 Exponents of Real Numbers

$$\begin{aligned}
 (iv) & \left(\frac{x^{a^2+b^2}}{x^{ab}} \right)^{a+b} \left(\frac{x^{b^2+c^2}}{x^{bc}} \right)^{b+c} \left(\frac{x^{c^2+a^2}}{x^{ac}} \right)^{a+c} \\
 &= \left(x^{a^2+b^2-ab} \right)^{a+b} \left(x^{b^2+c^2-bc} \right)^{b+c} \left(x^{c^2+a^2-ac} \right)^{a+c} \\
 &= \left(x^{a^2+b(a^2+b^2-ab)} \right) \left(x^{b^2+c(b^2+c^2-bc)} \right) \left(x^{a^2+c(c^2+a^2-ac)} \right) \\
 &= \left(x^{a^3+ab^2-a^2b+ab^2+b^3-ab^2} \right) \left(x^{b^3+bc^2-b^2c+cb^2+c^3-bc^2} \right) \left(x^{ac^2+a^3-a^2c+c^3+a^2c-ac^3} \right) \\
 &= \left(x^{a^3+b^3} \right) \left(x^{b^3+c^3} \right) \left(x^{a^3+c^3} \right) \\
 &= \left(x^{a^3+b^3+b^3+c^3+a^3+c^3} \right) \\
 &= \left(x^{2a^3+2b^3+2c^3} \right) \\
 &= \left(x^{2(a^3+b^3+c^3)} \right)
 \end{aligned}$$

$$(v) (x^{a-b})^{a+b} (x^{b-c})^{b+c} (x^{c-a})^{c+a} = 1$$

$$\begin{aligned}
 & (x^{a-b})^{a+b} (x^{b-c})^{b+c} (x^{c-a})^{c+a} \\
 &= x^{a^2-b^2} x^{b^2-c^2} x^{c^2-a^2} \\
 &= x^{a^2-b^2+b^2-c^2+c^2-a^2} \\
 &= x^0 \\
 &= 1
 \end{aligned}$$

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$\begin{aligned}(vi) & \left[\left(x^{a-a^{-1}} \right)^{\frac{1}{a-1}} \right]^{\frac{a}{a+1}} \\&= \left[\left(x^{\frac{a-a^{-1}}{a-1}} \right) \right]^{\frac{a}{a+1}} \\&= \left(x^{\frac{a(a-a^{-1})}{a^2-1}} \right) \\&= \left(x^{\frac{a^2-a^{-1}+1}{a^2-1}} \right) = \left(x^{\frac{a^2-1}{a^2-1}} \right) \\&= x^1 = x\end{aligned}$$

$$\begin{aligned}(vii) & \left[\frac{a^{x+1}}{a^{y+1}} \right]^{x+y} \left[\frac{a^{y+2}}{a^{z+2}} \right]^{y+z} \left[\frac{a^{z+3}}{a^{x+3}} \right]^{z+x} \\&= \left[a^{(x+1)-(y+1)} \right]^{x+y} \left[a^{(y+2)-(z+2)} \right]^{y+z} \left[a^{(z+3)-(x+3)} \right]^{z+x} \\&= \left[a^{x-y} \right]^{x+y} \left[a^{y-z} \right]^{y+z} \left[a^{z-x} \right]^{z+x} \\&= \left[a^{x^2-y^2} \right] \left[a^{y^2-z^2} \right] \left[a^{z^2-x^2} \right] \\&= a^{x^2-y^2+y^2-z^2+z^2-x^2} = a^0 = 1\end{aligned}$$

**Solutions for Class 9 Maths Chapter 2 Exponents of
Real Numbers**

$$\begin{aligned}(viii) & \left(\frac{3^a}{3^b}\right)^{a+b} \left(\frac{3^b}{3^c}\right)^{b+c} \left(\frac{3^c}{3^a}\right)^{c+a} \\&= (3^{a-b})^{a+b} (3^{b-c})^{b+c} (3^{c-a})^{c+a} \\&= 3^{a^2-b^2} \times 3^{b^2-c^2} \times 3^{c^2-a^2} \\&= 3^{a^2-b^2+b^2-c^2+c^2-a^2} \\&= 3^0 = 1\end{aligned}$$