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Indices and Surds

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1. $\left(\frac{64}{25}\right)^{-\frac{3}{2}} =?$ a) $\frac{125}{215}$ b) $\frac{125}{512}$ c) $\frac{125}{72}$ d) *none of these*

2. $(0.001)^{\frac{1}{3}} =?$ a) 0.1 b) 0.01 c) 1.1 d) *None of these*

3. If $27^x = \frac{9}{3^x}$, then the value of x is   a) 1/2 b) 1   c) 3/2 d) None of these

4. The value of $\frac{5^n + 5^{n-1}}{5^{n+1} - 5^n} =?$ a) 0.1 b) 0.2 c) 0.3 d) None of these

5. If $2^{x-7} \times 5^{x-4} = 1250$, then $x =?$ a) 2   b) 4   c) 6   d) 8

6. $\frac{x^{a(b-c)}}{x^{b(a-c)}} \div \left(\frac{x^b}{x^a}\right)^c =?$ a) 1   b) 2   c) 3   d) None of these

7. $\frac{(x^{a+b})^2 (x^{b+c})^2 (x^{c+a})^2}{(x^a x^b x^c)^4} = 1$ a) 1   b) 2   c) 3   d) None of these

8. Find the value of x, if $5^{x-3} . 3\sqrt{2x-8} = 225$ a) 3   b) 4   c) 5   d) None of these

9. If K= $\sqrt[3]{54} + \sqrt[3]{128} + \sqrt[3]{250} - \sqrt[3]{16}$,   a) 10   b) $10(3)^{\frac{1}{3}}$
   Then the value of K=?   c) $10(2)^{\frac{1}{3}}$ d) None of the above

10. Square root of $15 + 4\sqrt{14} =?$ a) $\sqrt{6} + \sqrt{9}$ b) $\sqrt{7} + \sqrt{8}$
    c) $\sqrt{10} + \sqrt{5}$ d) *None of the above*

11. Square root of $\sqrt{50} + \sqrt{48} =?$ a) $\sqrt{2} + \sqrt{3}$ b) $(\sqrt{2} + \sqrt{3})2^{\frac{1}{4}}$
    c) $\sqrt{2}(\sqrt{2} + \sqrt{3})$ d) *None of these*

12. $\frac{5\sqrt{3} + 2\sqrt{2}}{2\sqrt{3} - 3\sqrt{2}} =?$ a) $42 + 19\sqrt{6}$ b) $\frac{42 + 19\sqrt{6}}{-6}$
    c) $42 - 19\sqrt{6}$ d) *None of these*

13. The value of $\frac{11}{4 - \sqrt{5}} =?$ a) $4 - \sqrt{5}$ b) $2 + \sqrt{5}$
    c) $4 + \sqrt{5}$ d) *None of these*

14. $x = 7 - 4\sqrt{3}$, then the value of $\sqrt{x} - \dfrac{1}{\sqrt{x}} =?$ a)7   b)-7   c)4   d)-4

15. Which of the following is greatest $\sqrt[3]{2}, 2\sqrt[3]{4}, 2\sqrt{3}$ a) $\sqrt[3]{2}$ b) $2\sqrt[3]{4}$ c) $2\sqrt{3}$ d) None

16. If $x = 2 + 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$, then $x^3 - 6x^2 + 6x + 2 =?$ a) 0   b) 2   c) 4   d) 8

17. If $\dfrac{4+3\sqrt{3}}{\sqrt{7+4\sqrt{3}}} = a + \sqrt{b}$, then $(a, b) =?$ a) (12, 1)   b) (1, 12)

c) (-1,12)   d)(-12,1)

18. The value of $\dfrac{\sqrt{7}}{\sqrt{16+6\sqrt{7}}-\sqrt{16-6\sqrt{7}}}$ is   a) 0   b)1/2   c) 1   d) 2

19. If $a^{x-1} = bc, b^{y-1} = ca$ and $c^{z-1} = ab$, then $xy + yz + zx =?$

a) 0   b) 1   c)xyz   d)1/x

20. If $2^x = 3^y = 12^z$, then $\dfrac{1}{z} - \dfrac{1}{y} =?$

a) 2/x   b) 1/x   c)-1/x   d)-2/x

Answers with Solutions

1. $\left(\frac{64}{25}\right)^{-\frac{3}{2}} = ?$

   Solution:(B) $\left(\frac{64}{25}\right)^{-\frac{3}{2}} = \frac{1}{\left(\frac{64}{25}\right)^{\frac{3}{2}}} = \left(\frac{25}{64}\right)^{\frac{3}{2}} = \left[\left(\frac{5}{8}\right)^2\right]^{\frac{3}{2}} = \left(\frac{5}{8}\right)^3 = \frac{125}{512}$

2. $(0.001)^{\frac{1}{3}} = ?$

   Solution:(A) $(0.001)^{\frac{1}{3}} = \left(\frac{1}{1000}\right)^{\frac{1}{3}} = \left(\left(\frac{1}{10}\right)^3\right)^{\frac{1}{3}} = \frac{1}{10} = 0.1$

3. If $27^x = \frac{9}{3^x}$, then the value of x is

   Solution:(A)   Given expression
   $$27^x = \frac{9}{3^x}$$
   $$(3^3)^x \times 3^x = 9$$
   $$3^{4x} = 3^2 \rightarrow 4x = 2 \rightarrow x = \frac{1}{2}$$

4. The value of $\frac{5^n + 5^{n-1}}{5^{n+1} - 5^n} = ?$

   Solution:(C) $\frac{5^n + 5^{n-1}}{5^{n+1} - 5^n} = \frac{5^{n-1}(5+1)}{5^n(5-1)} = \frac{5^{n-1} \times 6}{5^n \times 4} = \frac{5^n \times 5^{-1} \times 6}{5^n \times 4} = \frac{6}{5 \times 4} = \frac{3}{10} = 0.3$

5. If $2^{x-7} \times 5^{x-4} = 1250$, then $x = ?$

   Solution:(D)   The given expression $2^{x-7} \times 5^{x-4} = \frac{2^x}{2^7} \times \frac{5^x}{5^4} = 1250$
   $$\rightarrow \frac{(10)^x}{(10)^4 \times 2^3} = 1250 \rightarrow \frac{(10)^x}{(10)^4} = 10000 \rightarrow (10)^{x-4} = (10)^4 \rightarrow x - 4 = 4 \rightarrow x = 8$$

6. $\frac{x^{a(b-c)}}{x^{b(a-c)}} \div \left(\frac{x^b}{x^a}\right)^c = ?$

   Solution:(A) $\frac{x^{ab-ac}}{x^{ab-ac}} \div \frac{x^{bc}}{x^{ac}} = x^{ab-ac-ab+ac} \times \frac{x^{ac}}{x^{bc}} = \frac{x^{bc}}{x^{ac}} \times \frac{x^{ac}}{x^{bc}} = 1$

7. $\dfrac{\left(x^{a+b}\right)^2\left(x^{b+c}\right)^2\left(x^{c+a}\right)^2}{\left(x^a x^b x^c\right)^4} = 1$

Solution:(C) $\dfrac{\left(x^{2a+2b}\right)\left(x^{2b+2c}\right)\left(x^{2c+2a}\right)}{x^{4a} \times x^{4b} \times x^{4c}} = \dfrac{x^{4a} x^{4b} x^{4c}}{x^{4a} x^{4b} x^{4c}} = 1$

8. Find the value of x, if $5^{x-3}.3\sqrt{2x-8} = 225$

Solution:(C) $5^{x-3} \times 3^{2x-8} = 225$

$5^{x-3} \times 3^{2x-8} = 5^2 \times 3^2$

$x - 3 = 2 \ and \ 2x - 8 = 2$

In case of x=5

9. If K= $\sqrt[3]{54} + \sqrt[3]{128} + \sqrt[3]{250} - \sqrt[3]{16}$, then the value of K=?

Given expression $\sqrt[3]{2}\left[\sqrt[3]{27} + \sqrt[3]{64} + \sqrt[3]{125} - \sqrt[3]{8}\right]$

$= \sqrt[3]{2}\left[(27)^{\frac{1}{3}} + (64)^{\frac{1}{3}} + (125)^{\frac{1}{3}} - (8)^{\frac{1}{3}}\right]$

$= \sqrt[3]{2}[3 + 4 + 5 - 2] = \sqrt[3]{2[10]} = (10)(2)^{\frac{1}{3}}$ (Option C)

10. Square root of 15+4$\sqrt{14}$ =?

Solution:(B) $\sqrt{15 + 4\sqrt{14}} = \sqrt{15 + 2\sqrt{56}} = \sqrt{15 + 2\sqrt{8 \times 7}} = \sqrt{\left(\sqrt{7} + \sqrt{8}\right)^2} = \sqrt{7} + \sqrt{8}$

11. Square root of $\sqrt{50} + \sqrt{48}$=?

Solution:(B) $\sqrt{\sqrt{50} + \sqrt{48}} = \sqrt{\sqrt{2}\left(5 + 2\sqrt{6}\right)} = \sqrt{\sqrt{2}\left(5 + 2\sqrt{2 \times 3}\right)}$

$= 2^{\frac{1}{4}} \times \sqrt{\left(\sqrt{2} + \sqrt{3}\right)^2} = 2^{\frac{1}{4}} \times \left(\sqrt{2} + \sqrt{3}\right) = \left(\sqrt{2} + \sqrt{3}\right)2^{\frac{1}{4}}$

12. $\dfrac{5\sqrt{3} + 2\sqrt{2}}{2\sqrt{3} - 3\sqrt{2}}$ =?

Solution:(B) $\frac{5\sqrt{3}+2\sqrt{2}}{2\sqrt{3}-3\sqrt{2}} \times \frac{2\sqrt{3}+3\sqrt{2}}{2\sqrt{3}+3\sqrt{2}} = \frac{30+1\ \sqrt{6}+4\sqrt{6}+1}{(2\sqrt{3})^2-(3\sqrt{2})^2}$

$= \frac{42+19\sqrt{6}}{12-18} = \frac{42+19\sqrt{6}}{-6}$

13. The value of $\frac{11}{4-\sqrt{5}} = ?$

Solution:(C) $\frac{11}{4-\sqrt{5}} = \frac{11}{4-\sqrt{5}} \times \frac{4+\sqrt{5}}{4+\sqrt{5}} = \frac{11(4+\sqrt{5})}{16-5} = 4+\sqrt{5}$

14. If $x = 7 - 4\sqrt{3}$, then the value of $\sqrt{x} - \frac{1}{\sqrt{x}} = ?$

Solution:(C)   Given x=7-4$\sqrt{3}$
$x + \frac{1}{x} = (7-4\sqrt{3}) + \frac{1}{7-4\sqrt{3}} = 7 - 4\sqrt{3} + 7 + 4\sqrt{3} = 14$

15. Which of the following is greatest $\sqrt[3]{2}, 2\sqrt[3]{4}, 2\sqrt{3}$

Solution(C) $\sqrt[3]{2}, 2\sqrt[3]{4}, 2\sqrt{3}$
$\rightarrow \sqrt[3]{2}, \sqrt[3]{32}, \sqrt{12}$
$LCM\ of\ 3\ and\ 2\ is\ 6.$
$\sqrt[3]{2} = 2^{\frac{1}{3}} = 2^{\frac{2}{6}} = \sqrt[6]{2^2} = \sqrt[6]{4}$
$\sqrt[3]{32} = (32)^{\frac{1}{3}} = (32)^{\frac{2}{6}} = \sqrt[6]{(32)^2} = \sqrt[6]{1024}$
$\sqrt{12} = (12)^{\frac{1}{2}} = (12)^{\frac{3}{6}} = \sqrt[6]{(12)^3} = \sqrt[6]{1728}$
$\therefore Gratest\ among\ all\ is\ \sqrt[6]{1728} = \sqrt{12} = 2\sqrt{3}$

16. If $x = 2 + 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$, then $x^3 - 6x^2 + 6x + 2 = ?$

Solution:(C) $Given\ x = 2 + 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$

$\rightarrow x - 2 = 2^{\frac{1}{3}}\left(1 + 2^{\frac{1}{3}}\right) \rightarrow (x-2)^3 = 2\left(1 + 2^{\frac{1}{3}}\right)^3$

$\rightarrow x^3 - 6x^2 + 12x - 8 = 2\left[1 + 2 + 3 \times 2^{\frac{1}{3}}\left(1 + 2^{\frac{1}{3}}\right)\right]$

$= 2[3 + 3(x-2)] = 6x - 6$

$\rightarrow x^3 - 6x^2 + 6x - 2 = 0$

$\rightarrow x^3 - 6x^2 + 6x + 2 = 4$

17. If $\frac{4+3\sqrt{3}}{\sqrt{7+4\sqrt{3}}} = a + \sqrt{b}$, then $(a, b) = ?$

Solution:(C) $\frac{4+3\sqrt{3}}{\sqrt{7+4\sqrt{3}}} = \frac{4+3\sqrt{3}}{\sqrt{7+2\sqrt{12}}} = \frac{4+3\sqrt{3}}{2+\sqrt{3}} = \frac{(4+3\sqrt{3})(2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})} = \frac{8-4\sqrt{3}+6\sqrt{3}-9}{4-3}$

$= 2\sqrt{3} - 1 = -1 + \sqrt{12}$

18. *The value of* $\frac{\sqrt{7}}{\sqrt{16+6\sqrt{7}}-\sqrt{16-6\sqrt{7}}}$ *is*

Solution:(B) $\sqrt{16 + 6\sqrt{7}} = \sqrt{16 + 2\sqrt{63}} = \sqrt{16 + 2\sqrt{9 \times 7}}$

$= \sqrt{9} + \sqrt{7} = 3 + \sqrt{7}$

$\sqrt{16 - 6\sqrt{7}} = \sqrt{16 - 2\sqrt{63}} = \sqrt{16 - 2\sqrt{9 \times 7}}$

$= \sqrt{9} - \sqrt{7} = 3 - \sqrt{7}$

Given expression $= \frac{\sqrt{7}}{(3+\sqrt{7})-(3-\sqrt{7})} = \frac{\sqrt{7}}{2\sqrt{7}} = \frac{1}{2}$

19. *If* $a^{x-1} = bc, b^{y-1} = ca$ *and* $c^{z-1} = ab,$ *then* $xy + yz + zx =?$

Solution:(C) $a^{x-1} = bc \rightarrow a^x = abc \rightarrow b = (abc)^{\frac{1}{x}}$ ... (1)

$b^{y-1} = ca \rightarrow b^y = abc \rightarrow b = (abc)^{\frac{1}{y}}$ ... (2)

$c^{z-1} = ab \rightarrow c^z = abc \rightarrow c = (abc)^{\frac{1}{z}}$ ... (3)

Multiplying Eqs. (1), (2), (3)

$(abc) = (abc)^{\frac{1}{x}}(abc)^{\frac{1}{y}}(abc)^{\frac{1}{z}} = (abc)^{\frac{1}{x}+\frac{1}{y}+\frac{1}{z}}$

$\rightarrow 1 = \frac{1}{x} + \frac{1}{y} + \frac{1}{z} \rightarrow xy + yz + zx = xyz$

20. *If* $2^x = 3^y = 12^z,$ *then* $\frac{1}{z} - \frac{1}{y} =?$

Solution:(A) *Given* $3^y = 2^x \rightarrow 3 = 2^{\frac{x}{y}} \rightarrow 3^{\frac{1}{x}} = 2^{\frac{1}{y}}$ ... (1)

$12^z = 2^x \rightarrow 12 = 2^{\frac{x}{z}} \rightarrow 12^{\frac{1}{x}} = 2^{\frac{1}{z}}$ ... (2)

Dividing $\frac{3^{\frac{1}{x}}}{12^{\frac{1}{x}}} = \frac{2^{\frac{1}{y}}}{2^{\frac{1}{z}}} = 2^{\frac{1}{y}-\frac{1}{z}}$

$\rightarrow \frac{3^{\frac{1}{x}}}{3^{\frac{1}{x}} \times 4^{\frac{1}{x}}} = 2^{\frac{1}{y}-\frac{1}{z}} \rightarrow 2^{-\frac{2}{x}} = 2^{\frac{1}{y}-\frac{1}{z}}$

$\rightarrow \frac{1}{y} - \frac{1}{z} = -\frac{2}{x} \rightarrow \frac{1}{z} - \frac{1}{y} = \frac{2}{x}$