3. FUNDAMENTALS OF SURDS ①

Class: VII, Mathematics FOUNDATION+, SOLUTIONS 2025-26

JEEMAINS LEVEL

01. $\sqrt{75} = \sqrt{25 \times 3} = 5\sqrt{3}$, a surd — Ans: C

02 $\sqrt{3} + \sqrt{5} - \sqrt{6}$ — Ans: C

03 Conceptual — Ans: C

04 Option B: $\sqrt[10]{3} = 3^{\frac{1}{10}}$

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

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

$\therefore$ L.C.M. of $10, 4, 5 = 20$

$\therefore 3^{\frac{1}{10}} = 3^{\frac{2}{20}} = \sqrt[20]{9}$

$2^{\frac{1}{4}} = 2^{\frac{5}{20}} = \sqrt[20]{32}$

$5^{\frac{1}{5}} = 5^{\frac{4}{20}} = \sqrt[20]{625}$

$\sqrt[20]{9} < \sqrt[20]{32} < \sqrt[20]{625}$

$\sqrt[10]{3} < \sqrt[4]{2} < \sqrt[5]{5}$ — Ans: B

05. A) $(\sqrt[5]{7})^5 = 7$, not a surd

Ans: A

(2)

06. $p^6 = 2^x = 4^3 = 2^6$

$\therefore x = 6, p = 2$

$q^{12} = 2^{y+1} = 8^4 = 2^{12}$

$q = 2$; $y + 1 = 12 \Rightarrow y = 11$

$r^{20} = 2^{z+2} = 16^5 = 2^{20}$

$r = 2$, $z + 2 = 20$

$z = 18$

A) $\sqrt[r]{z}$, $\sqrt[q]{y}$, $\sqrt[p]{x}$

$\sqrt[2]{18}$, $\sqrt[2]{11}$, $\sqrt[2]{6}$ → decending order

Ans. A

07. $3^{\frac{1}{4}}$, $2^{\frac{1}{6}}$, $4^{\frac{1}{3}}$

L.C.M. of 4, 6, 3 = 12

$3^{\frac{1}{4}} = 3^{\frac{3}{12}} = \sqrt[12]{27}$

$2^{\frac{1}{6}} = 2^{\frac{2}{12}} = \sqrt[12]{4}$

$4^{\frac{1}{3}} = 4^{\frac{4}{12}} = \sqrt[12]{256}$

Descending order $\sqrt[3]{4}$, $\sqrt[4]{3}$, $\sqrt[6]{2}$

Ans: A

08. $\sqrt[3]{a^2}\left\{\sqrt[3]{a}\left(\sqrt[4]{a}\right)^4\right\}^{\frac{1}{4}}$

$= \sqrt[3]{a^2}\left\{\sqrt[3]{a}\cdot a\right\}^{\frac{1}{4}}$

$= \sqrt[3]{a^2}\left\{a^{\frac{4}{3}}\right\}^{\frac{1}{4}}$

$= a^{\frac{2}{3}+\frac{1}{3}}$

$= a$

Ans: C

09. $\sqrt[m]{a} = K \Rightarrow a = K^m$ | $\sqrt[n]{b} = K \Rightarrow b = K^n$ | $\sqrt[p]{c} = K \Rightarrow c = K^p$

Now $abc = 1$

$\Rightarrow K^{m+n+p} = K^0$

$\Rightarrow m+n+p = 0$

Ans: A

10. $\sqrt[n]{x^3y^2} = x^b \cdot y^4$

$\Rightarrow (x^3y^2)^{\frac{1}{n}} = x^b \cdot y^4$

$\Rightarrow (x^3y^2)^{\frac{1}{n}} = (x^3 \cdot y^2)^2$

$\Rightarrow \frac{1}{n} = 2$

$\Rightarrow n = \frac{1}{2}$

Ans: C

JEE ADVANCED

01. Conceptual — Ans: A, B, C

02. Conceptual — Ans: A, B

03 Statement I: Conceptual (True)
Statement II: Conceptual (False) — Ans: C

04. Statement I: Conceptual (False)
Statement II: Conceptual (True) — Ans: D

05 Assertion: $\sqrt{72} = \sqrt{36 \times 2} = 6\sqrt{2}$
Reason: True — Ans: A

06. Assertion: $5\sqrt{3}$ is a mixed surd (False)
Reason: Conceptual (True) — Ans: C

07. $4 \cdot \sqrt[3]{\frac{2010}{64}}$

$= \sqrt[3]{\frac{2010}{64} \times 4^3}$

$= \sqrt[3]{2010}$ — Ans: C

08 $\sqrt{\frac{\overset{402}{\cancel{2010}} \times 402 \times 2}{\underset{25}{\cancel{125}} \times 125}} = \frac{402}{25}\sqrt{\frac{2}{5}}$ (5)

Ans: D

09. $a - \sqrt[n]{b} = a \cdot \sqrt[n]{b}$

$\Rightarrow a = a \cdot \sqrt[n]{b} + \sqrt[n]{b}$

$\Rightarrow a = (a+1)\sqrt[n]{b}$

$\Rightarrow \sqrt[n]{b} = \frac{a}{a+1}$

$\Rightarrow b = \left(\frac{a}{a+1}\right)^n$

Ans: B

10. Conceptual

Ans: D

11. $\sqrt[4]{3^1 \times 3^3 \times 3^4} = \sqrt[4]{3^8} = (3^8)^{\frac{1}{4}} = 3^2 = 9$

Ans: 9

12 Conceptual

Ans: 1

13 a) $\sqrt[2]{3} = \sqrt[2\times6]{3^6} = \sqrt[12]{729}$ (S)

b) $\sqrt{2} = \sqrt[12]{\quad}$

c) $\sqrt[4]{2} = \sqrt[4\times3]{2^3} = \sqrt[12]{8}$ (Q)

d) $\sqrt[3]{4} = \sqrt[3\times4]{4^4} = \sqrt[12]{256}$ (P)

Ans: S, —, Q, P

14 a) $3^{\frac{1}{3}}, 5^{\frac{1}{4}}$ (6)

L.c.m 3, 4 = 12

$= 3^{\frac{4}{12}}, 5^{\frac{3}{12}}$

$= \sqrt[12]{81}, \sqrt[12]{125}$

Greater $= \sqrt[4]{5}$ (s)

b) $3^{\frac{1}{3}} = 3^{\frac{4}{12}} = \sqrt[12]{81}$

$4^{\frac{1}{4}} = 4^{\frac{3}{12}} = \sqrt[12]{64}$

Greater $= \sqrt[3]{3}$ (p)

c) $3^{\frac{1}{4}} = 3^{\frac{3}{12}} = \sqrt[12]{27}$

$4^{\frac{1}{3}} = 4^{\frac{4}{12}} = \sqrt[12]{256}$ (r)

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

d) $3^{\frac{1}{4}} = 3^{\frac{3}{12}} = \sqrt[12]{27}$

$10^{\frac{1}{6}} = 10^{\frac{2}{12}} = \sqrt[12]{100}$

lesser $= \sqrt[4]{3}$ (r)

Ans: s, p, r, r

LEARNERS TASK
CUBE'S

01. $\sqrt{2}$ Ans.. A

02 $\sqrt[5]{32} = \sqrt[5]{2^5} = 2$, not a surd Ans.. D

03 $\sqrt[2]{\sqrt[3]{6}} = \sqrt[6]{6}$ (1)

$\therefore$ Order $= 6$ Ans: B

04 An Irrational number Ans: B

05 $\sqrt[4]{\sqrt[3]{2^6}} = \sqrt[12]{2^6} = (2^6)^{\frac{1}{12}} = 2^{1/2} = \sqrt{2}$

Ans: D

06 $\sqrt{\frac{5}{4}} = \frac{\sqrt{5}}{\sqrt{4}} = \frac{\sqrt{5}}{2}$ Ans: D

07 $2^{\frac{1}{2}}, 2^{\frac{1}{3}}, 2^{\frac{1}{4}}, 2^{1/5}$

clearly $2^{\frac{1}{2}}$ is greater and $2^{\frac{1}{5}}$ is least Ans: A

08 $\sqrt{19}$ Ans: D

09 $a^n = x^a = 16$

$\Rightarrow 4^2 = 2^4 = 16$

here $n=4$, $a=2$, $x=4$

A) $\sqrt[3]{n^{a+a}} = \sqrt[3]{4^4} = 4^{4/3}$

B) $\sqrt[4]{x^{a+a}} = \sqrt[4]{4^4} = 4$

C) $2\sqrt{a^{n+x}} = 2 \cdot \sqrt{2^{4+4}} = 2 \cdot \sqrt{2^8} = 2 \cdot 2^4$

D) $\sqrt{a^{n+n}} = \sqrt{2^{4+4}} = \sqrt{2^8} = 2^4$ Ans: C

10 $a = \sqrt[3]{343} = 7$; $b = \sqrt[3]{216} = 6$ (8)

$c = \sqrt[3]{125} = 5$, $d = \sqrt[3]{64} = 4$

Now $\sqrt[5]{a}$, $\sqrt[5]{b}$, $\sqrt[5]{6}$, $\sqrt[5]{d}$

$\Rightarrow \sqrt[5]{7}$, $\sqrt[5]{6}$, $\sqrt[5]{5}$, $\sqrt[5]{4}$

Descending order $\sqrt[5]{7}$, $\sqrt[5]{6}$, $\sqrt[5]{5}$, $\sqrt[5]{4}$

Ans: C

JEE MAINS LEVEL

01. 11 Ans: A

02 $3 \cdot \sqrt[4]{5} = \sqrt[4]{3^4 \cdot 5} = \sqrt[4]{405}$ Ans: A

03 $\sqrt{\sqrt[3]{512}} = \sqrt[6]{512} = \sqrt[6]{2^9} = 2^{3/2} = 2\sqrt{2}$ Ans: A

04. $\frac{\sqrt[3]{2009}}{\sqrt[3]{2010}} = \sqrt[3]{\frac{2009}{2010}}$ Ans: C

05 e

06 $\sqrt[5]{288} = \sqrt[5]{2^5 \times 9} = 2\sqrt[5]{9}$ Ans: C

07 $(ab)^{\frac{m}{n}} = (ab)^{\frac{1}{k}} \Rightarrow k = \frac{n}{m}$ Ans: B

08 $x = 7^{\frac{1}{3}}, \quad y = 7^{\frac{1}{4}}, \quad z = 7^{\frac{1}{2}}$

L.c.m of 3, 4, 2 = 12

$x = 7^{\frac{4}{12}} = \sqrt[12]{7^4}$ | $y = 7^{\frac{3}{12}} = \sqrt[12]{7^3}$ | $z = 7^{\frac{6}{12}} = \sqrt[12]{7^6}$

Descending Order → $\sqrt[12]{7^6} > \sqrt[12]{7^4} > \sqrt[12]{7^3}$

→ $z > x > y$

Ans: A

09 $\frac{2}{3}\sqrt{32} = \sqrt{\frac{4}{9} \times 32} = \sqrt{\frac{128}{9}}$ Ans. D

10 $\sqrt{1350} = \sqrt{225 \times 6} = 15\sqrt{6}$ Ans: C

ADVANCED LEVEL

-01. A) $\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$

B) $\sqrt{24} = \sqrt{4 \times 6} = 2\sqrt{6}$

C) $\sqrt{18} = 3\sqrt{2}$

All are dissimilar surds Ans: D

02 A) $\sqrt[4]{9\sqrt{11}} = \sqrt[36]{11}$

C) $\sqrt[9]{9\sqrt{11}} = \sqrt[36]{11}$ Ans: A, C

03 Statement I: Conceptual (True) (10)

Statement II: $2 \pm \sqrt[5]{6}$ is a mixed surd (False)

Ans: C

04. Statement I: Conceptual (False)

Statement II: Conceptual (True)

Ans: D

05 Assertion: $\frac{\sqrt{18}}{\sqrt{2}} = \sqrt{\frac{18}{2}} = \sqrt{9}$ (True)

Reason: $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$ (True)

Ans: A

06 Assertion: $\sqrt{3} \times \sqrt{12} = \sqrt{36}$ (True)

Reason: $\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$ (True)

Ans: A

07. $\sqrt[5]{\sqrt[2]{(x^2)^y}} = \sqrt[2]{x^{5/2}}$

$= x^{\frac{2y}{10}} = x^{\frac{5}{4}}$

$\Rightarrow \frac{y}{5} = \frac{5}{4}$

$\Rightarrow y = \frac{25}{4}$

Ans: D

08 $\sqrt[5]{\sqrt[11]{a^{x+y}}} = \sqrt[11]{a^{x-y}}$

$\Rightarrow a^{\frac{x+y}{55}} = a^{\frac{x-y}{11}}$

$\Rightarrow \frac{x+y}{55} = \frac{x-y}{11}$

$\Rightarrow x+y = 5(x-y)$

$\Rightarrow x+y = 5x-5y$

$\Rightarrow 4x = 6y$

$\Rightarrow 2x = 3y$

Ans: B

09 D) $13+\sqrt{13}$

Ans: D

10 B) $\frac{\sqrt{11}}{2} \cdot \sqrt[6]{64}$

$= \frac{\sqrt{11}}{2} \cdot \sqrt[6]{2^6} = \frac{\sqrt{11}}{2} \times 2 = \sqrt{11}$ → not a mixed surd

c) $\frac{17}{2} \cdot \sqrt[3]{34}$ → mixed surd

A) $\frac{11}{2} \sqrt[3]{216} = \frac{11}{2} \times 6 = 33$ → not a surd

Ans: B

11. $\frac{4z}{xy} = \frac{4\sqrt[3]{256}}{\sqrt[6]{64} \cdot \sqrt[3]{64}} = \frac{4 \cdot 4}{2 \times 8} = 1$

Ans: 1

12 $\sqrt{2}, \sqrt{5}, \sqrt{7}$ are surds Ans: 3

(12)

13 a) $\sqrt[5]{16} \times \sqrt[5]{2} = \sqrt[5]{32} = 2$ (r)

b) $\frac{\sqrt[4]{243}}{\sqrt[4]{3}} = \sqrt[4]{\frac{243}{3}} = \sqrt[4]{81} = 3$ (q)

c) $\sqrt[3]{4} \times \sqrt[3]{16} = \sqrt[3]{64} = 4$ (s)

d) $\frac{\sqrt[4]{1250}}{\sqrt[4]{2}} = \sqrt[4]{\frac{1250}{2}} = \sqrt[4]{625} = 5$ (p)

Ans: r, q, s, p

14 a) $\sqrt[2]{3} \times \sqrt[3]{4}$

$= 3^{\frac{1}{2}} \times 4^{\frac{1}{3}}$

$= 2^{\frac{3}{6}} \times 4^{\frac{2}{6}}$

$= \sqrt[6]{8} \times \sqrt[6]{16}$

$= \sqrt[6]{108}$ -

b) $\frac{\sqrt[5]{30}}{\sqrt[5]{6}} = \sqrt[5]{\frac{30}{6}}$

$= \sqrt[5]{5}$ (p)

c) $\sqrt[3]{3} \cdot \sqrt[4]{5}$

$= 3^{\frac{1}{3}} \quad 5^{\frac{1}{4}}$

$= 3^{\frac{4}{12}} \cdot 5^{\frac{3}{12}}$

$= \sqrt[12]{81 \times 125}$

$= \sqrt[12]{10125}$

(s)

d) $\sqrt[5]{\sqrt[7]{[(2010)^7]^5}}$

$= 2010$ (r)

Ans: —, P, S, r

ADDITIONAL PRACTICE QUESTIONS (13)

01. $\sqrt[n]{x^3y^2} = x^6 \cdot y^4$

$\Rightarrow x^{\frac{3}{n}} \cdot y^{\frac{2}{n}} = x^6 \cdot y^4$

$\Rightarrow \frac{3}{n} = 6 \Rightarrow n = \frac{1}{2}$

Ans: C

02 $1838\frac{17}{64} = \frac{117649}{64} = \left(\frac{7}{2}\right)^6$

$\therefore$ sixth root $= \frac{7}{2}$

Ans: A

03 $2 + \sqrt{1 - \frac{2176}{2401}} = 2 + \sqrt{\frac{225}{2401}}$

$= 2 + \frac{15}{49} = \frac{113}{49}$

$\therefore 1 + x = \frac{113}{49}$

$x = \frac{113}{49} - 1 = \frac{64}{49}$

Ans: D

04 $\frac{x}{\sqrt{0.0064}} = \sqrt[3]{0.008}$

$= \frac{x}{0.08} = 0.2$

$\Rightarrow x = 0.016$

Ans: C

05 A) $\sqrt{8} = 2\sqrt{2}$

B) $\sqrt{244} = \sqrt{4 \times 61} = 2\sqrt{61}$

c) $\sqrt{242} = \sqrt{2 \times 11^2} = 11\sqrt{2}$

d) $\sqrt{245} = \sqrt{5 \times 7^2} = 7\sqrt{5}$

∴ Similar surds A, C

Ans: A, C

06 Statement I: Conceptual (True)

Statement II: Conceptual (False) Ans: C

07. Statement I: Conceptual (False)

Statement II: Conceptual (True) Ans: D

08. A) $2009\sqrt{2010}$

D) $\frac{\sqrt{3}}{\sqrt{5}}$ are mixed surds

Ans: A, D

09. $\sqrt{5} + \sqrt{8} - \sqrt{11}$ Ans: A

10 $2008 \cdot \sqrt[3]{2009} = \sqrt[3]{(2008)^3 \cdot 2009}$ Ans: D

11 monomial surd → $\sqrt{5}$ Ans: A

⟹ THE END ⟸