

Rationalization (Surds)

MCQ Test, Set 02

Time: 30 minutes

Maximum marks: 25

Name: _____ Class: _____ Date: _____

- There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
- Each correct answer carries 1 mark. There is no negative marking.
- The key sheet and worked solutions are at the end of this test.

1. $\sqrt[4]{81} =$

A. 3

B. $\frac{81}{4}$

C. 9

D. 12

2. Which of the following is irrational but not a surd?

A. $\sqrt{13}$ B. $\sqrt[3]{49}$ C. $\sqrt[5]{18}$ D. π

3. Pick the mixed surd from the following.

A. $3\sqrt[3]{4}$ B. $6\sqrt{324}$ C. $\sqrt[4]{81}$ D. $\sqrt{8}$

4. The conjugate surd of $5 - \sqrt{13}$ is

A. $-5 + \sqrt{13}$ B. $-5 - \sqrt{13}$ C. $\frac{1}{5 - \sqrt{13}}$ D. $5 + \sqrt{13}$

5. $\sqrt{2} \times \sqrt{50} =$

A. $2\sqrt{50}$

B. 10

C. $\sqrt{52}$

D. 100

6. $\sqrt{21} \times \sqrt{23} =$

A. $21\sqrt{23}$ B. $\sqrt{44}$

C. 483

D. $\sqrt{483}$

7. $\frac{\sqrt{23}}{\sqrt{15}} =$

A. $\frac{23}{15}$ B. $\sqrt{8}$ C. $\sqrt{\frac{15}{23}}$ D. $\sqrt{\frac{23}{15}}$

8. $\sqrt[5]{9}$ in exponent form is

A. $\frac{9}{5}$ B. $9^{\frac{1}{5}}$ C. 9^5 D. $5^{\frac{1}{9}}$

9. $\sqrt[4]{8} \times \sqrt[4]{2} =$

A. 2

B. 16

C. $\sqrt[4]{10}$ D. $\sqrt[8]{16}$

10. If $(k\sqrt{2})^2 = 128$ and $k > 0$, then $k =$

A. 64

B. $8\sqrt{2}$

C. 16

D. 8

11. $(4 + \sqrt{3})(5 + \sqrt{3}) =$

A. $17 + 9\sqrt{3}$

B. 23

C. $23 + 9\sqrt{3}$ D. $23 - 9\sqrt{3}$

12. A rationalising factor of $20 + \sqrt{5}$ is
A. $20 + \sqrt{5}$ **B.** $\sqrt{5}$ **C.** $20 - \sqrt{5}$ **D.** $-\sqrt{5} - 20$
-
13. The rationalising factor of $\sqrt[3]{4} - \sqrt[3]{2}$ is
A. $\sqrt[3]{4} + \sqrt[3]{2}$ **B.** $(\sqrt[3]{4})^2 - \sqrt[3]{4} \cdot \sqrt[3]{2} + (\sqrt[3]{2})^2$
C. $(\sqrt[3]{4})^2 + (\sqrt[3]{2})^2$ **D.** $(\sqrt[3]{4})^2 + \sqrt[3]{4} \cdot \sqrt[3]{2} + (\sqrt[3]{2})^2$
-
14. $\sqrt{20} + \sqrt{245} =$
A. $\sqrt{265}$ **B.** $9\sqrt{5}$ **C.** $9\sqrt{10}$ **D.** $14\sqrt{5}$
-
15. $(\sqrt{11})^3 =$
A. $3\sqrt{11}$ **B.** 121 **C.** $11\sqrt{11}$ **D.** 11
-
16. $(8 - \sqrt{5})^2 =$
A. $69 - 8\sqrt{5}$ **B.** $69 - 16\sqrt{5}$ **C.** 69 **D.** $89 - 16\sqrt{5}$
-
17. $(\sqrt{6} + \sqrt{3})^2 =$
A. $45 + 6\sqrt{2}$ **B.** $9 - 6\sqrt{2}$ **C.** $9 + 6\sqrt{2}$ **D.** 9
-
18. $(10 + 2\sqrt{6})(10 - 2\sqrt{6}) =$
A. -44 **B.** 124 **C.** 76 **D.** 88
-
19. $\frac{1}{5-\sqrt{5}} =$
A. $\frac{5+\sqrt{5}}{30}$ **B.** $-\frac{5+\sqrt{5}}{20}$ **C.** $\frac{5-\sqrt{5}}{20}$ **D.** $\frac{5+\sqrt{5}}{20}$
-
20. If $\frac{10+3\sqrt{5}}{4-\sqrt{5}} = a + b\sqrt{5}$, then $b =$
A. 2 **B.** 3 **C.** 5 **D.** -2
-
21. $\frac{\sqrt{7}+\sqrt{2}}{\sqrt{7}-\sqrt{2}} + \frac{\sqrt{7}-\sqrt{2}}{\sqrt{7}+\sqrt{2}} =$
A. $-\frac{18}{5}$ **B.** $\frac{18}{5}$ **C.** $\frac{9}{5}$ **D.** $\frac{4\sqrt{14}}{5}$
-
22. $\frac{1}{\sqrt{17}+\sqrt{13}} + \frac{1}{\sqrt{17}-\sqrt{13}} =$
A. $\frac{\sqrt{17}}{2}$ **B.** 0 **C.** $\frac{\sqrt{13}}{2}$ **D.** $\frac{\sqrt{17}}{15}$
-
23. If $x = \frac{1}{15+4\sqrt{14}}$, then $x + \frac{1}{x} =$
A. 30 **B.** $8\sqrt{14}$ **C.** 15 **D.** 450
-
24. $\sqrt{10 + \sqrt{96}} =$
A. $2 - \sqrt{6}$ **B.** $\sqrt{6} + 2$ **C.** $\sqrt{6} - 2$ **D.** $\sqrt{24} + 1$
-
25. $\sqrt{4 + \sqrt{15}} =$
A. $\frac{\sqrt{5}+\sqrt{3}}{2}$ **B.** $\frac{\sqrt{5}-\sqrt{3}}{\sqrt{2}}$
C. $\frac{\sqrt{5}+\sqrt{3}}{\sqrt{2}}$ **D.** $\sqrt{5} + \sqrt{3}$
-

Key sheet

1. A	2. D	3. A	4. D	5. B
6. D	7. D	8. B	9. A	10. D
11. C	12. C	13. D	14. B	15. C
16. B	17. C	18. C	19. D	20. A
21. B	22. A	23. A	24. B	25. C

Solutions

1. $\sqrt[4]{81} =$

$$\sqrt[4]{81} = \sqrt[4]{3 \times 3 \times 3 \times 3} = 3$$

Ans: (A) 3

2. Which of the following is irrational but not a surd?

π is irrational, but it is not the root of a rational number.

The other three are surds.

Ans: (D) π

3. Pick the mixed surd from the following.

$3\sqrt[3]{4} = 3 \cdot \sqrt[3]{4}$: a rational number times a surd.

$\sqrt{8}$ is a pure surd; $6\sqrt{324} = 108$ and $\sqrt[4]{81} = 3$ are rational.

Ans: (A) $3\sqrt[3]{4}$

4. The conjugate surd of $5 - \sqrt{13}$ is

Only the sign of the surd part changes: the conjugate of $5 - \sqrt{13}$ is $5 + \sqrt{13}$.

Ans: (D) $5 + \sqrt{13}$

5. $\sqrt{2} \times \sqrt{50} =$

$$\sqrt{2} \times \sqrt{50} = \sqrt{100} = \sqrt{10 \times 10} = 10$$

Ans: (B) 10

6. $\sqrt{21} \times \sqrt{23} =$

$$\sqrt{21} \times \sqrt{23} = \sqrt{21 \times 23} = \sqrt{483} \text{ (multiply the numbers under the roots).}$$

Ans: (D) $\sqrt{483}$

7. $\frac{\sqrt{23}}{\sqrt{15}} =$

$$\frac{\sqrt{23}}{\sqrt{15}} = \sqrt{\frac{23}{15}} \text{ (divide the numbers under the roots)}$$

Ans: (D) $\sqrt{\frac{23}{15}}$

8. $\sqrt[5]{9}$ in exponent form is

$$\sqrt[n]{a} = a^{\frac{1}{n}}, \text{ so } \sqrt[5]{9} = 9^{\frac{1}{5}}$$

Ans: (B) $9^{\frac{1}{5}}$

9. $\sqrt[4]{8} \times \sqrt[4]{2} =$

$$\begin{aligned} \sqrt[4]{8} \times \sqrt[4]{2} &= \sqrt[4]{8 \times 2} \\ &= \sqrt[4]{16} = \sqrt[4]{2^4} = 2 \end{aligned}$$

Ans: (A) 2

10. If $(k\sqrt{2})^2 = 128$ and $k > 0$, then $k =$

$$(k\sqrt{2})^2 = k^2 \times 2 = 2k^2$$

$$2k^2 = 128, \text{ so } k^2 = 64 \text{ and } k = 8$$

Ans: (D) 8

11. $(4 + \sqrt{3})(5 + \sqrt{3}) =$

$$(4 + \sqrt{3})(5 + \sqrt{3}) = 20 + 4\sqrt{3} + 5\sqrt{3} + 3$$

$$= 23 + 9\sqrt{3}$$

Ans: (C) $23 + 9\sqrt{3}$

12. A rationalising factor of $20 + \sqrt{5}$ is

$$(20 + \sqrt{5})(20 - \sqrt{5}) = 395, \text{ a rational number.}$$

None of the other products is rational.

Ans: (C) $20 - \sqrt{5}$

13. The rationalising factor of $\sqrt[3]{4} - \sqrt[3]{2}$ is

$$\text{Use } (x - y)(x^2 + xy + y^2) = x^3 - y^3 \text{ with } x = \sqrt[3]{4}, y = \sqrt[3]{2}.$$

$$\text{Rationalising factor: } (\sqrt[3]{4})^2 + \sqrt[3]{4} \cdot \sqrt[3]{2} + (\sqrt[3]{2})^2$$

$$\text{Product} = (\sqrt[3]{4})^3 - (\sqrt[3]{2})^3 = 4 - 2 = 2$$

Ans: (D) $(\sqrt[3]{4})^2 + \sqrt[3]{4} \cdot \sqrt[3]{2} + (\sqrt[3]{2})^2$

14. $\sqrt{20} + \sqrt{245} =$

$$\sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}$$

$$\sqrt{245} = \sqrt{49 \times 5} = 7\sqrt{5}$$

$$2\sqrt{5} + 7\sqrt{5} = 9\sqrt{5} \text{ (add like surds)}$$

Ans: (B) $9\sqrt{5}$

15. $(\sqrt{11})^3 =$

$$(\sqrt{11})^3 = (\sqrt{11})^2 \times \sqrt{11} = 11\sqrt{11}$$

Ans: (C) $11\sqrt{11}$

16. $(8 - \sqrt{5})^2 =$

$$(8 - \sqrt{5})^2 = 8^2 + (\sqrt{5})^2 - 2(8)(\sqrt{5}) = 69 - 16\sqrt{5}$$

Ans: (B) $69 - 16\sqrt{5}$

17. $(\sqrt{6} + \sqrt{3})^2 =$

$$(\sqrt{6} + \sqrt{3})^2 = 6 + 3 + 2\sqrt{18} = 9 + 6\sqrt{2}$$

Ans: (C) $9 + 6\sqrt{2}$

18. $(10 + 2\sqrt{6})(10 - 2\sqrt{6}) =$

$$(a + b)(a - b) = a^2 - b^2$$

$$= 10^2 - (2\sqrt{6})^2 = 100 - 24 = 76$$

Ans: (C) 76

19. $\frac{1}{5-\sqrt{5}} =$

Multiply above and below by $5 + \sqrt{5}$: $(5 - \sqrt{5})(5 + \sqrt{5}) = 25 - 5 = 20$

$$= \frac{5+\sqrt{5}}{20}$$

Ans: (D) $\frac{5+\sqrt{5}}{20}$

20. If $\frac{10+3\sqrt{5}}{4-\sqrt{5}} = a + b\sqrt{5}$, then $b =$

$$\frac{10+3\sqrt{5}}{4-\sqrt{5}} = \frac{(10+3\sqrt{5})(4+\sqrt{5})}{(4-\sqrt{5})(4+\sqrt{5})}$$

$$\text{Numerator: } 40 + 10\sqrt{5} + 12\sqrt{5} + 15 = 55 + 22\sqrt{5}$$

$$\text{Denominator: } 4^2 - (\sqrt{5})^2 = 16 - 5 = 11$$

$$\frac{55+22\sqrt{5}}{11} = 5 + 2\sqrt{5}$$

So $a = 5$, $b = 2$

Ans: (A) 2

21. $\frac{\sqrt{7}+\sqrt{2}}{\sqrt{7}-\sqrt{2}} + \frac{\sqrt{7}-\sqrt{2}}{\sqrt{7}+\sqrt{2}} =$

$$= \frac{(\sqrt{7}+\sqrt{2})^2 + (\sqrt{7}-\sqrt{2})^2}{(\sqrt{7}+\sqrt{2})(\sqrt{7}-\sqrt{2})} = \frac{18}{5}$$

The $\sqrt{14}$ terms cancel and $(\sqrt{7} + \sqrt{2})(\sqrt{7} - \sqrt{2}) = 7 - 2 = 5$.

Ans: (B) $\frac{18}{5}$

22. $\frac{1}{\sqrt{17}+\sqrt{13}} + \frac{1}{\sqrt{17}-\sqrt{13}} =$

$$= \frac{(\sqrt{17}-\sqrt{13}) + (\sqrt{17}+\sqrt{13})}{(\sqrt{17}+\sqrt{13})(\sqrt{17}-\sqrt{13})} = \frac{2\sqrt{17}}{4} = \frac{\sqrt{17}}{2}$$

Ans: (A) $\frac{\sqrt{17}}{2}$

23. If $x = \frac{1}{15+4\sqrt{14}}$, then $x + \frac{1}{x} =$

$$x = 15 - 4\sqrt{14} \text{ and } \frac{1}{x} = 15 + 4\sqrt{14}$$

$$x + \frac{1}{x} = 30$$

Ans: (A) 30

24. $\sqrt{10 + \sqrt{96}} =$

$$\sqrt{96} = \sqrt{4 \times 24} = 2\sqrt{24}$$

$$\sqrt{10 + \sqrt{96}} = \sqrt{6 + 4 + 2\sqrt{6} \times 4}$$

$$= \sqrt{(\sqrt{6})^2 + (2)^2 + 2(\sqrt{6})(2)}$$

$$= \sqrt{(\sqrt{6} + 2)^2} = \sqrt{6} + 2$$

Ans: (B) $\sqrt{6} + 2$

25. $\sqrt{4 + \sqrt{15}} =$

$$\sqrt{4 + \sqrt{15}} = \sqrt{\frac{2(4+\sqrt{15})}{2}} = \frac{\sqrt{8+2\sqrt{15}}}{\sqrt{2}}$$

$$= \frac{\sqrt{5+3+2\sqrt{5} \times 3}}{\sqrt{2}}$$

$$= \frac{\sqrt{(\sqrt{5})^2 + (\sqrt{3})^2 + 2(\sqrt{5})(\sqrt{3})}}{\sqrt{2}}$$

$$= \frac{\sqrt{(\sqrt{5}+\sqrt{3})^2}}{\sqrt{2}} = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{2}}$$

Ans: (C) $\frac{\sqrt{5}+\sqrt{3}}{\sqrt{2}}$