

Rationalization (Surds)

MCQ Test, Set 03

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. For which value of n is $\sqrt{n}$ a surd?

- A. 169 B. 400 C. 25 D. 19

2. $\pi = 3.14 \dots$ is

- A. an irrational number, but not a surd
B. a rational number
C. a mixed surd
D. a surd

3. $3\sqrt{n}$ is a mixed surd when n is

- A. 40 B. 324 C. 64 D. 289

4. The conjugate surd of $7 - \sqrt{15}$ is

- A. $\frac{1}{7-\sqrt{15}}$ B. $-7 + \sqrt{15}$ C. $-7 - \sqrt{15}$ D. $7 + \sqrt{15}$

5. $\sqrt{15} \times \sqrt{15} =$

- A. 15 B. $2\sqrt{15}$ C. 225 D. $\sqrt{15}$

6. $\frac{\sqrt{17}}{\sqrt{10}} =$

- A. $\sqrt{7}$ B. $\sqrt{\frac{17}{10}}$ C. $\frac{17}{10}$ D. $\sqrt{\frac{10}{17}}$

7. $1024^{\frac{1}{5}} =$

- A. 4 B. 20 C. $\frac{1024}{5}$ D. 16

8. $\sqrt[4]{27} \times \sqrt[4]{3} =$

- A. 81 B. $\sqrt[4]{30}$ C. 3 D. $\sqrt[8]{81}$

9. If $(k\sqrt{17})^2 = 272$ and $k > 0$, then $k =$

- A. 16 B. 8 C. 4 D. $4\sqrt{17}$

10. $(5 - \sqrt{5})(1 - \sqrt{5}) =$

- A. $-6\sqrt{5}$ B. $10 - 6\sqrt{5}$ C. 10 D. $10 + 6\sqrt{5}$

11. $(3 + \sqrt{3})(6 + \sqrt{3}) =$
A. $15 + 9\sqrt{3}$ **B.** $21 - 9\sqrt{3}$ **C.** $21 + 9\sqrt{3}$ **D.** 21
-
12. A rationalising factor of $12 + \sqrt{6}$ is
A. $12 - \sqrt{6}$ **B.** $-\sqrt{6} - 12$ **C.** $\sqrt{6}$ **D.** $12 + \sqrt{6}$
-
13. The rationalising factor of $\sqrt[3]{15} + \sqrt[3]{14}$ is
A. $(\sqrt[3]{15})^2 + \sqrt[3]{15} \cdot \sqrt[3]{14} + (\sqrt[3]{14})^2$
B. $\sqrt[3]{15} - \sqrt[3]{14}$
C. $(\sqrt[3]{15})^2 - \sqrt[3]{15} \cdot \sqrt[3]{14} + (\sqrt[3]{14})^2$
D. $(\sqrt[3]{15})^2 + (\sqrt[3]{14})^2$
-
14. $\sqrt{175}$ in simplest form is
A. $7\sqrt{5}$ **B.** $25\sqrt{7}$ **C.** $5\sqrt{35}$ **D.** $5\sqrt{7}$
-
15. $(3\sqrt{2})^4 =$
A. 36 **B.** 162 **C.** 324 **D.** 12
-
16. $(4 - \sqrt{6})^2 =$
A. 22 **B.** $22 - 4\sqrt{6}$ **C.** $52 - 8\sqrt{6}$ **D.** $22 - 8\sqrt{6}$
-
17. $(7 + 5\sqrt{6})(7 - 5\sqrt{6}) =$
A. -851 **B.** 199 **C.** -101 **D.** 19
-
18. $\frac{1}{\sqrt{5}-\sqrt{3}} =$
A. $\sqrt{5} + \sqrt{3}$ **B.** $\frac{\sqrt{5}+\sqrt{3}}{8}$
C. $\frac{\sqrt{5}-\sqrt{3}}{2}$ **D.** $\frac{\sqrt{5}+\sqrt{3}}{2}$
-
19. If $\frac{12+7\sqrt{6}}{4-\sqrt{6}} = a + b\sqrt{6}$, then $a + b =$
A. 19 **B.** 36 **C.** 5 **D.** 13
-
20. $\frac{4+\sqrt{7}}{4-\sqrt{7}} + \frac{4-\sqrt{7}}{4+\sqrt{7}} =$
A. $\frac{16\sqrt{7}}{9}$ **B.** $\frac{46}{9}$ **C.** $\frac{23}{9}$ **D.** $-\frac{46}{9}$
-
21. $\frac{1}{\sqrt{6}+\sqrt{2}} + \frac{1}{\sqrt{6}-\sqrt{2}} =$
A. 0 **B.** $\frac{\sqrt{2}}{2}$ **C.** $\frac{\sqrt{6}}{4}$ **D.** $\frac{\sqrt{6}}{2}$
-
22. $\frac{1}{3+\sqrt{7}} + \frac{1}{3-\sqrt{7}} =$
A. 0 **B.** $\sqrt{7}$ **C.** 3 **D.** $\frac{3}{8}$
-
23. If $x = \sqrt[3]{8 + 3\sqrt{7}}$, then $x^3 + \frac{1}{x^3} =$
A. 8 **B.** $6\sqrt{7}$ **C.** 16 **D.** 0
-
24. $\sqrt{14 + 2\sqrt{33}} =$
A. $\sqrt{3} - \sqrt{11}$ **B.** $\sqrt{11} + \sqrt{3}$ **C.** $\sqrt{11} - \sqrt{3}$ **D.** $\sqrt{33} + 1$
-

25. $\sqrt{7 - \sqrt{45}} =$

A. $\frac{3+\sqrt{5}}{\sqrt{2}}$

C. $3 - \sqrt{5}$

B. $\frac{3-\sqrt{5}}{\sqrt{2}}$

D. $\frac{3-\sqrt{5}}{2}$

Key sheet

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

Solutions

1. For which value of n is $\sqrt{n}$ a surd?

$4^2 = 16$ and $5^2 = 25$, so 19 is not a perfect square.

The other three are perfect squares, so their roots are rational.

Ans: (D) 19

2. $\pi = 3.14 \dots$ is

Its decimal never ends and never repeats, so it is irrational.

It is not a root of a rational number, so it is not a surd.

Ans: (A) an irrational number, but not a surd

3. $3\sqrt{n}$ is a mixed surd when n is

$6^2 = 36$ and $7^2 = 49$, so 40 is not a perfect square. So $3\sqrt{40}$ is a mixed surd.

For the others $\sqrt{n}$ is a whole number, so the product is rational.

Ans: (A) 40

4. The conjugate surd of $7 - \sqrt{15}$ is

Only the sign of the surd part changes: the conjugate of $7 - \sqrt{15}$ is $7 + \sqrt{15}$.

Ans: (D) $7 + \sqrt{15}$

5. $\sqrt{15} \times \sqrt{15} =$

$$\sqrt{15} \times \sqrt{15} = \sqrt{15^2} = 15$$

Ans: (A) 15

6. $\frac{\sqrt{17}}{\sqrt{10}} =$

$$\frac{\sqrt{17}}{\sqrt{10}} = \sqrt{\frac{17}{10}} \text{ (divide the numbers under the roots)}$$

Ans: (B) $\sqrt{\frac{17}{10}}$

7. $1024^{\frac{1}{5}} =$

$$1024^{\frac{1}{5}} = \sqrt[5]{1024} = \sqrt[5]{4^5} = 4$$

Ans: (A) 4

8. $\sqrt[4]{27} \times \sqrt[4]{3} =$

$$\begin{aligned}\sqrt[4]{27} \times \sqrt[4]{3} &= \sqrt[4]{27 \times 3} \\ &= \sqrt[4]{81} = \sqrt[4]{3^4} = 3\end{aligned}$$

Ans: (C) 3

9. If $(k\sqrt{17})^2 = 272$ and $k > 0$, then $k =$

$$(k\sqrt{17})^2 = k^2 \times 17 = 17k^2$$

$$17k^2 = 272, \text{ so } k^2 = 16 \text{ and } k = 4$$

Ans: (C) 4

10. $(5 - \sqrt{5})(1 - \sqrt{5}) =$
 $(5 - \sqrt{5})(1 - \sqrt{5}) = 5 - 5\sqrt{5} - \sqrt{5} + 5$
 $= 10 - 6\sqrt{5}$
Ans: (B) $10 - 6\sqrt{5}$

11. $(3 + \sqrt{3})(6 + \sqrt{3}) =$
 $(3 + \sqrt{3})(6 + \sqrt{3}) = 18 + 3\sqrt{3} + 6\sqrt{3} + 3$
 $= 21 + 9\sqrt{3}$
Ans: (C) $21 + 9\sqrt{3}$

12. A rationalising factor of $12 + \sqrt{6}$ is
 $(12 + \sqrt{6})(12 - \sqrt{6}) = 138$, a rational number.
None of the other products is rational.
Ans: (A) $12 - \sqrt{6}$

13. The rationalising factor of $\sqrt[3]{15} + \sqrt[3]{14}$ is
Use $(x + y)(x^2 - xy + y^2) = x^3 + y^3$ with $x = \sqrt[3]{15}$, $y = \sqrt[3]{14}$.
Rationalising factor: $(\sqrt[3]{15})^2 - \sqrt[3]{15} \cdot \sqrt[3]{14} + (\sqrt[3]{14})^2$
Product $= (\sqrt[3]{15})^3 + (\sqrt[3]{14})^3 = 15 + 14 = 29$
Ans: (C) $(\sqrt[3]{15})^2 - \sqrt[3]{15} \cdot \sqrt[3]{14} + (\sqrt[3]{14})^2$

14. $\sqrt{175}$ in simplest form is
 $\sqrt{175} = \sqrt{25 \times 7} = 5\sqrt{7}$
Ans: (D) $5\sqrt{7}$

15. $(3\sqrt{2})^4 =$
 $(3\sqrt{2})^4 = 3^4 \times (\sqrt{2})^4 = 81 \times 4 = 324$
Ans: (C) 324

16. $(4 - \sqrt{6})^2 =$
 $(4 - \sqrt{6})^2 = 4^2 + (\sqrt{6})^2 - 2(4)(\sqrt{6}) = 22 - 8\sqrt{6}$
Ans: (D) $22 - 8\sqrt{6}$

17. $(7 + 5\sqrt{6})(7 - 5\sqrt{6}) =$
 $(a + b)(a - b) = a^2 - b^2$
 $= 7^2 - (5\sqrt{6})^2 = 49 - 150 = -101$
Ans: (C) -101

18. $\frac{1}{\sqrt{5} - \sqrt{3}} =$
Multiply above and below by $\sqrt{5} + \sqrt{3}$: $(\sqrt{5} - \sqrt{3})(\sqrt{5} + \sqrt{3}) = 5 - 3 = 2$
 $= \frac{\sqrt{5} + \sqrt{3}}{2}$
Ans: (D) $\frac{\sqrt{5} + \sqrt{3}}{2}$

19. If $\frac{12+7\sqrt{6}}{4-\sqrt{6}} = a + b\sqrt{6}$, then $a + b =$

$$\frac{12+7\sqrt{6}}{4-\sqrt{6}} = \frac{(12+7\sqrt{6})(4+\sqrt{6})}{(4-\sqrt{6})(4+\sqrt{6})}$$

$$\text{Numerator: } 48 + 12\sqrt{6} + 28\sqrt{6} + 42 = 90 + 40\sqrt{6}$$

$$\text{Denominator: } 4^2 - (\sqrt{6})^2 = 16 - 6 = 10$$

$$\frac{90+40\sqrt{6}}{10} = 9 + 4\sqrt{6}$$

$$\text{So } a = 9, b = 4$$

Ans: (D) 13

20. $\frac{4+\sqrt{7}}{4-\sqrt{7}} + \frac{4-\sqrt{7}}{4+\sqrt{7}} =$

$$= \frac{(4+\sqrt{7})^2 + (4-\sqrt{7})^2}{(4+\sqrt{7})(4-\sqrt{7})} = \frac{46}{9}$$

The $\sqrt{7}$ terms cancel and $(4 + \sqrt{7})(4 - \sqrt{7}) = 9$.

Ans: (B) $\frac{46}{9}$

21. $\frac{1}{\sqrt{6}+\sqrt{2}} + \frac{1}{\sqrt{6}-\sqrt{2}} =$

$$= \frac{(\sqrt{6}-\sqrt{2}) + (\sqrt{6}+\sqrt{2})}{(\sqrt{6}+\sqrt{2})(\sqrt{6}-\sqrt{2})} = \frac{2\sqrt{6}}{4} = \frac{\sqrt{6}}{2}$$

Ans: (D) $\frac{\sqrt{6}}{2}$

22. $\frac{1}{3+\sqrt{7}} + \frac{1}{3-\sqrt{7}} =$

$$= \frac{(3-\sqrt{7}) + (3+\sqrt{7})}{(3+\sqrt{7})(3-\sqrt{7})} = \frac{6}{2} = 3$$

Ans: (C) 3

23. If $x = \sqrt[3]{8 + 3\sqrt{7}}$, then $x^3 + \frac{1}{x^3} =$

$$x^3 = 8 + 3\sqrt{7}, \text{ so } \frac{1}{x^3} = \frac{1}{8+3\sqrt{7}} = 8 - 3\sqrt{7}$$

$$x^3 + \frac{1}{x^3} = (8 + 3\sqrt{7}) + (8 - 3\sqrt{7}) = 16$$

Ans: (C) 16

24. $\sqrt{14 + 2\sqrt{33}} =$

$$\sqrt{14 + 2\sqrt{33}} = \sqrt{11 + 3 + 2\sqrt{11 \times 3}}$$

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

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

Ans: (B) $\sqrt{11} + \sqrt{3}$

25. $\sqrt{7 - \sqrt{45}} =$

$$\sqrt{7 - \sqrt{45}} = \sqrt{\frac{2(7-\sqrt{45})}{2}} = \frac{\sqrt{14-2\sqrt{45}}}{\sqrt{2}}$$

$$= \frac{\sqrt{9+5-2\sqrt{9 \times 5}}}{\sqrt{2}}$$

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

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

Ans: (B) $\frac{3-\sqrt{5}}{\sqrt{2}}$
