

Rationalization (Surds)

MCQ Test, Set 09

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. $\sqrt[5]{1024} =$

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

2. $\sqrt[4]{25}$ and π are both irrational. Which of them is a surd?

- A. Both B. Neither C. π only D. $\sqrt[4]{25}$ only

3. $7\sqrt[3]{n}$ is a mixed surd when n is

- A. 512 B. 19 C. 1000 D. 216

4. The conjugate of $\sqrt{17} + 20$ is

- A. $\frac{1}{\sqrt{17}+20}$ B. $-\sqrt{17} + 20$ C. $-\sqrt{17} - 20$ D. $\sqrt{17} - 20$

5. $(\sqrt{32})^2 =$

- A. $\sqrt{32}$ B. 1024 C. $2\sqrt{32}$ D. 32

6. $\frac{\sqrt{84}}{\sqrt{21}} =$

- A. $2\sqrt{21}$ B. 2 C. $\sqrt{63}$ D. 4

7. $729^{\frac{1}{6}} =$

- A. $\frac{729}{6}$ B. 18 C. 3 D. 9

8. $\frac{\sqrt[3]{875}}{\sqrt[3]{7}} =$

- A. 125 B. 5 C. $\sqrt[3]{882}$ D. $\sqrt[3]{868}$

9. If $(k\sqrt{21})^2 = 756$ and $k > 0$, then $k =$

- A. 6 B. 12 C. 36 D. $6\sqrt{21}$

10. $(4 - \sqrt{13})(1 - \sqrt{13}) =$

- A. $17 + 5\sqrt{13}$ B. $17 - 5\sqrt{13}$ C. $-9 - 5\sqrt{13}$ D. 17

11. A rationalising factor of $15 + \sqrt{13}$ is

- A. $-\sqrt{13} - 15$ B. $\sqrt{13}$ C. $15 + \sqrt{13}$ D. $15 - \sqrt{13}$

12. The rationalising factor of $\sqrt[3]{11} + \sqrt[3]{3}$ is

A. $(\sqrt[3]{11})^2 - \sqrt[3]{11} \cdot \sqrt[3]{3} + (\sqrt[3]{3})^2$

B. $(\sqrt[3]{11})^2 + (\sqrt[3]{3})^2$

C. $\sqrt[3]{11} - \sqrt[3]{3}$

D. $(\sqrt[3]{11})^2 + \sqrt[3]{11} \cdot \sqrt[3]{3} + (\sqrt[3]{3})^2$

13. $\sqrt{375}$ in simplest form is

A. $25\sqrt{15}$

B. $5\sqrt{75}$

C. $15\sqrt{5}$

D. $5\sqrt{15}$

14. $(2\sqrt{3})^3 =$

A. $6\sqrt{3}$

B. $8\sqrt{3}$

C. $24\sqrt{3}$

D. 24

15. $(10 - \sqrt{10})^2 =$

A. $200 - 20\sqrt{10}$

B. $110 - 10\sqrt{10}$

C. $110 - 20\sqrt{10}$

D. 110

16. $(\sqrt{13} - \sqrt{11})(\sqrt{13} + \sqrt{11}) =$

A. 48

B. 2

C. 24

D. $\sqrt{2}$

17. $(2 + 5\sqrt{5})(2 - 5\sqrt{5}) =$

A. -121

B. 129

C. -621

D. -21

18. $\frac{1}{\sqrt{11} + \sqrt{10}} =$

A. $\frac{\sqrt{11} - \sqrt{10}}{21}$

B. $\sqrt{11} + \sqrt{10}$

C. $\sqrt{10} - \sqrt{11}$

D. $\sqrt{11} - \sqrt{10}$

19. If $\frac{2+3\sqrt{2}}{2-\sqrt{2}} = a + b\sqrt{2}$, then $b =$

A. 4

B. 5

C. -4

D. 3

20. $\frac{\sqrt{17} + \sqrt{15}}{\sqrt{17} - \sqrt{15}} + \frac{\sqrt{17} - \sqrt{15}}{\sqrt{17} + \sqrt{15}} =$

A. $2\sqrt{255}$

B. -32

C. 16

D. 32

21. $\frac{12 + \sqrt{13}}{12 - \sqrt{13}} + \frac{12 - \sqrt{13}}{12 + \sqrt{13}} =$

A. $\frac{314}{131}$

B. $\frac{48\sqrt{13}}{131}$

C. $-\frac{314}{131}$

D. $\frac{157}{131}$

22. $\frac{1}{5 + \sqrt{3}} + \frac{1}{5 - \sqrt{3}} =$

A. 0

B. $\frac{5}{14}$

C. $\frac{5}{11}$

D. $\frac{\sqrt{3}}{11}$

23. If $x = \sqrt[3]{10 + 3\sqrt{11}}$, then $x^3 + \frac{1}{x^3} =$

A. $6\sqrt{11}$

B. 10

C. 20

D. 0

24. $\sqrt{16 + \sqrt{220}} =$

A. $\sqrt{11} + \sqrt{5}$

B. $\sqrt{11} - \sqrt{5}$

C. $\sqrt{5} - \sqrt{11}$

D. $\sqrt{55} + 1$

25. $\sqrt{12 + \sqrt{23}} =$

A. $\frac{\sqrt{23} + 1}{2}$

B. $\frac{\sqrt{23} - 1}{\sqrt{2}}$

C. $\sqrt{23} + 1$

D. $\frac{\sqrt{23} + 1}{\sqrt{2}}$

Key sheet

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

Solutions

1. $\sqrt[5]{1024} =$

$$\sqrt[5]{1024} = \sqrt[5]{4 \times 4 \times 4 \times 4 \times 4} = 4$$

Ans: (D) 4

2. $\sqrt[4]{25}$ and π are both irrational. Which of them is a surd?

$2^4 = 16$ and $3^4 = 81$, so 25 is not a perfect fourth power. So $\sqrt[4]{25}$ is a surd.

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

Ans: (D) $\sqrt[4]{25}$ only

3. $7\sqrt[3]{n}$ is a mixed surd when n is

$2^3 = 8$ and $3^3 = 27$, so 19 is not a perfect cube. So $7\sqrt[3]{19}$ is a mixed surd.

For the others $\sqrt[3]{n}$ is a whole number, so the product is rational.

Ans: (B) 19

4. The conjugate of $\sqrt{17} + 20$ is

Only the sign of the surd part changes: the conjugate of $\sqrt{17} + 20$ is $-\sqrt{17} + 20$.

Ans: (B) $-\sqrt{17} + 20$

5. $(\sqrt{32})^2 =$

$$\sqrt{32} \times \sqrt{32} = \sqrt{32^2} = 32$$

Ans: (D) 32

6. $\frac{\sqrt{84}}{\sqrt{21}} =$

$$\begin{aligned}\frac{\sqrt{84}}{\sqrt{21}} &= \sqrt{\frac{84}{21}} \\ &= \sqrt{4} = \sqrt{2 \times 2} = 2\end{aligned}$$

Ans: (B) 2

7. $729^{\frac{1}{6}} =$

$$729^{\frac{1}{6}} = \sqrt[6]{729} = \sqrt[6]{3^6} = 3$$

Ans: (C) 3

8. $\frac{\sqrt[3]{875}}{\sqrt[3]{7}} =$

$$\begin{aligned}\frac{\sqrt[3]{875}}{\sqrt[3]{7}} &= \sqrt[3]{\frac{875}{7}} \\ &= \sqrt[3]{125} = \sqrt[3]{5^3} = 5\end{aligned}$$

Ans: (B) 5

9. If $(k\sqrt{21})^2 = 756$ and $k > 0$, then $k =$

$$(k\sqrt{21})^2 = k^2 \times 21 = 21k^2$$

$$21k^2 = 756, \text{ so } k^2 = 36 \text{ and } k = 6$$

Ans: (A) 6

10. $(4 - \sqrt{13})(1 - \sqrt{13}) =$

$$(4 - \sqrt{13})(1 - \sqrt{13}) = 4 - 4\sqrt{13} - \sqrt{13} + 13$$

$$= 17 - 5\sqrt{13}$$

Ans: (B) $17 - 5\sqrt{13}$

11. A rationalising factor of $15 + \sqrt{13}$ is

$$(15 + \sqrt{13})(15 - \sqrt{13}) = 212, \text{ a rational number.}$$

None of the other products is rational.

Ans: (D) $15 - \sqrt{13}$

12. The rationalising factor of $\sqrt[3]{11} + \sqrt[3]{3}$ is

$$\text{Use } (x + y)(x^2 - xy + y^2) = x^3 + y^3 \text{ with } x = \sqrt[3]{11}, y = \sqrt[3]{3}.$$

$$\text{Rationalising factor: } (\sqrt[3]{11})^2 - \sqrt[3]{11} \cdot \sqrt[3]{3} + (\sqrt[3]{3})^2$$

$$\text{Product} = (\sqrt[3]{11})^3 + (\sqrt[3]{3})^3 = 11 + 3 = 14$$

Ans: (A) $(\sqrt[3]{11})^2 - \sqrt[3]{11} \cdot \sqrt[3]{3} + (\sqrt[3]{3})^2$

13. $\sqrt{375}$ in simplest form is

$$\sqrt{375} = \sqrt{25 \times 15} = 5\sqrt{15}$$

Ans: (D) $5\sqrt{15}$

14. $(2\sqrt{3})^3 =$

$$(2\sqrt{3})^3 = 2^3 \times (\sqrt{3})^3 = 8 \times 3\sqrt{3} = 24\sqrt{3}$$

Ans: (C) $24\sqrt{3}$

15. $(10 - \sqrt{10})^2 =$

$$(10 - \sqrt{10})^2 = 10^2 + (\sqrt{10})^2 - 2(10)(\sqrt{10}) = 110 - 20\sqrt{10}$$

Ans: (C) $110 - 20\sqrt{10}$

16. $(\sqrt{13} - \sqrt{11})(\sqrt{13} + \sqrt{11}) =$

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

$$= (\sqrt{13})^2 - (\sqrt{11})^2 = 13 - 11 = 2$$

Ans: (B) 2

17. $(2 + 5\sqrt{5})(2 - 5\sqrt{5}) =$

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

$$= 2^2 - (5\sqrt{5})^2 = 4 - 125 = -121$$

Ans: (A) -121

18. $\frac{1}{\sqrt{11} + \sqrt{10}} =$

$$\text{Multiply above and below by } \sqrt{11} - \sqrt{10}: (\sqrt{11} + \sqrt{10})(\sqrt{11} - \sqrt{10}) = 11 - 10 = 1$$

$$= \sqrt{11} - \sqrt{10}$$

Ans: (D) $\sqrt{11} - \sqrt{10}$

19. If $\frac{2+3\sqrt{2}}{2-\sqrt{2}} = a + b\sqrt{2}$, then $b =$

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

$$\text{Numerator: } 4 + 2\sqrt{2} + 6\sqrt{2} + 6 = 10 + 8\sqrt{2}$$

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

$$\frac{10+8\sqrt{2}}{2} = 5 + 4\sqrt{2}$$

$$\text{So } a = 5, b = 4$$

Ans: (A) 4

20. $\frac{\sqrt{17}+\sqrt{15}}{\sqrt{17}-\sqrt{15}} + \frac{\sqrt{17}-\sqrt{15}}{\sqrt{17}+\sqrt{15}} =$

$$= \frac{(\sqrt{17}+\sqrt{15})^2 + (\sqrt{17}-\sqrt{15})^2}{(\sqrt{17}+\sqrt{15})(\sqrt{17}-\sqrt{15})} = \frac{64}{2} = 32$$

$$\text{The } \sqrt{255} \text{ terms cancel and } (\sqrt{17} + \sqrt{15})(\sqrt{17} - \sqrt{15}) = 17 - 15 = 2.$$

Ans: (D) 32

21. $\frac{12+\sqrt{13}}{12-\sqrt{13}} + \frac{12-\sqrt{13}}{12+\sqrt{13}} =$

$$= \frac{(12+\sqrt{13})^2 + (12-\sqrt{13})^2}{(12+\sqrt{13})(12-\sqrt{13})} = \frac{314}{131}$$

$$\text{The } \sqrt{13} \text{ terms cancel and } (12 + \sqrt{13})(12 - \sqrt{13}) = 131.$$

Ans: (A) $\frac{314}{131}$

22. $\frac{1}{5+\sqrt{3}} + \frac{1}{5-\sqrt{3}} =$

$$= \frac{(5-\sqrt{3}) + (5+\sqrt{3})}{(5+\sqrt{3})(5-\sqrt{3})} = \frac{10}{22} = \frac{5}{11}$$

Ans: (C) $\frac{5}{11}$

23. If $x = \sqrt[3]{10 + 3\sqrt{11}}$, then $x^3 + \frac{1}{x^3} =$

$$x^3 = 10 + 3\sqrt{11}, \text{ so } \frac{1}{x^3} = \frac{1}{10+3\sqrt{11}} = 10 - 3\sqrt{11}$$

$$x^3 + \frac{1}{x^3} = (10 + 3\sqrt{11}) + (10 - 3\sqrt{11}) = 20$$

Ans: (C) 20

24. $\sqrt{16} + \sqrt{220} =$

$$\sqrt{220} = \sqrt{4 \times 55} = 2\sqrt{55}$$

$$\sqrt{16} + \sqrt{220} = \sqrt{11} + 5 + 2\sqrt{11 \times 5}$$

$$= \sqrt{(\sqrt{11})^2 + (\sqrt{5})^2 + 2(\sqrt{11})(\sqrt{5})}$$

$$= \sqrt{(\sqrt{11} + \sqrt{5})^2} = \sqrt{11} + \sqrt{5}$$

Ans: (A) $\sqrt{11} + \sqrt{5}$

25. $\sqrt{12} + \sqrt{23} =$

$$\sqrt{12} + \sqrt{23} = \sqrt{\frac{2(12+\sqrt{23})}{2}} = \frac{\sqrt{24+2\sqrt{23}}}{\sqrt{2}}$$

$$= \frac{\sqrt{23+1+2\sqrt{23 \times 1}}}{\sqrt{2}}$$

$$= \frac{\sqrt{(\sqrt{23})^2 + (1)^2 + 2(\sqrt{23})(1)}}{\sqrt{2}}$$

$$= \frac{\sqrt{(\sqrt{23}+1)^2}}{\sqrt{2}} = \frac{\sqrt{23}+1}{\sqrt{2}}$$

Ans: (D) $\frac{\sqrt{23}+1}{\sqrt{2}}$