

Rationalization (Surds)

MCQ Test, Set 10

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. Which one of these numbers is rational?

- A. $\sqrt[4]{8}$ B. $\sqrt{121}$ C. $\sqrt[5]{24}$ D. $\sqrt[3]{13}$

2. $\sqrt[3]{46}$ and π are both irrational. Which of them is a surd?

- A. π only B. Both C. Neither D. $\sqrt[3]{46}$ only

3. $6\sqrt{n}$ is a mixed surd when n is

- A. 12 B. 169 C. 361 D. 36

4. The conjugate of $\sqrt{22} + 15$ is

- A. $-\sqrt{22} + 15$ B. $\frac{1}{\sqrt{22}+15}$ C. $-\sqrt{22} - 15$ D. $\sqrt{22} - 15$

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

- A. $2\sqrt{5}$ B. 10 C. $\sqrt{10}$ D. $\sqrt{7}$

6. $\frac{\sqrt{135}}{\sqrt{15}} =$

- A. 3 B. $3\sqrt{15}$ C. 9 D. $\sqrt{120}$

7. $\sqrt[4]{15}$ in exponent form is

- A. $\frac{15}{4}$ B. $15^{\frac{1}{4}}$ C. 15^4 D. $4^{\frac{1}{15}}$

8. $\sqrt[3]{25} \times \sqrt[3]{40} =$

- A. $\sqrt[6]{1000}$ B. $\sqrt[3]{65}$ C. 10 D. 1000

9. $\frac{\sqrt[3]{432}}{\sqrt[3]{2}} =$

- A. 216 B. $\sqrt[3]{430}$ C. $\sqrt[3]{434}$ D. 6

10. $(3\sqrt{10})^2 =$

- A. 30 B. 90 C. 900 D. $9\sqrt{10}$

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

- A. 5 B. $5 + 2\sqrt{10}$ C. $5 - 2\sqrt{10}$ D. $25 - 2\sqrt{10}$

12.	A rationalising factor of $8\sqrt{7}$ is			
	A. $\sqrt{7}$	B. 7	C. $8 + \sqrt{7}$	D. 8
13.	$(\sqrt[3]{10} + \sqrt[3]{9})((\sqrt[3]{10})^2 - \sqrt[3]{10} \cdot \sqrt[3]{9} + (\sqrt[3]{9})^2) =$			
	A. 1729	B. 19	C. $\sqrt[3]{19}$	D. 1
14.	$\sqrt{180} + \sqrt{80} =$			
	A. $\sqrt{260}$	B. $24\sqrt{5}$	C. $10\sqrt{10}$	D. $10\sqrt{5}$
15.	$(\sqrt{3})^5 =$			
	A. 9	B. $3\sqrt{3}$	C. $9\sqrt{3}$	D. $27\sqrt{3}$
16.	$(\sqrt{5} - \sqrt{3})^2 =$			
	A. 2	B. $8 - 2\sqrt{15}$	C. $8 + 2\sqrt{15}$	D. $34 - 2\sqrt{15}$
17.	$(\sqrt{10} - \sqrt{7})(\sqrt{10} + \sqrt{7}) =$			
	A. $\sqrt{3}$	B. 17	C. 3	D. 51
18.	$\frac{1}{2+\sqrt{10}} =$			
	A. $\frac{\sqrt{10}-2}{6}$	B. $\frac{\sqrt{10}-2}{8}$	C. $\frac{2-\sqrt{10}}{14}$	D. $-\frac{2+\sqrt{10}}{6}$
19.	If $\frac{3+3\sqrt{6}}{3-\sqrt{6}} = a + b\sqrt{6}$, then $a + b =$			
	A. 6	B. 36	C. 5	D. 13
20.	$\frac{5+\sqrt{5}}{5-\sqrt{5}} + \frac{5-\sqrt{5}}{5+\sqrt{5}} =$			
	A. $\sqrt{5}$	B. 3	C. $\frac{3}{2}$	D. -3
21.	$\frac{1}{9+\sqrt{10}} + \frac{1}{9-\sqrt{10}} =$			
	A. $\frac{18}{91}$	B. 0	C. $\frac{2\sqrt{10}}{71}$	D. $\frac{18}{71}$
22.	If $x = \frac{1}{10-3\sqrt{11}}$, then $x + \frac{1}{x} =$			
	A. 20	B. 200	C. $6\sqrt{11}$	D. 10
23.	$\sqrt{20 + 2\sqrt{91}} =$			
	A. $\sqrt{13} - \sqrt{7}$	B. $\sqrt{7} - \sqrt{13}$	C. $\sqrt{13} + \sqrt{7}$	D. $\sqrt{91} + 1$
24.	$\sqrt{18 - \sqrt{224}} =$			
	A. $\sqrt{14} + 2$	B. $\sqrt{14} - 2$	C. $\sqrt{56} - 1$	D. $2 - \sqrt{14}$
25.	$\sqrt{9 - \sqrt{17}} =$			
	A. $\frac{\sqrt{17}+1}{\sqrt{2}}$	B. $\frac{\sqrt{17}-1}{2}$	C. $\sqrt{17} - 1$	D. $\frac{\sqrt{17}-1}{\sqrt{2}}$

Key sheet

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

Solutions

1. Which one of these numbers is rational?

$\sqrt{121} = \sqrt{11 \times 11} = 11$, a rational number, so it is not a surd.

The other three are roots of numbers that are not perfect powers, so they are surds.

Ans: (B) $\sqrt{121}$

2. $\sqrt[3]{46}$ and π are both irrational. Which of them is a surd?

$3^3 = 27$ and $4^3 = 64$, so 46 is not a perfect cube. So $\sqrt[3]{46}$ is a surd.

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

Ans: (D) $\sqrt[3]{46}$ only

3. $6\sqrt{n}$ is a mixed surd when n is

$3^2 = 9$ and $4^2 = 16$, so 12 is not a perfect square. So $6\sqrt{12}$ is a mixed surd.

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

Ans: (A) 12

4. The conjugate of $\sqrt{22} + 15$ is

Only the sign of the surd part changes: the conjugate of $\sqrt{22} + 15$ is $-\sqrt{22} + 15$.

Ans: (A) $-\sqrt{22} + 15$

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

$\sqrt{2} \times \sqrt{5} = \sqrt{2 \times 5} = \sqrt{10}$ (multiply the numbers under the roots).

Ans: (C) $\sqrt{10}$

6. $\frac{\sqrt{135}}{\sqrt{15}} =$

$$\frac{\sqrt{135}}{\sqrt{15}} = \sqrt{\frac{135}{15}}$$

$$= \sqrt{9} = \sqrt{3 \times 3} = 3$$

Ans: (A) 3

7. $\sqrt[4]{15}$ in exponent form is

$$\sqrt[n]{a} = a^{\frac{1}{n}}, \text{ so } \sqrt[4]{15} = 15^{\frac{1}{4}}$$

Ans: (B) $15^{\frac{1}{4}}$

8. $\sqrt[3]{25} \times \sqrt[3]{40} =$

$$\sqrt[3]{25} \times \sqrt[3]{40} = \sqrt[3]{25 \times 40}$$

$$= \sqrt[3]{1000} = \sqrt[3]{10^3} = 10$$

Ans: (C) 10

9. $\frac{\sqrt[3]{432}}{\sqrt[3]{2}} =$

$$\frac{\sqrt[3]{432}}{\sqrt[3]{2}} = \sqrt[3]{\frac{432}{2}}$$

$$= \sqrt[3]{216} = \sqrt[3]{6^3} = 6$$

Ans: (D) 6

10. $(3\sqrt{10})^2 =$
 $(3\sqrt{10})^2 = 3^2 \times (\sqrt{10})^2$
 $= 9 \times 10 = 90$

Ans: (B) 90

11. $(3 - \sqrt{10})(5 + \sqrt{10}) =$
 $(3 - \sqrt{10})(5 + \sqrt{10}) = 15 + 3\sqrt{10} - 5\sqrt{10} - 10$
 $= 5 - 2\sqrt{10}$

Ans: (C) $5 - 2\sqrt{10}$

12. A rationalising factor of $8\sqrt{7}$ is
 $8\sqrt{7} \times \sqrt{7} = 8 \times 7 = 56$, a rational number.

Ans: (A) $\sqrt{7}$

13. $(\sqrt[3]{10} + \sqrt[3]{9})((\sqrt[3]{10})^2 - \sqrt[3]{10} \cdot \sqrt[3]{9} + (\sqrt[3]{9})^2) =$
 Use $(x + y)(x^2 - xy + y^2) = x^3 + y^3$ with $x = \sqrt[3]{10}$, $y = \sqrt[3]{9}$.
 Product $= (\sqrt[3]{10})^3 + (\sqrt[3]{9})^3 = 10 + 9 = 19$

Ans: (B) 19

14. $\sqrt{180} + \sqrt{80} =$
 $\sqrt{180} = \sqrt{36 \times 5} = 6\sqrt{5}$
 $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$
 $6\sqrt{5} + 4\sqrt{5} = 10\sqrt{5}$ (add like surds)

Ans: (D) $10\sqrt{5}$

15. $(\sqrt{3})^5 =$
 $(\sqrt{3})^5 = [(\sqrt{3})^2]^2 \times \sqrt{3} = 3^2 \times \sqrt{3} = 9\sqrt{3}$

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

16. $(\sqrt{5} - \sqrt{3})^2 =$
 $(\sqrt{5} - \sqrt{3})^2 = 5 + 3 - 2\sqrt{15} = 8 - 2\sqrt{15}$

Ans: (B) $8 - 2\sqrt{15}$

17. $(\sqrt{10} - \sqrt{7})(\sqrt{10} + \sqrt{7}) =$
 $(a + b)(a - b) = a^2 - b^2$
 $= (\sqrt{10})^2 - (\sqrt{7})^2 = 10 - 7 = 3$

Ans: (C) 3

18. $\frac{1}{2 + \sqrt{10}} =$
 Multiply above and below by $2 - \sqrt{10}$: $(2 + \sqrt{10})(2 - \sqrt{10}) = 4 - 10 = -6$
 $= \frac{\sqrt{10}-2}{6}$

Ans: (A) $\frac{\sqrt{10}-2}{6}$

19. If $\frac{3+3\sqrt{6}}{3-\sqrt{6}} = a + b\sqrt{6}$, then $a + b =$

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

$$\text{Numerator: } 9 + 3\sqrt{6} + 9\sqrt{6} + 18 = 27 + 12\sqrt{6}$$

$$\text{Denominator: } 3^2 - (\sqrt{6})^2 = 9 - 6 = 3$$

$$\frac{27+12\sqrt{6}}{3} = 9 + 4\sqrt{6}$$

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

Ans: (D) 13

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

$$= \frac{(5+\sqrt{5})^2 + (5-\sqrt{5})^2}{(5+\sqrt{5})(5-\sqrt{5})} = \frac{60}{20} = 3$$

The $\sqrt{5}$ terms cancel and $(5 + \sqrt{5})(5 - \sqrt{5}) = 20$.

Ans: (B) 3

21. $\frac{1}{9+\sqrt{10}} + \frac{1}{9-\sqrt{10}} =$

$$= \frac{(9-\sqrt{10}) + (9+\sqrt{10})}{(9+\sqrt{10})(9-\sqrt{10})} = \frac{18}{71}$$

Ans: (D) $\frac{18}{71}$

22. If $x = \frac{1}{10-3\sqrt{11}}$, then $x + \frac{1}{x} =$

$$x = 10 + 3\sqrt{11} \text{ and } \frac{1}{x} = 10 - 3\sqrt{11}$$

$$x + \frac{1}{x} = 20$$

Ans: (A) 20

23. $\sqrt{20 + 2\sqrt{91}} =$

$$\sqrt{20 + 2\sqrt{91}} = \sqrt{13 + 7 + 2\sqrt{13 \times 7}}$$

$$= \sqrt{(\sqrt{13})^2 + (\sqrt{7})^2 + 2(\sqrt{13})(\sqrt{7})}$$

$$= \sqrt{(\sqrt{13} + \sqrt{7})^2} = \sqrt{13} + \sqrt{7}$$

Ans: (C) $\sqrt{13} + \sqrt{7}$

24. $\sqrt{18 - \sqrt{224}} =$

$$\sqrt{224} = \sqrt{4 \times 56} = 2\sqrt{56}$$

$$\sqrt{18 - \sqrt{224}} = \sqrt{14 + 4 - 2\sqrt{14 \times 4}}$$

$$= \sqrt{(\sqrt{14})^2 + (2)^2 - 2(\sqrt{14})(2)}$$

$$= \sqrt{(\sqrt{14} - 2)^2} = \sqrt{14} - 2$$

Ans: (B) $\sqrt{14} - 2$

25. $\sqrt{9 - \sqrt{17}} =$

$$\begin{aligned}\sqrt{9 - \sqrt{17}} &= \sqrt{\frac{2(9 - \sqrt{17})}{2}} = \frac{\sqrt{18 - 2\sqrt{17}}}{\sqrt{2}} \\&= \frac{\sqrt{17+1-2\sqrt{17 \times 1}}}{\sqrt{2}} \\&= \frac{\sqrt{(\sqrt{17})^2 + (1)^2 - 2(\sqrt{17})(1)}}{\sqrt{2}} \\&= \frac{\sqrt{(\sqrt{17}-1)^2}}{\sqrt{2}} = \frac{\sqrt{17}-1}{\sqrt{2}}\end{aligned}$$

Ans: (D) $\frac{\sqrt{17}-1}{\sqrt{2}}$
