

Rationalization (Surds)

MCQ Test, Set 06

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. $\sqrt[4]{1296} =$

A. 36

B. 6

C. 24

D. 324

2. $e = 2.71 \dots$ is

A. a mixed surd

B. a rational number

C. an irrational number, but not a surd

D. a surd

3. $5\sqrt{n}$ is a mixed surd when n is

A. 225

B. 36

C. 17

D. 196

4. The conjugate surd of $\sqrt{3} + 14$ is

A. $\sqrt{3} - 14$ B. $-\sqrt{3} - 14$ C. $\frac{1}{\sqrt{3}+14}$ D. $-\sqrt{3} + 14$

5. $\sqrt{40} \times \sqrt{90} =$

A. 60

B. 3600

C. $\sqrt{130}$ D. $40\sqrt{90}$

6. $\frac{\sqrt{14}}{\sqrt{5}} =$

A. $\sqrt{9}$ B. $\sqrt{\frac{5}{14}}$ C. $\sqrt{\frac{14}{5}}$ D. $\frac{14}{5}$

7. $81^{\frac{1}{4}} =$

A. 9

B. 3

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

D. 12

8. $\sqrt[4]{12} \times \sqrt[4]{108} =$

A. 1296

B. 6

C. $\sqrt[8]{1296}$ D. $\sqrt[4]{120}$

9. $(12\sqrt{19})^2 =$

A. $144\sqrt{19}$

B. 51984

C. 228

D. 2736

10. $(8 + \sqrt{3})(7 + \sqrt{3}) =$

A. $59 + 15\sqrt{3}$

B. 59

C. $59 - 15\sqrt{3}$ D. $53 + 15\sqrt{3}$

11. A rationalising factor of $3 + \sqrt{30}$ is
A. $\sqrt{30}$ **B.** $-\sqrt{30} - 3$ **C.** $3 + \sqrt{30}$ **D.** $3 - \sqrt{30}$
-
12. The rationalising factor of $\sqrt[3]{17} - \sqrt[3]{9}$ is
A. $(\sqrt[3]{17})^2 - \sqrt[3]{17} \cdot \sqrt[3]{9} + (\sqrt[3]{9})^2$ **B.** $(\sqrt[3]{17})^2 + \sqrt[3]{17} \cdot \sqrt[3]{9} + (\sqrt[3]{9})^2$
C. $\sqrt[3]{17} + \sqrt[3]{9}$ **D.** $(\sqrt[3]{17})^2 + (\sqrt[3]{9})^2$
-
13. $\sqrt{192} + \sqrt{147} =$
A. $15\sqrt{6}$ **B.** $15\sqrt{3}$ **C.** $56\sqrt{3}$ **D.** $\sqrt{339}$
-
14. $\sqrt{176}$ in simplest form is
A. $11\sqrt{16}$ **B.** $16\sqrt{11}$ **C.** $4\sqrt{11}$ **D.** $4\sqrt{44}$
-
15. $(\sqrt{7})^5 =$
A. $343\sqrt{7}$ **B.** 49 **C.** $49\sqrt{7}$ **D.** $7\sqrt{7}$
-
16. $(\sqrt{10} + \sqrt{7})^2 =$
A. $17 - 2\sqrt{70}$ **B.** $149 + 2\sqrt{70}$ **C.** 17 **D.** $17 + 2\sqrt{70}$
-
17. $(2 - \sqrt{15})^2 =$
A. $19 - 4\sqrt{15}$ **B.** $19 - 2\sqrt{15}$ **C.** $229 - 4\sqrt{15}$ **D.** 19
-
18. $(\sqrt{17} - \sqrt{6})(\sqrt{17} + \sqrt{6}) =$
A. 11 **B.** 253 **C.** $\sqrt{11}$ **D.** 23
-
19. Rationalising the denominator of $\frac{1}{\sqrt{19} - \sqrt{15}}$ gives
A. $\frac{\sqrt{19} - \sqrt{15}}{4}$ **B.** $\frac{\sqrt{19} + \sqrt{15}}{34}$
C. $\frac{\sqrt{19} + \sqrt{15}}{4}$ **D.** $\sqrt{19} + \sqrt{15}$
-
20. If $\frac{6+2\sqrt{6}}{6-2\sqrt{6}} = a + b\sqrt{6}$, then $a + b =$
A. 10 **B.** 7 **C.** 3 **D.** 8
-
21. $\frac{9+\sqrt{19}}{9-\sqrt{19}} + \frac{9-\sqrt{19}}{9+\sqrt{19}} =$
A. $\frac{18\sqrt{19}}{31}$ **B.** $\frac{100}{31}$ **C.** $\frac{50}{31}$ **D.** $-\frac{100}{31}$
-
22. $\frac{1}{\sqrt{13}+\sqrt{6}} + \frac{1}{\sqrt{13}-\sqrt{6}} =$
A. $\frac{2\sqrt{13}}{7}$ **B.** $\frac{2\sqrt{6}}{7}$ **C.** $\frac{2\sqrt{13}}{19}$ **D.** 0
-
23. If $x = 6 + \sqrt{35}$, then $x^2 - 12x =$
A. $24\sqrt{35} - 1$ **B.** 0 **C.** -1 **D.** 1
-
24. $\sqrt{15 - \sqrt{56}} =$
A. $1 - \sqrt{14}$ **B.** $\sqrt{7} - \sqrt{2}$ **C.** $\sqrt{14} + 1$ **D.** $\sqrt{14} - 1$
-

25. $\sqrt{7 + \sqrt{13}} =$

A. $\frac{\sqrt{13}-1}{\sqrt{2}}$

C. $\frac{\sqrt{13}+1}{2}$

B. $\sqrt{13} + 1$

D. $\frac{\sqrt{13}+1}{\sqrt{2}}$

Key sheet

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

Solutions

1. $\sqrt[4]{1296} =$

$$\sqrt[4]{1296} = \sqrt[4]{6 \times 6 \times 6 \times 6} = 6$$

Ans: (B) 6

2. $e = 2.71 \dots$ 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: (C) an irrational number, but not a surd

3. $5\sqrt{n}$ is a mixed surd when n is

$4^2 = 16$ and $5^2 = 25$, so 17 is not a perfect square. So $5\sqrt{17}$ is a mixed surd.

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

Ans: (C) 17

4. The conjugate surd of $\sqrt{3} + 14$ is

Only the sign of the surd part changes: the conjugate of $\sqrt{3} + 14$ is $-\sqrt{3} + 14$.

Ans: (D) $-\sqrt{3} + 14$

5. $\sqrt{40} \times \sqrt{90} =$

$$\sqrt{40} \times \sqrt{90} = \sqrt{3600} = \sqrt{60 \times 60} = 60$$

Ans: (A) 60

6. $\frac{\sqrt{14}}{\sqrt{5}} =$

$$\frac{\sqrt{14}}{\sqrt{5}} = \sqrt{\frac{14}{5}} \text{ (divide the numbers under the roots)}$$

Ans: (C) $\sqrt{\frac{14}{5}}$

7. $81^{\frac{1}{4}} =$

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

Ans: (B) 3

8. $\sqrt[4]{12} \times \sqrt[4]{108} =$

$$\begin{aligned}\sqrt[4]{12} \times \sqrt[4]{108} &= \sqrt[4]{12 \times 108} \\ &= \sqrt[4]{1296} = \sqrt[4]{6^4} = 6\end{aligned}$$

Ans: (B) 6

9. $(12\sqrt{19})^2 =$

$$\begin{aligned}(12\sqrt{19})^2 &= 12^2 \times (\sqrt{19})^2 \\ &= 144 \times 19 = 2736\end{aligned}$$

Ans: (D) 2736

10. $(8 + \sqrt{3})(7 + \sqrt{3}) =$

$$(8 + \sqrt{3})(7 + \sqrt{3}) = 56 + 8\sqrt{3} + 7\sqrt{3} + 3 \\ = 59 + 15\sqrt{3}$$

Ans: (A) $59 + 15\sqrt{3}$

11. A rationalising factor of $3 + \sqrt{30}$ is

$$(3 + \sqrt{30})(3 - \sqrt{30}) = -21, \text{ a rational number.}$$

None of the other products is rational.

Ans: (D) $3 - \sqrt{30}$

12. The rationalising factor of $\sqrt[3]{17} - \sqrt[3]{9}$ is

$$\text{Use } (x - y)(x^2 + xy + y^2) = x^3 - y^3 \text{ with } x = \sqrt[3]{17}, y = \sqrt[3]{9}.$$

$$\text{Rationalising factor: } (\sqrt[3]{17})^2 + \sqrt[3]{17} \cdot \sqrt[3]{9} + (\sqrt[3]{9})^2$$

$$\text{Product} = (\sqrt[3]{17})^3 - (\sqrt[3]{9})^3 = 17 - 9 = 8$$

Ans: (B) $(\sqrt[3]{17})^2 + \sqrt[3]{17} \cdot \sqrt[3]{9} + (\sqrt[3]{9})^2$

13. $\sqrt{192} + \sqrt{147} =$

$$\sqrt{192} = \sqrt{64 \times 3} = 8\sqrt{3}$$

$$\sqrt{147} = \sqrt{49 \times 3} = 7\sqrt{3}$$

$$8\sqrt{3} + 7\sqrt{3} = 15\sqrt{3} \text{ (add like surds)}$$

Ans: (B) $15\sqrt{3}$

14. $\sqrt{176}$ in simplest form is

$$\sqrt{176} = \sqrt{16 \times 11} = 4\sqrt{11}$$

Ans: (C) $4\sqrt{11}$

15. $(\sqrt{7})^5 =$

$$(\sqrt{7})^5 = [(\sqrt{7})^2]^2 \times \sqrt{7} = 7^2 \times \sqrt{7} = 49\sqrt{7}$$

Ans: (C) $49\sqrt{7}$

16. $(\sqrt{10} + \sqrt{7})^2 =$

$$(\sqrt{10} + \sqrt{7})^2 = 10 + 7 + 2\sqrt{70} = 17 + 2\sqrt{70}$$

Ans: (D) $17 + 2\sqrt{70}$

17. $(2 - \sqrt{15})^2 =$

$$(2 - \sqrt{15})^2 = 2^2 + (\sqrt{15})^2 - 2(2)(\sqrt{15}) = 19 - 4\sqrt{15}$$

Ans: (A) $19 - 4\sqrt{15}$

18. $(\sqrt{17} - \sqrt{6})(\sqrt{17} + \sqrt{6}) =$

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

$$= (\sqrt{17})^2 - (\sqrt{6})^2 = 17 - 6 = 11$$

Ans: (A) 11

19. Rationalising the denominator of $\frac{1}{\sqrt{19}-\sqrt{15}}$ gives

$$\begin{aligned} &\text{Multiply above and below by } \sqrt{19} + \sqrt{15}: (\sqrt{19} - \sqrt{15})(\sqrt{19} + \sqrt{15}) = 19 - 15 = 4 \\ &= \frac{\sqrt{19} + \sqrt{15}}{4} \end{aligned}$$

Ans: (C) $\frac{\sqrt{19} + \sqrt{15}}{4}$

20. If $\frac{6+2\sqrt{6}}{6-2\sqrt{6}} = a + b\sqrt{6}$, then $a + b =$

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

$$\text{Numerator: } 36 + 12\sqrt{6} + 12\sqrt{6} + 24 = 60 + 24\sqrt{6}$$

$$\text{Denominator: } 6^2 - (2\sqrt{6})^2 = 36 - 24 = 12$$

$$\frac{60+24\sqrt{6}}{12} = 5 + 2\sqrt{6}$$

$$\text{So } a = 5, b = 2$$

Ans: (B) 7

21. $\frac{9+\sqrt{19}}{9-\sqrt{19}} + \frac{9-\sqrt{19}}{9+\sqrt{19}} =$

$$= \frac{(9+\sqrt{19})^2 + (9-\sqrt{19})^2}{(9+\sqrt{19})(9-\sqrt{19})} = \frac{200}{62} = \frac{100}{31}$$

$$\text{The } \sqrt{19} \text{ terms cancel and } (9 + \sqrt{19})(9 - \sqrt{19}) = 62.$$

Ans: (B) $\frac{100}{31}$

22. $\frac{1}{\sqrt{13}+\sqrt{6}} + \frac{1}{\sqrt{13}-\sqrt{6}} =$

$$= \frac{(\sqrt{13}-\sqrt{6})+(\sqrt{13}+\sqrt{6})}{(\sqrt{13}+\sqrt{6})(\sqrt{13}-\sqrt{6})} = \frac{2\sqrt{13}}{7}$$

Ans: (A) $\frac{2\sqrt{13}}{7}$

23. If $x = 6 + \sqrt{35}$, then $x^2 - 12x =$

$$x - 6 = \sqrt{35}, \text{ so } (x - 6)^2 = 35$$

$$x^2 - 12x + 36 = 35, \text{ so } x^2 - 12x = -1$$

Ans: (C) -1

24. $\sqrt{15} - \sqrt{56} =$

$$\sqrt{56} = \sqrt{4 \times 14} = 2\sqrt{14}$$

$$\sqrt{15} - \sqrt{56} = \sqrt{14 + 1 - 2\sqrt{14} \times 1}$$

$$= \sqrt{(\sqrt{14})^2 + (1)^2 - 2(\sqrt{14})(1)}$$

$$= \sqrt{(\sqrt{14} - 1)^2} = \sqrt{14} - 1$$

Ans: (D) $\sqrt{14} - 1$

25. $\sqrt{7 + \sqrt{13}} =$

$$\sqrt{7 + \sqrt{13}} = \sqrt{\frac{2(7+\sqrt{13})}{2}} = \frac{\sqrt{14+2\sqrt{13}}}{\sqrt{2}}$$

$$= \frac{\sqrt{13+1+2\sqrt{13} \times 1}}{\sqrt{2}}$$

$$= \frac{\sqrt{(\sqrt{13})^2 + (1)^2 + 2(\sqrt{13})(1)}}{\sqrt{2}}$$

$$= \frac{\sqrt{(\sqrt{13}+1)^2}}{\sqrt{2}} = \frac{\sqrt{13}+1}{\sqrt{2}}$$

Ans: (D) $\frac{\sqrt{13}+1}{\sqrt{2}}$
