EXPRESSWALA ACADEMY

Rationalization (Surds)

MCQ Test, Set 04

Time: 30 minutes | Maximum marks: 25

Name: _____ Class: _____ Date: _____

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

1. For which value of n is $\sqrt[3]{n}$ a rational number?

A. 37 **B.** 216 **C.** 33 **D.** 21

2. Which of the following statements is false?

A. Every surd is an irrational number.

B. Every irrational number is a surd.

C. e is an irrational number.

D. $\sqrt{48}$ is a surd.

3. Which one of these is a mixed surd?

A. $9\sqrt{100}$ **B.** $\sqrt[4]{16}$ **C.** $\sqrt[3]{44}$ **D.** $5\sqrt[3]{29}$

4. The conjugate of $11 - \sqrt{21}$ is

A. $-11 + \sqrt{21}$ **B.** $-11 - \sqrt{21}$ **C.** $11 + \sqrt{21}$ **D.** $\frac{1}{11-\sqrt{21}}$

5. $\sqrt{6} \times \sqrt{24} =$

A. 144 **B.** $6\sqrt{24}$ **C.** $\sqrt{30}$ **D.** 12

6. $\frac{\sqrt{192}}{\sqrt{3}} =$

A. 64 **B.** $\sqrt{189}$ **C.** 8 **D.** $8\sqrt{3}$

7. $17^{\frac{1}{6}} =$

A. $\frac{17}{6}$ **B.** $6\sqrt{17}$ **C.** $\sqrt[17]{6}$ **D.** $\sqrt[6]{17}$

8. $\frac{\sqrt[5]{729}}{\sqrt[5]{3}} =$

A. 243 **B.** 3 **C.** $\sqrt[5]{726}$ **D.** $\sqrt[5]{732}$

9. $(2\sqrt{7})^2 =$

A. 28 **B.** $4\sqrt{7}$ **C.** 14 **D.** 196

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

A. 17 **B.** $17 - 7\sqrt{5}$ **C.** $17 + 7\sqrt{5}$ **D.** $7 + 7\sqrt{5}$

11. A rationalising factor of $5\sqrt{14}$ is

A. $\sqrt{14}$ **B.** 14 **C.** 5 **D.** $5+\sqrt{14}$

12. $(\sqrt[3]{13}-\sqrt[3]{11})\left((\sqrt[3]{13})^2+\sqrt[3]{13}\cdot\sqrt[3]{11}+(\sqrt[3]{11})^2\right)=$

A. $\sqrt[3]{2}$ **B.** 24 **C.** 2 **D.** 866

13. $\sqrt{200}$ in simplest form is

A. $10\sqrt{2}$ **B.** $10\sqrt{20}$ **C.** $2\sqrt{10}$ **D.** $100\sqrt{2}$

14. $(\sqrt{15})^4=$

A. $15\sqrt{15}$ **B.** 225 **C.** 60 **D.** 50625

15. $(\sqrt{11}+\sqrt{10})^2=$

A. $21+2\sqrt{110}$ **B.** $21-2\sqrt{110}$ **C.** $221+2\sqrt{110}$ **D.** 21

16. $(\sqrt{19}-\sqrt{14})(\sqrt{19}+\sqrt{14})=$

A. 165 **B.** $\sqrt{5}$ **C.** 5 **D.** 33

17. $(3+5\sqrt{7})(3-5\sqrt{7})=$

A. 184 **B.** -26 **C.** -166 **D.** -1216

18. $\frac{1}{9+\sqrt{11}}=$

A. $\frac{\sqrt{11}-9}{2}$ **B.** $\frac{9-\sqrt{11}}{70}$ **C.** $\frac{9+\sqrt{11}}{70}$ **D.** $\frac{9-\sqrt{11}}{92}$

19. If $\frac{6+3\sqrt{7}}{4-\sqrt{7}}=a+b\sqrt{7}$, then $a=$

A. 45 **B.** 2 **C.** -5 **D.** 5

20. $\frac{\sqrt{19}+\sqrt{5}}{\sqrt{19}-\sqrt{5}}+\frac{\sqrt{19}-\sqrt{5}}{\sqrt{19}+\sqrt{5}}=$

A. $-\frac{24}{7}$ **B.** $\frac{2\sqrt{95}}{7}$ **C.** $\frac{12}{7}$ **D.** $\frac{24}{7}$

21. $\frac{1}{\sqrt{7}+\sqrt{5}}+\frac{1}{\sqrt{7}-\sqrt{5}}=$

A. $\sqrt{5}$ **B.** 0 **C.** $\sqrt{7}$ **D.** $\frac{\sqrt{7}}{6}$

22. If $x=\sqrt[3]{15-4\sqrt{14}}$, then $x^3+\frac{1}{x^3}=$

A. 30 **B.** 0 **C.** $8\sqrt{14}$ **D.** 15

23. $\sqrt{9+2\sqrt{18}}=$

A. $\sqrt{3}-\sqrt{6}$ **B.** $\sqrt{18}+1$ **C.** $\sqrt{6}+\sqrt{3}$ **D.** $\sqrt{6}-\sqrt{3}$

24. $\sqrt{11-2\sqrt{30}}=$

A. $\sqrt{5}-\sqrt{6}$ **B.** $\sqrt{6}-\sqrt{5}$ **C.** $\sqrt{6}+\sqrt{5}$ **D.** $\sqrt{30}-1$

25. $\sqrt{16+\sqrt{207}}=$

A. $\sqrt{23}+3$ **B.** $\frac{\sqrt{23}-3}{\sqrt{2}}$

C. $\frac{\sqrt{23}+3}{2}$ **D.** $\frac{\sqrt{23}+3}{\sqrt{2}}$

Key sheet

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

Solutions

1. For which value of n is $\sqrt[3]{n}$ a rational number?

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

The other three are not perfect cubes, so their roots are surds.

Ans: (B) 216

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2. Which of the following statements is false?

π and e are irrational numbers but not surds.

So 'every irrational number is a surd' is false.

Ans: (B) Every irrational number is a surd.

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3. Which one of these is a mixed surd?

$5\sqrt[3]{29} = 5 \cdot \sqrt[3]{29}$: a rational number times a surd.

$\sqrt[3]{44}$ is a pure surd; $9\sqrt{100} = 90$ and $\sqrt[4]{16} = 2$ are rational.

Ans: (D) $5\sqrt[3]{29}$

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4. The conjugate of $11 - \sqrt{21}$ is

Only the sign of the surd part changes: the conjugate of $11 - \sqrt{21}$ is $11 + \sqrt{21}$.

Ans: (C) $11 + \sqrt{21}$

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5. $\sqrt{6} \times \sqrt{24} =$

$\sqrt{6} \times \sqrt{24} = \sqrt{144} = \sqrt{12 \times 12} = 12$

Ans: (D) 12

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6. $\frac{\sqrt{192}}{\sqrt{3}} =$

$\frac{\sqrt{192}}{\sqrt{3}} = \sqrt{\frac{192}{3}}$

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

Ans: (C) 8

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7. $17^{\frac{1}{6}} =$

$a^{\frac{1}{n}} = \sqrt[n]{a}$, so $17^{\frac{1}{6}} = \sqrt[6]{17}$

Ans: (D) $\sqrt[6]{17}$

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8. $\frac{\sqrt[5]{729}}{\sqrt[5]{3}} =$

$\frac{\sqrt[5]{729}}{\sqrt[5]{3}} = \sqrt[5]{\frac{729}{3}}$

$= \sqrt[5]{243} = \sqrt[5]{3^5} = 3$

Ans: (B) 3

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9. $(2\sqrt{7})^2 =$

$(2\sqrt{7})^2 = 2^2 \times (\sqrt{7})^2$

$= 4 \times 7 = 28$

Ans: (A) 28

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

$(4+\sqrt{5})(3+\sqrt{5}) = 12+4\sqrt{5}+3\sqrt{5}+5$

$= 17+7\sqrt{5}$

Ans: (C) $17+7\sqrt{5}$

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11. A rationalising factor of $5\sqrt{14}$ is

$5\sqrt{14} \times \sqrt{14} = 5 \times 14 = 70$, a rational number.

Ans: (A) $\sqrt{14}$

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12. $(\sqrt[3]{13}-\sqrt[3]{11})\left((\sqrt[3]{13})^2+\sqrt[3]{13}\cdot\sqrt[3]{11}+(\sqrt[3]{11})^2\right) =$

Use $(x-y)(x^2+xy+y^2) = x^3-y^3$ with $x=\sqrt[3]{13}$, $y=\sqrt[3]{11}$.

Product $= (\sqrt[3]{13})^3-(\sqrt[3]{11})^3 = 13-11 = 2$

Ans: (C) 2

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13. $\sqrt{200}$ in simplest form is

$\sqrt{200} = \sqrt{100\times 2} = 10\sqrt{2}$

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

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14. $(\sqrt{15})^4 =$

$(\sqrt{15})^4 = [(\sqrt{15})^2]^2 = 15^2 = 225$

Ans: (B) 225

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15. $(\sqrt{11}+\sqrt{10})^2 =$

$(\sqrt{11}+\sqrt{10})^2 = 11+10+2\sqrt{110} = 21+2\sqrt{110}$

Ans: (A) $21+2\sqrt{110}$

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16. $(\sqrt{19}-\sqrt{14})(\sqrt{19}+\sqrt{14}) =$

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

$= (\sqrt{19})^2-(\sqrt{14})^2 = 19-14 = 5$

Ans: (C) 5

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17. $(3+5\sqrt{7})(3-5\sqrt{7}) =$

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

$= 3^2-(5\sqrt{7})^2 = 9-175 = -166$

Ans: (C) -166

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18. $\frac{1}{9+\sqrt{11}} =$

Multiply above and below by $9-\sqrt{11}$: $(9+\sqrt{11})(9-\sqrt{11}) = 81-11 = 70$

$= \frac{9-\sqrt{11}}{70}$

Ans: (B) $\frac{9-\sqrt{11}}{70}$

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19. If $\frac{6+3\sqrt{7}}{4-\sqrt{7}} = a + b\sqrt{7}$, then $a =$

$\frac{6+3\sqrt{7}}{4-\sqrt{7}} = \frac{(6+3\sqrt{7})(4+\sqrt{7})}{(4-\sqrt{7})(4+\sqrt{7})}$

Numerator: $24 + 6\sqrt{7} + 12\sqrt{7} + 21 = 45 + 18\sqrt{7}$

Denominator: $4^2 - (\sqrt{7})^2 = 16 - 7 = 9$

$\frac{45+18\sqrt{7}}{9} = 5 + 2\sqrt{7}$

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

Ans: (D) 5

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20. $\frac{\sqrt{19}+\sqrt{5}}{\sqrt{19}-\sqrt{5}} + \frac{\sqrt{19}-\sqrt{5}}{\sqrt{19}+\sqrt{5}} =$

$= \frac{(\sqrt{19}+\sqrt{5})^2+(\sqrt{19}-\sqrt{5})^2}{(\sqrt{19}+\sqrt{5})(\sqrt{19}-\sqrt{5})} = \frac{48}{14} = \frac{24}{7}$

The $\sqrt{95}$ terms cancel and $(\sqrt{19} + \sqrt{5})(\sqrt{19} - \sqrt{5}) = 19 - 5 = 14$.

Ans: (D) $\frac{24}{7}$

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21. $\frac{1}{\sqrt{7}+\sqrt{5}} + \frac{1}{\sqrt{7}-\sqrt{5}} =$

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

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

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22. If $x = \sqrt[3]{15 - 4\sqrt{14}}$, then $x^3 + \frac{1}{x^3} =$

$x^3 = 15 - 4\sqrt{14}$, so $\frac{1}{x^3} = \frac{1}{15-4\sqrt{14}} = 15 + 4\sqrt{14}$

$x^3 + \frac{1}{x^3} = (15 - 4\sqrt{14}) + (15 + 4\sqrt{14}) = 30$

Ans: (A) 30

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23. $\sqrt{9 + 2\sqrt{18}} =$

$\sqrt{9 + 2\sqrt{18}} = \sqrt{6 + 3 + 2\sqrt{6 \times 3}}$

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

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

Ans: (C) $\sqrt{6} + \sqrt{3}$

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24. $\sqrt{11 - 2\sqrt{30}} =$

$\sqrt{11 - 2\sqrt{30}} = \sqrt{6 + 5 - 2\sqrt{6 \times 5}}$

$= \sqrt{(\sqrt{6})^2 + (\sqrt{5})^2 - 2(\sqrt{6})(\sqrt{5})}$

$= \sqrt{(\sqrt{6} - \sqrt{5})^2} = \sqrt{6} - \sqrt{5}$

Ans: (B) $\sqrt{6} - \sqrt{5}$

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25. $\sqrt{16+\sqrt{207}} =$

$\sqrt{16+\sqrt{207}} = \sqrt{\frac{2(16+\sqrt{207})}{2}} = \frac{\sqrt{32+2\sqrt{207}}}{\sqrt{2}}$

$= \frac{\sqrt{23+9+2\sqrt{23\times 9}}}{\sqrt{2}}$

$= \frac{\sqrt{(\sqrt{23})^2+(3)^2+2(\sqrt{23})(3)}}{\sqrt{2}}$

$= \frac{\sqrt{(\sqrt{23}+3)^2}}{\sqrt{2}} = \frac{\sqrt{23}+3}{\sqrt{2}}$

Ans: (D) $\frac{\sqrt{23}+3}{\sqrt{2}}$