EXPRESSWALA ACADEMY

Rationalization (Surds)

MCQ Test, Set 08

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 $\sqrt{n}$ a rational number?

A. 50 **B.** 400 **C.** 48 **D.** 55

2. $\sqrt[5]{19}$ and π are both irrational. Which of them is a surd?

A. Both **B.** $\sqrt[5]{19}$ only **C.** Neither **D.** π only

3. $2\sqrt{n}$ is a mixed surd when n is

A. 24 **B.** 400 **C.** 36 **D.** 81

4. Which of the following is the conjugate of $20+\sqrt{21}$?

A. $-20-\sqrt{21}$ **B.** $\frac{1}{20+\sqrt{21}}$ **C.** $-20+\sqrt{21}$ **D.** $20-\sqrt{21}$

5. $\sqrt{7}\times\sqrt{17}=$

A. $\sqrt{24}$ **B.** 119 **C.** $\sqrt{119}$ **D.** $7\sqrt{17}$

6. $\frac{\sqrt{180}}{\sqrt{5}}=$

A. $6\sqrt{5}$ **B.** 36 **C.** 6 **D.** $\sqrt{175}$

7. $\frac{\sqrt{13}}{\sqrt{23}}=$

A. $\frac{13}{23}$ **B.** $\sqrt{\frac{13}{23}}$ **C.** $\sqrt{10}$ **D.** $\sqrt{\frac{23}{13}}$

8. $\sqrt[7]{16}$ in exponent form is

A. $7^{\frac{1}{16}}$ **B.** 16^{7} **C.** $\frac{16}{7}$ **D.** $16^{\frac{1}{7}}$

9. $\frac{\sqrt[4]{768}}{\sqrt[4]{3}}=$

A. 256 **B.** 4 **C.** $\sqrt[4]{765}$ **D.** $\sqrt[4]{771}$

10. $(7\sqrt{14})^2=$

A. 686 **B.** 98 **C.** $49\sqrt{14}$ **D.** 9604

11. $(6-\sqrt{11})(9-\sqrt{11})=$

A. 65 **B.** $65+15\sqrt{11}$ **C.** $43-15\sqrt{11}$ **D.** $65-15\sqrt{11}$

12. $(9-\sqrt{6})(7-\sqrt{6}) =$

A. $69+16\sqrt{6}$ **B.** 69 **C.** $69-16\sqrt{6}$ **D.** $57-16\sqrt{6}$

13. A rationalising factor of $4\sqrt{11}$ is

A. $4+\sqrt{11}$ **B.** 11 **C.** 4 **D.** $\sqrt{11}$

14. $(\sqrt[3]{7}-\sqrt[3]{5})\left((\sqrt[3]{7})^2+\sqrt[3]{7}\cdot\sqrt[3]{5}+(\sqrt[3]{5})^2\right) =$

A. 12 **B.** $\sqrt[3]{2}$ **C.** 2 **D.** 218

15. $\sqrt{224}$ in simplest form is

A. $4\sqrt{14}$ **B.** $14\sqrt{16}$ **C.** $16\sqrt{14}$ **D.** $4\sqrt{56}$

16. $(\sqrt{6})^3 =$

A. 36 **B.** $3\sqrt{6}$ **C.** $6\sqrt{6}$ **D.** 6

17. $(6-\sqrt{3})^2 =$

A. 39 **B.** $39-6\sqrt{3}$ **C.** $39-12\sqrt{3}$ **D.** $45-12\sqrt{3}$

18. $(10+5\sqrt{2})(10-5\sqrt{2}) =$

A. 50 **B.** 90 **C.** 150 **D.** 0

19. $\frac{1}{9-\sqrt{3}} =$

A. $\frac{9+\sqrt{3}}{6}$ **B.** $\frac{9+\sqrt{3}}{84}$ **C.** $\frac{9-\sqrt{3}}{78}$ **D.** $\frac{9+\sqrt{3}}{78}$

20. If $\frac{4+2\sqrt{3}}{4-2\sqrt{3}} = a+b\sqrt{3}$, then $a+b =$

A. 28 **B.** 6 **C.** 3 **D.** 11

21. $\frac{\sqrt{11}+\sqrt{6}}{\sqrt{11}-\sqrt{6}} + \frac{\sqrt{11}-\sqrt{6}}{\sqrt{11}+\sqrt{6}} =$

A. $\frac{4\sqrt{66}}{5}$ **B.** $-\frac{34}{5}$ **C.** $\frac{34}{5}$ **D.** $\frac{17}{5}$

22. $\frac{1}{6+\sqrt{5}} + \frac{1}{6-\sqrt{5}} =$

A. $\frac{12}{31}$ **B.** 0 **C.** $\frac{2\sqrt{5}}{31}$ **D.** $\frac{12}{41}$

23. If $x = \sqrt[3]{13-2\sqrt{42}}$, then $x^3+\frac{1}{x^3} =$

A. 13 **B.** $4\sqrt{42}$ **C.** 26 **D.** 0

24. $\sqrt{14-2\sqrt{45}} =$

A. $3+\sqrt{5}$ **B.** $\sqrt{45}-1$ **C.** $\sqrt{5}-3$ **D.** $3-\sqrt{5}$

25. $\sqrt{10+\sqrt{99}} =$

A. $\frac{\sqrt{11}-3}{\sqrt{2}}$ **B.** $\frac{\sqrt{11}+3}{\sqrt{2}}$

C. $\sqrt{11}+3$ **D.** $\frac{\sqrt{11}+3}{2}$

Key sheet

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

Solutions

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

$\sqrt{400} = \sqrt{20 \times 20} = 20$

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

Ans: (B) 400

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2. $\sqrt[5]{19}$ and π are both irrational. Which of them is a surd?

$1^5 = 1$ and $2^5 = 32$, so 19 is not a perfect fifth power. So $\sqrt[5]{19}$ is a surd.

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

Ans: (B) $\sqrt[5]{19}$ **only**

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3. $2\sqrt{n}$ is a mixed surd when n is

$4^2 = 16$ and $5^2 = 25$, so 24 is not a perfect square. So $2\sqrt{24}$ is a mixed surd.

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

Ans: (A) 24

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4. Which of the following is the conjugate of $20 + \sqrt{21}$?

Only the sign of the surd part changes: the conjugate of $20 + \sqrt{21}$ is $20 - \sqrt{21}$.

Ans: (D) $20 - \sqrt{21}$

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5. $\sqrt{7} \times \sqrt{17} =$

$\sqrt{7} \times \sqrt{17} = \sqrt{7 \times 17} = \sqrt{119}$ (multiply the numbers under the roots).

Ans: (C) $\sqrt{119}$

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6. $\frac{\sqrt{180}}{\sqrt{5}} =$

$\frac{\sqrt{180}}{\sqrt{5}} = \sqrt{\frac{180}{5}}$

$= \sqrt{36} = \sqrt{6 \times 6} = 6$

Ans: (C) 6

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7. $\frac{\sqrt{13}}{\sqrt{23}} =$

$\frac{\sqrt{13}}{\sqrt{23}} = \sqrt{\frac{13}{23}}$ (divide the numbers under the roots)

Ans: (B) $\sqrt{\frac{13}{23}}$

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8. $\sqrt[7]{16}$ in exponent form is

$\sqrt[n]{a} = a^{\frac{1}{n}}$, so $\sqrt[7]{16} = 16^{\frac{1}{7}}$

Ans: (D) $16^{\frac{1}{7}}$

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9. $\frac{\sqrt[4]{768}}{\sqrt[4]{3}} =$

$\frac{\sqrt[4]{768}}{\sqrt[4]{3}} = \sqrt[4]{\frac{768}{3}}$

$= \sqrt[4]{256} = \sqrt[4]{4^4} = 4$

Ans: (B) 4

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10. $(7\sqrt{14})^2 =$

$(7\sqrt{14})^2 = 7^2 \times (\sqrt{14})^2$

$= 49 \times 14 = 686$

Ans: (A) 686

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11. $(6 - \sqrt{11})(9 - \sqrt{11}) =$

$(6 - \sqrt{11})(9 - \sqrt{11}) = 54 - 6\sqrt{11} - 9\sqrt{11} + 11$

$= 65 - 15\sqrt{11}$

Ans: (D) $65 - 15\sqrt{11}$

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12. $(9 - \sqrt{6})(7 - \sqrt{6}) =$

$(9 - \sqrt{6})(7 - \sqrt{6}) = 63 - 9\sqrt{6} - 7\sqrt{6} + 6$

$= 69 - 16\sqrt{6}$

Ans: (C) $69 - 16\sqrt{6}$

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13. A rationalising factor of $4\sqrt{11}$ is

$4\sqrt{11} \times \sqrt{11} = 4 \times 11 = 44$, a rational number.

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

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14. $(\sqrt[3]{7} - \sqrt[3]{5})\left((\sqrt[3]{7})^2 + \sqrt[3]{7} \cdot \sqrt[3]{5} + (\sqrt[3]{5})^2\right) =$

Use $(x - y)(x^2 + xy + y^2) = x^3 - y^3$ with $x = \sqrt[3]{7}$, $y = \sqrt[3]{5}$.

Product $= (\sqrt[3]{7})^3 - (\sqrt[3]{5})^3 = 7 - 5 = 2$

Ans: (C) 2

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15. $\sqrt{224}$ in simplest form is

$\sqrt{224} = \sqrt{16 \times 14} = 4\sqrt{14}$

Ans: (A) $4\sqrt{14}$

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16. $(\sqrt{6})^3 =$

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

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

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17. $(6 - \sqrt{3})^2 =$

$(6 - \sqrt{3})^2 = 6^2 + (\sqrt{3})^2 - 2(6)(\sqrt{3}) = 39 - 12\sqrt{3}$

Ans: (C) $39 - 12\sqrt{3}$

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18. $(10 + 5\sqrt{2})(10 - 5\sqrt{2}) =$

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

$= 10^2 - (5\sqrt{2})^2 = 100 - 50 = 50$

Ans: (A) 50

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19. $\frac{1}{9-\sqrt{3}} =$

Multiply above and below by $9+\sqrt{3}$: $(9-\sqrt{3})(9+\sqrt{3}) = 81-3 = 78$

$= \frac{9+\sqrt{3}}{78}$

Ans: (D) $\frac{9+\sqrt{3}}{78}$

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20. If $\frac{4+2\sqrt{3}}{4-2\sqrt{3}} = a+b\sqrt{3}$, then $a+b =$

$\frac{4+2\sqrt{3}}{4-2\sqrt{3}} = \frac{(4+2\sqrt{3})(4+2\sqrt{3})}{(4-2\sqrt{3})(4+2\sqrt{3})}$

Numerator: $16+8\sqrt{3}+8\sqrt{3}+12 = 28+16\sqrt{3}$

Denominator: $4^2-(2\sqrt{3})^2 = 16-12 = 4$

$\frac{28+16\sqrt{3}}{4} = 7+4\sqrt{3}$

So $a=7$, $b=4$

Ans: (D) 11

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21. $\frac{\sqrt{11}+\sqrt{6}}{\sqrt{11}-\sqrt{6}} + \frac{\sqrt{11}-\sqrt{6}}{\sqrt{11}+\sqrt{6}} =$

$= \frac{(\sqrt{11}+\sqrt{6})^2+(\sqrt{11}-\sqrt{6})^2}{(\sqrt{11}+\sqrt{6})(\sqrt{11}-\sqrt{6})} = \frac{34}{5}$

The $\sqrt{66}$ terms cancel and $(\sqrt{11}+\sqrt{6})(\sqrt{11}-\sqrt{6}) = 11-6 = 5$.

Ans: (C) $\frac{34}{5}$

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22. $\frac{1}{6+\sqrt{5}} + \frac{1}{6-\sqrt{5}} =$

$= \frac{(6-\sqrt{5})+(6+\sqrt{5})}{(6+\sqrt{5})(6-\sqrt{5})} = \frac{12}{31}$

Ans: (A) $\frac{12}{31}$

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23. If $x = \sqrt[3]{13-2\sqrt{42}}$, then $x^3+\frac{1}{x^3} =$

$x^3 = 13-2\sqrt{42}$, so $\frac{1}{x^3} = \frac{1}{13-2\sqrt{42}} = 13+2\sqrt{42}$

$x^3+\frac{1}{x^3} = (13-2\sqrt{42})+(13+2\sqrt{42}) = 26$

Ans: (C) 26

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24. $\sqrt{14-2\sqrt{45}} =$

$\sqrt{14-2\sqrt{45}} = \sqrt{9+5-2\sqrt{9\times 5}}$

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

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

Ans: (D) $3-\sqrt{5}$

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25. $\sqrt{10+\sqrt{99}} =$

$\sqrt{10+\sqrt{99}} = \sqrt{\frac{2(10+\sqrt{99})}{2}} = \frac{\sqrt{20+2\sqrt{99}}}{\sqrt{2}}$

$= \frac{\sqrt{11+9+2\sqrt{11\times 9}}}{\sqrt{2}}$

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

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

Ans: (B) $\frac{\sqrt{11}+3}{\sqrt{2}}$