Self Assessment Test

By : www.udgamwelfarefoundation.com

Time : 1.5 Hours

Class : 9 Standard

Chapter : Number System

NS0901

Maximum Marks : 61

Marking Scheme:
Section A: 8 Questions × 1 mark = 8 Marks
Section B: 6 Questions × 2 marks = 12 Marks
Section C: 4 Questions × 4 marks = 16 Marks
Section D: 5 Questions × 5 marks = 25 Marks
Total = 61 Marks

Section A: Multiple Choice Questions (1 mark each)

1. Which of the following is irrational?
   (A) $\frac{22}{7}$ (B) $0.1010010001\ldots$ (C) 0.125 (D) $0.\overline{23}$

2. The value of $(\sqrt{7}-\sqrt{5})(\sqrt{7}+\sqrt{5})$ is:
   (A) 12 (B) 2 (C) 14 (D) 49

3. The decimal expansion of $\frac{65}{2^3 \cdot 5^2}$ is:
   (A) terminating (B) non-terminating recurring (C) irrational (D) none

4. The reciprocal of $\sqrt{2}$ after rationalization is:
   (A) $\frac{1}{\sqrt{2}}$ (B) $\frac{\sqrt{2}}{2}$ (C) $\frac{2}{\sqrt{2}}$ (D) 2

5. If $a^m \cdot a^n = a^{12}$ and $m = 5$, then n equals:
   (A) 6 (B) 7 (C) 5 (D) 12

6. Which number lies between $\sqrt{5}$ and $\sqrt{6}$?
   (A) 2.1 (B) 2.3 (C) 2.7 (D) 2.9

7. The simplified form of $\frac{1}{\sqrt{5}-\sqrt{2}}$ is:
   (A) $\sqrt{5}+\sqrt{2}$ (B) $\frac{\sqrt{5}+\sqrt{2}}{3}$ (C) $\frac{\sqrt{5}-\sqrt{2}}{3}$ (D) $\sqrt{5}-\sqrt{2}$

8. The decimal expansion of $\frac{1}{13}$ is:
   (A) terminating (B) recurring (C) irrational (D) non-recurring

Section B: Short Answer Questions (2 marks each)

1. Without long division, show that $\frac{35}{40}$ is a terminating decimal.
2. Locate $\sqrt{8}$ on the number line using a geometrical method.
3. Rationalize $\frac{5}{\sqrt{3}+\sqrt{2}}$.
4. If $x = \sqrt{3}+\sqrt{2}$, find $x^2 - 10$.
5. Simplify: $2^{-4} + 2^2 + 2^0$.
6. Without division, determine whether $\frac{81}{2^3 \cdot 5^4}$ has a terminating decimal expansion.

Section C: Long Answer Questions (4 marks each)

1. Draw a number line and represent $\sqrt{2}$ and $\sqrt{3}$ on it.
2. Simplify: $\frac{3}{\sqrt{11}-\sqrt{7}} - \frac{3}{\sqrt{11}+\sqrt{7}}$.
3. Using laws of exponents, simplify: $\frac{5^4 \cdot 25^{-2} \cdot 125}{5^{-3}}$.
4. Prove by contradiction that $\sqrt{11}$ is irrational.

Section D: Case Study Based Questions (5 marks each)

Case Study:
In a mathematics workshop, students investigated rational and irrational numbers. They first considered fractions like $\frac{1}{2} = 0.5$, $\frac{3}{8} = 0.375$, and $\frac{7}{22} = 0.\overline{318}$. Then they compared these with $\sqrt{2} = 1.414213\ldots$ and $\pi = 3.14159\ldots$. They noticed that rational numbers always have terminating or recurring decimals, while irrational numbers have non-terminating and non-recurring expansions. The teacher then asked them to construct $\sqrt{10}$ on a number line, and later rationalize $\frac{1}{\sqrt{7}}$. They concluded the session with a discussion on the importance of rationalization in simplifying expressions and the use of laws of exponents in handling large powers.

1. Which of the following has a non-terminating recurring decimal expansion?
   (A) $\frac{1}{2}$ (B) $\frac{3}{8}$ (C) $\frac{7}{22}$ (D) $\sqrt{2}$
2. Which of the following is irrational?
   (A) π (B) $\frac{7}{22}$ (C) 0.75 (D) $0.\overline{45}$

3. Rationalizing $\dfrac{1}{\sqrt{7}}$ gives:

   (A) $\sqrt{7}$ (B) $\dfrac{1}{7\sqrt{7}}$ (C) $\dfrac{\sqrt{7}}{7}$ (D) 7

4. To construct $\sqrt{10}$ on a number line, one can use:
   (A) Right triangle with legs 1 and 9 (B) Right triangle with legs 2 and $\sqrt{6}$ (C) Right triangle with legs 3 and 1 (D) Right triangle with legs 10 and 1

5. The law of exponents used to simplify $\dfrac{a^7}{a^4}$ is:
   (A) a^{m+n} (B) a^{m-n} (C) $(a^m)^n$ (D) $(ab)^m$

Answers with Detailed Solutions

Section A

1. Answer: B. 0.1010010001 . . . is non-terminating, non-recurring.
2. Answer: A. $(\sqrt{7}-\sqrt{5})(\sqrt{7}+\sqrt{5}) = 7-5 = 2$.
3. Answer: A. Denominator is $2^3 \cdot 5^2$, so terminating decimal.
4. Answer: B. $\frac{1}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$.
5. Answer: B. $a^m \cdot a^n = a^{m+n} = a^{12}$, so $n = 7$.
6. Answer: B. $\sqrt{5} \approx 2.236$, $\sqrt{6} \approx 2.449$, so 2.3 lies between them.
7. Answer: B. Multiply by $\frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}+\sqrt{2}}$: $\frac{\sqrt{5}+\sqrt{2}}{5-2} = \frac{\sqrt{5}+\sqrt{2}}{3}$.
8. Answer: B. $\frac{1}{13}$ is non-terminating recurring.

Section B

1. $\frac{35}{40} = \frac{7}{8}$; denominator 2^3, so terminating.
2. Draw a right triangle with legs 2 and 2; hypotenuse $\sqrt{8}$, represent on number line.
3. $\frac{5}{\sqrt{3}+\sqrt{2}} \times \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}} = \frac{5(\sqrt{3}-\sqrt{2})}{3-2} = 5(\sqrt{3}-\sqrt{2})$.
4. $x^2 = (\sqrt{3}+\sqrt{2})^2 = 3+2+2\sqrt{6} = 5+2\sqrt{6}$, so $x^2 - 10 = 2\sqrt{6} - 5$.
5. $2^{-4} + 2^2 + 2^0 = \frac{1}{16} + 4 + 1 = \frac{1}{16} + 5 = \frac{81}{16}$.
6. Denominator $2^3 \cdot 5^4$ contains only 2 and 5, so terminating.

Section C

1. Construct unit circle; extend line to represent $\sqrt{2}$, $\sqrt{3}$.
2. $\frac{3}{\sqrt{11}-\sqrt{7}} - \frac{3}{\sqrt{11}+\sqrt{7}} = \frac{3(\sqrt{11}+\sqrt{7})}{11-7} - \frac{3(\sqrt{11}-\sqrt{7})}{11-7}$

$= \frac{3\sqrt{11}+3\sqrt{7}-3\sqrt{11}+3\sqrt{7}}{4} = \frac{6\sqrt{7}}{4} = \frac{3\sqrt{7}}{2}$.

3. $25^{-2} = (5^2)^{-2} = 5^{-4}$, $125 = 5^3$. So expression $= \frac{5^4 \cdot 5^{-4} \cdot 5^3}{5^{-3}} = \frac{5^3}{5^{-3}} = 5^6 = 15625$.
4. Assume $\sqrt{11} = \frac{p}{q}$ with $\gcd(p,q) = 1$. Then $11q^2 = p^2$. So $11|p$. Let $p = 11k$, then $p^2 = 121k^2$, so $11q^2 = 121k^2 \implies q^2 = 11k^2$. Thus $11|q$. Contradiction since $\gcd(p,q) = 1$. Hence $\sqrt{11}$ is irrational.

Section D

1. Answer: C. $\frac{7}{22} = 0.3\overline{18}$ is recurring.
2. Answer: A. π is irrational.
3. Answer: C. $\frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$.
4. Answer: B. Right triangle with legs 2 and $\sqrt{6}$, hypotenuse $\sqrt{10}$.
5. Answer: B. $\frac{a^m}{a^n} = a^{m-n}$.