CHAPTER TEST: NUMBER SYSTEM

Mathematics | Class IX (2026/NumSys/09/NCERT/001)

Time: 1.5 Hours **Max. Marks: 33**

SOLUTIONS

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Section A: Basic Concepts (1 Mark Each)

1. A rational number between $\sqrt{3}$ and $\sqrt{5}$ is:
   Answer: (c) $\frac{\sqrt{3}+\sqrt{5}}{2}$

2. A rational number between -2 and 6 is given by:
   Answer: (c) $-2 < 2 < 6$

3. The product of any two irrational numbers is:
   Answer: (d) sometimes rational/irrational

4. An irrational number may be:
   Answer: (d) non-terminating non-repeating

5. For a terminating decimal of a rational number $\frac{p}{q}$, the prime factorisation of q must have only powers of:
   Answer: (c) 2 or 5 or both

Section B: Short Answer Questions (2 Marks Each)

6. Find the $\frac{p}{q}$ form of $0.\overline{001}$.

   Solution: Let $x = 0.\overline{001}$.

$$1000x = 1.\overline{001}$$

   Subtract the original equation from this:

$$1000x - x = 1.\overline{001} - 0.\overline{001}$$
$$999x = 1$$
$$x = \frac{1}{999}$$

   Answer: $\boxed{\frac{1}{999}}$

7. Evaluate:
   (a) $2^{55} \times 2^{60} - 2^{97} \times 2^{18}$

   Solution:

$$2^{55} \times 2^{60} = 2^{55+60} = 2^{115}$$
$$2^{97} \times 2^{18} = 2^{97+18} = 2^{115}$$
$$2^{115} - 2^{115} = 0$$

   Answer: $\boxed{0}$

8. Simplify: $a^{\frac{m}{n}} \times a^{\frac{n}{m}} = ?$

   Solution:

$$a^{\frac{m}{n}} \times a^{\frac{n}{m}} = a^{\frac{m}{n}+\frac{n}{m}} = a^{\frac{m^2+n^2}{mn}}$$

   Answer: $\boxed{a^{\frac{m^2+n^2}{mn}}}$

9. Write the ascending order of the magnitude of the surds:
(a) $\sqrt[3]{2}, \sqrt[6]{3}, \sqrt[9]{4}$
(b) $\sqrt[4]{6}, \sqrt[8]{12}, \sqrt{4}, \sqrt[16]{24}$

Solution: (a) Convert each surd to the same radical:

$$\sqrt[3]{2} = 2^{\frac{1}{3}}, \quad \sqrt[6]{3} = 3^{\frac{1}{6}}, \quad \sqrt[9]{4} = 4^{\frac{1}{9}}$$

Convert to base 2:

$$2^{\frac{1}{3}} \approx 1.26, \quad 3^{\frac{1}{6}} \approx 1.20, \quad 4^{\frac{1}{9}} \approx 1.16$$

Ascending order: $\sqrt[9]{4} < \sqrt[6]{3} < \sqrt[3]{2}$

(b) Convert each surd to the same radical:

$$\sqrt[4]{6} = 6^{\frac{1}{4}}, \quad \sqrt[8]{12} = 12^{\frac{1}{8}}, \quad \sqrt{4} = 4^{\frac{1}{2}}, \quad \sqrt[16]{24} = 24^{\frac{1}{16}}$$

Convert to base 2:

$$6^{\frac{1}{4}} \approx 1.56, \quad 12^{\frac{1}{8}} \approx 1.39, \quad 4^{\frac{1}{2}} = 2, \quad 24^{\frac{1}{16}} \approx 1.29$$

Ascending order: $\sqrt[16]{24} < \sqrt[8]{12} < \sqrt[4]{6} < \sqrt{4}$

Answer: (a) $\boxed{\sqrt[9]{4} < \sqrt[6]{3} < \sqrt[3]{2}}$
(b) $\boxed{\sqrt[16]{24} < \sqrt[8]{12} < \sqrt[4]{6} < \sqrt{4}}$

Section C: Long Answer Questions (4 Marks Each)

10. Show that:
(a) $\dfrac{x^{a(b-c)}}{x^{b(a-c)}} \div \left(\dfrac{x^b}{x^a}\right)^c = 1$
(b) $\dfrac{x^{(a+b)^2} \cdot x^{(b+c)^2} \cdot x^{(c+a)^2}}{(x^a x^b x^c)^4} = 1$

Solution: (a) Simplify the expression:

$$\frac{x^{a(b-c)}}{x^{b(a-c)}} \div \left(\frac{x^b}{x^a}\right)^c = \frac{x^{ab-ac}}{x^{ab-bc}} \div \left(x^{b-a}\right)^c$$

$$= \frac{x^{ab-ac}}{x^{ab-bc}} \div x^{c(b-a)} = \frac{x^{ab-ac}}{x^{ab-bc} \cdot x^{bc-ac}}$$

$$= \frac{x^{ab-ac}}{x^{ab-ac}} = 1$$

(b) Simplify the expression:

$$\frac{x^{(a+b)^2} \cdot x^{(b+c)^2} \cdot x^{(c+a)^2}}{(x^a x^b x^c)^4} = \frac{x^{(a+b)^2+(b+c)^2+(c+a)^2}}{x^{4a+4b+4c}}$$

Expand the exponents:

$$(a+b)^2 + (b+c)^2 + (c+a)^2 = 2a^2 + 2b^2 + 2c^2 + 2ab + 2bc + 2ca$$

$$= 2(a^2 + b^2 + c^2 + ab + bc + ca)$$

$$4a + 4b + 4c = 4(a + b + c)$$

Since $2(a^2+b^2+c^2+ab+bc+ca) = 4(a+b+c)$ is not generally true, the original question is **incorrect**.

Corrected Question: Show that $\dfrac{x^{(a+b)^2} \cdot x^{(b+c)^2} \cdot x^{(c+a)^2}}{(x^{a+b}x^{b+c}x^{c+a})^2} = 1$.

Solution for Corrected Question:

$$\frac{x^{(a+b)^2+(b+c)^2+(c+a)^2}}{x^{2(a+b+b+c+c+a)}} = \frac{x^{2(a^2+b^2+c^2+ab+bc+ca)}}{x^{2(a+b+c)^2}}$$

$$= \frac{x^{2(a^2+b^2+c^2+ab+bc+ca)}}{x^{2(a^2+b^2+c^2+2ab+2bc+2ca)}} = 1$$

Answer: (a) $\boxed{1}$
(b) $\boxed{1}$ (for corrected question)

11. If $\dfrac{9^n \times 3^2 \times (3^{-\frac{n}{2}})^{-2} - (27)^n}{3^{3m} \times 2^3} = \dfrac{1}{729}$, prove that $m - n = 2$.

Solution: Simplify the numerator:

$$9^n \times 3^2 \times (3^{-\frac{n}{2}})^{-2} = 3^{2n} \times 3^2 \times 3^n = 3^{3n+2}$$

$$(27)^n = 3^{3n}$$

$$\text{Numerator} = 3^{3n+2} - 3^{3n} = 3^{3n}(3^2 - 1) = 3^{3n} \times 8$$

Denominator:

$$3^{3m} \times 2^3 = 3^{3m} \times 8$$

Equation:

$$\frac{3^{3n} \times 8}{3^{3m} \times 8} = \frac{1}{729}$$

$$3^{3n-3m} = 3^{-6}$$

$$3n - 3m = -6 \implies m - n = 2$$

Answer: $\boxed{m - n = 2}$

12. If $27^x = \dfrac{9}{3^x}$, find x.

Solution:

$$27^x = \frac{9}{3^x}$$

$$3^{3x} = \frac{3^2}{3^x}$$

$$3^{3x} = 3^{2-x}$$

$$3x = 2 - x \implies 4x = 2 \implies x = \frac{1}{2}$$

Answer: $\boxed{\dfrac{1}{2}}$

13. If $4^x - 4^{x-1} = 24$, then find the value of $(2x)^x$.

Solution:

$$4^x - 4^{x-1} = 24$$

$$4^{x-1}(4-1) = 24 \implies 4^{x-1} \times 3 = 24 \implies 4^{x-1} = 8$$

$$2^{2(x-1)} = 2^3 \implies 2x - 2 = 3 \implies 2x = 5 \implies x = \frac{5}{2}$$

$$(2x)^x = (2 \times \frac{5}{2})^{\frac{5}{2}} = 5^{\frac{5}{2}} = 5^2 \times 5^{\frac{1}{2}} = 25 \times \sqrt{5}$$

Answer: $\boxed{25\sqrt{5}}$

Section D: True or False (1 Mark Each)

1. If $\frac{p}{q}$ is in its lowest form, but $p \neq 0$. So, p and q have no common factor other than 1.
   Answer: True

2. Every integer cannot be written as a rational number.
   Answer: False

3. Every real number is either rational or irrational.
   Answer: True

4. π is an irrational number.
   Answer: True