Multiple Choice Questions

Sample Question 1

Which of the following is not equal to

$$\left(\frac{5}{6}\right)^{\frac{1}{6}}$$

(A) $\left(\frac{5}{6}\right)^{\frac{1}{6}\times\frac{1}{6}}$
(B) $\left(\left(\frac{5}{6}\right)^{\frac{1}{5}}\right)^{\frac{1}{6}}$
(C) $\left(\frac{6}{5}\right)^{\frac{1}{30}}$
(D) $\left(\frac{5}{6}\right)^{\frac{1}{30}}$

Exercise 1.1

Question 1

Every rational number is
(A) a natural number
(B) an integer
(C) a real number
(D) a whole number

1. **Between two rational numbers**
   (A) there is no rational number
   (B) there is exactly one rational number
   (C) there are infinitely many rational numbers
   (D) there are only rational numbers and no irrational numbers

2. **Decimal representation of a rational number cannot be**
   (A) terminating
   (B) non-terminating
   (C) non-terminating repeating
   (D) non-terminating non-repeating

3. **The product of any two irrational numbers is**
   (A) always an irrational number

(B) always a rational number
(C) always an integer
(D) sometimes rational, sometimes irrational

4. **The decimal expansion of the number √2 is**
(A) a finite decimal
(B) 1.41421
(C) non-terminating recurring
(D) non-terminating non-recurring

5. **Which of the following is irrational?**
(A) √(4/9)
(B) √(12/3)
(C) √7
(D) √81

6. **Which of the following is irrational?**
(A) 0.14
(B) 0.1416
(C) 0.1416 (repeated)
(D) 0.4014001400014...

7. **A rational number between √2 and √3 is**
(A) (√2 + √3)/2
(B) (√2 . √3)/2
(C) 1.5
(D) 1.8

Example Questions:

1. **Which of the following numbers is a rational number?**
(A) √5
(B) 0.75
(C) π
(D) e

2. **The decimal expansion of 1/7 is**
(A) terminating
(B) non-terminating repeating

(C) non-terminating non-repeating
(D) an integer

3. **If p/q is a rational number (q ≠0), then its decimal expansion is always**
(A) terminating or non-terminating repeating
(B) always terminating
(C) always non-terminating repeating
(D) non-terminating non-repeating

Questions:

9. The value of 1.999... in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$, is
(A) $\frac{19}{10}$
(B) $\frac{1999}{1000}$
(C) 2
(D) $\frac{1}{9}$

10. $2\sqrt{3}+\sqrt{3}$ is equal to
(A) $2\sqrt{6}$
(B) 6
(C) $3\sqrt{3}$
(D) $4\sqrt{6}$

11. $\sqrt{10} \times \sqrt{15}$ is equal to
(A) $6\sqrt{5}$
(B) $5\sqrt{6}$
(C) $\sqrt{25}$
(D) $10\sqrt{5}$

12. The number obtained on rationalising the denominator of $\frac{1}{\sqrt{7}-2}$ is
(A) $\frac{\sqrt{7}+2}{3}$
(B) $\frac{\sqrt{7}-2}{3}$
(C) $\frac{\sqrt{7}+2}{5}$
(D) $\frac{\sqrt{7}+2}{45}$

13. $\frac{1}{\sqrt{9}-\sqrt{8}}$ is equal to

(A) $\frac{1}{2}(3-2\sqrt{2})$

(B) $\frac{1}{3+2\sqrt{2}}$

(C) $3-2\sqrt{2}$

(D) $3+2\sqrt{2}$

14. After rationalising the denominator of $\frac{7}{3\sqrt{3}-2\sqrt{2}}$, we get the denominator as

(A) 13

(B) 19

(C) 5

(D) 35

15. The value of $\frac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}}$ is equal to

(A) $\sqrt{2}$

(B) 2

(C) 4

(D) 8

16. If $\sqrt{2}=1.4142$, then $\frac{\sqrt{2}-1}{\sqrt{2}+1}$ is equal to

---

Multiple Choice Questions:

17. $\sqrt[3]{\sqrt{2^2}}$ equals

    (A) $2^{-1/6}$

    (B) 2^{-6}

    (C) $\frac{1}{2^6}$

    (D) 2^6

18. The product $\sqrt[3]{2}\cdot\sqrt{2}\cdot\sqrt[3]{32}$ equals

    (A) $\sqrt{2}$

    (B) 2

    (C) $\sqrt[12]{2}$

    (D) $\sqrt[3]{32}$

19. Value of $\sqrt[4]{(81)^{-2}}$ is
    (A) $\frac{1}{9}$
    (B) $\frac{1}{3}$
    (C) 9
    (D) $\frac{1}{81}$

20. Value of $(256)^{0.16} \times (256)^{0.09}$ is
    (A) 4
    (B) 16
    (C) 64
    (D) 256.25

21. Which of the following is equal to x?
    (A) $\frac{12}{x^7} - x^{7/5}$
    (B) $\sqrt[12]{(x^4)^{1/3}}$
    (C) $\left(\sqrt{x^3}\right)^{2/3}$
    (D) $\frac{12}{x^7} \times x^{7/12}$

Short Answer Questions with Reasoning:

Sample Question 1:
Are there two irrational numbers whose sum and product both are rationals? Justify.

Sample Question 2:
State whether the following statement is true:
There is a number x such that x^2 is irrational but x^4 is rational. Justify your answer by an example.

EXERCISE 1.2

1. Let x and y be rational and irrational numbers, respectively. Is $x+y$ necessarily an irrational number? Give an example in support of your answer.

2. Let x be rational and y be irrational. Is $x\,y$ necessarily irrational? Justify your answer by an example.

3. State whether the following statements are true or false. Justify your answer.
   (i) $\frac{\sqrt{2}}{3}$ is a rational number.
   (ii) There are infinitely many integers between any two integers.
   (iii) Number of rational numbers between 15 and 18 is finite.
   (iv) There are numbers which cannot be written in the form $\frac{p}{q}$, $q \neq 0$, p, q both are integers.
   (v) The square of an irrational number is always rational.
   (vi) $\frac{\sqrt{12}}{\sqrt{3}}$ is not a rational number as $\sqrt{12}$ and $\sqrt{3}$ are not integers.
   (vii) $\frac{\sqrt{15}}{\sqrt{3}}$ is written in the form $\frac{p}{q}$, $q \neq 0$, and so it is a rational number.

4. Classify the following numbers as rational or irrational with justification:
   (i) $\sqrt{196}$
   (ii) $3\sqrt{18}$
   (iii) $\sqrt{\frac{9}{27}}$
   (iv) $\sqrt{\frac{28}{343}}$

EXERCISE 1.2

1. Let x and y be rational and irrational numbers, respectively. Is $x + y$ necessarily an irrational number? Give an example in support of your answer.

2. Let x be rational and y be irrational. Is $x\,y$ necessarily irrational? Justify your answer by an example.

3. State whether the following statements are true or false. Justify your answer.
   (i) $\frac{\sqrt{2}}{3}$ is a rational number.
   (ii) There are infinitely many integers between any two integers.
   (iii) The number of rational numbers between 15 and 18 is finite.
   (iv) There are numbers which cannot be written in the form $\frac{p}{q}$, $q \neq 0$, p, q both are integers.
   (v) The square of an irrational number is always rational.

(vi) $\frac{\sqrt{12}}{\sqrt{3}}$ is not a rational number as $\sqrt{12}$ and $\sqrt{3}$ are not integers.

(vii) $\frac{\sqrt{15}}{\sqrt{3}}$ is written in the form $\frac{p}{q}$, $q \neq 0$ and so it is a rational number.

4. Classify the following numbers as rational or irrational with justification:
   (i) $\sqrt{196}$
   (ii) $3\sqrt{18}$
   (iii) $\sqrt{\frac{9}{27}}$
   (iv) $\sqrt{\frac{28}{343}}$

Questions:

1. $-\sqrt{0.4}$
2. $\frac{\sqrt{12}}{\sqrt{75}}$
3. 0.5918
4. $(1+\sqrt{5})-(4+\sqrt{5})$
5. $10.124124\ldots$
6. $1.010010001\ldots$

Short Answer Questions:

7. **Sample Question 1**: Locate $\sqrt{13}$ on the number line.
8. **Sample Question 2**: Express $0.1\dot{2}3$ in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Example Questions:

1. Simplify: $(3\sqrt{5}-5\sqrt{2})(4\sqrt{5}+3\sqrt{2})$.
2. Find the value of a in the following:
$$\frac{6}{3\sqrt{2}-2\sqrt{3}} = 3\sqrt{2} - a\sqrt{3}$$
3. Simplify:
$$\left[5^{\left(\frac{1}{3}\right)}\left(8^3+27^3\right)^{\left(\frac{1}{4}\right)}\right]$$

Example Problems

1. **Convert** 0.123 **into a fraction and simplify.**

Sample Questions

2. **Simplify:** $(3\sqrt{5}-5\sqrt{2})(4\sqrt{5}+3\sqrt{2})$

3. **Find the value of a in the following equation:**

$$\frac{6}{3\sqrt{2}-2\sqrt{3}}=3\sqrt{2}-a\sqrt{3}$$

4. **Simplify:**

$$\left[5^{\left(\frac{1}{3}\right)}\left(8^3+27^3\right)^{\left(\frac{1}{4}\right)}\right]$$

Exemplar Problems

7. Express the following in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$:

(i) 0.2
(ii) 0.888...
(iii) $5.\dot{2}$
(iv) 0.001
(v) 0.2555...
(vi) $0.1\dot{3}4$
(vii) 0.00323232...
(viii) 0.404040...

8. Show that $0.142857142857\ldots=\frac{1}{7}$.

9. Simplify the following:

(i) $\sqrt{45}-3\sqrt{20}+4\sqrt{5}$
(ii) $\frac{\sqrt{24}}{8}+\frac{\sqrt{54}}{9}$
(iii) $\sqrt[4]{12}\times\sqrt{6}$
(iv) $\sqrt[4]{28}\div\sqrt[3]{7}\div\sqrt[3]{7}$
(v) $3\sqrt{3}+2\sqrt{27}+\frac{7}{\sqrt{3}}$
(vi) $\left(\sqrt{3}-\sqrt{2}\right)^2$
(vii) $\sqrt[4]{81}-8\sqrt[3]{216}+15\sqrt[5]{32}+\sqrt{225}$

(viii) $\frac{3}{\sqrt{8}}+\frac{1}{\sqrt{2}}$

(ix) $\frac{2\sqrt{3}}{3}-\frac{\sqrt{3}}{6}$

10. Rationalize the denominator of the following:

(i) $\frac{2}{3\sqrt{3}}$

(ii) $\frac{\sqrt{40}}{\sqrt{3}}$

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

(iv) $\frac{16}{\sqrt{41}-5}$

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

(vi) $\frac{\sqrt{6}}{\sqrt{2}+\sqrt{3}}$

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

(viii) $\frac{3\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$

(ix) $\frac{\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}}$

11. Find the values of a and b in each of the following:

(i) $\frac{5+2\sqrt{3}}{7+4\sqrt{3}}=a-6\sqrt{3}$

NUMBER SYSTEMS

1. **Simplify and express in the form of $a+b\sqrt{c}$:**
   (i) $\frac{3-\sqrt{5}}{3+2\sqrt{5}}$
   (ii) $\frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}}$
   (iii) $\frac{7+\sqrt{5}}{7-\sqrt{5}}\cdot\frac{7-\sqrt{5}}{7+\sqrt{5}}$

2. **If $a=2+\sqrt{3}$, then find the value of $a-\frac{1}{a}$.**

3. **Rationalise the denominator in each of the following and hence evaluate by taking**

$\sqrt{2}=1.414$, $\sqrt{3}=1.732$, and $\sqrt{5}=2.236$, up to three decimal places:

(i) $\frac{4}{\sqrt{3}}$

(ii) $\frac{6}{\sqrt{6}}$

(iii) $\frac{\sqrt{10}-\sqrt{5}}{2}$

(iv) $\frac{\sqrt{2}}{2+\sqrt{2}}$

(v) $\frac{1}{\sqrt{3}+\sqrt{2}}$

4. **Simplify the following:**

(i) $\left(1^3+2^3+3^3\right)^{\frac{1}{2}}$

(ii) $\frac{3}{5}\times\frac{4}{8}\times\frac{-12}{5}\times\frac{32}{5}$

(iii) $\frac{1}{27}^{-2/3}$

(iv) $(625)^{-\frac{1}{2}-\frac{1}{4}\times 2}$

(v) $9^{\frac{1}{3}}\times 27^{\frac{1}{2}}$ divided by $36^{\frac{1}{3}}\times 3^{\frac{-2}{3}}$

(vi) $\frac{64^{-\frac{1}{3}}}{64^{\frac{1}{3}}-64^{\frac{2}{3}}}$

(vii) $8^{\frac{1}{3}}\times 16^{\frac{1}{3}}$ divided by $32^{-\frac{1}{3}}$

Example Questions for Practice

1. **Simplify and express in the form $a+b\sqrt{c}$:**
$\frac{5+\sqrt{7}}{5-\sqrt{7}}$

2. **If $a=3+\sqrt{2}$, find the value of a^2-2a+1.**

3. **Rationalise the denominator and evaluate up to three decimal places:**
$\frac{7}{\sqrt{11}-\sqrt{3}}$

4. **Simplify:**
   (i) $\left(2^5 \times 4^3\right)^{1/2}$
   (ii) $\dfrac{81^{1/4} \times 27^{1/3}}{9^{1/2}}$

Sample Question 1:

If $a = 5 + 2\sqrt{6}$ and $b = \dfrac{1}{a}$, then what will be the value of $a^2 + b^2$?

EXERCISE 1.4

1. Express $0.6 + 0.\dot{7} + 0.47$ in the form $\dfrac{p}{q}$, where p and q are integers and $q \neq 0$.
2. Simplify:
$$\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} + \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} + \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$$
3. If $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, then find the value of
$$\frac{4}{3\sqrt{3}-2\sqrt{2}} + \frac{3}{3\sqrt{3}+2\sqrt{2}}$$
4. If $a = \dfrac{3+\sqrt{5}}{2}$, then find the value of $a^2 + \dfrac{1}{a^2}$.
5. If $x = \dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ and $y = \dfrac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$, then find the value of $x^2 + y^2$.
6. Simplify: $(256)^{\frac{1}{4}}$.
7. Find the value of
$$\frac{4}{(216)^{\frac{2}{3}}} + \frac{1}{(256)^{\frac{3}{4}}} + \frac{2}{(243)^{\frac{-1}{5}}}$$