

24. If a and b are rational numbers, find the value of a and b .

$$\frac{\sqrt{3}-1}{\sqrt{3}+1} = a + b\sqrt{3}$$

Ans. $a = 2, b = -1$

25. Simplify the following by rationalising the denominators.

$$\frac{3}{5-\sqrt{3}} + \frac{2}{5+\sqrt{3}}$$

Ans. $\frac{25+\sqrt{3}}{22}$

26. If $x = \sqrt{13} + 2\sqrt{3}$, then find the value of $x - \frac{1}{x}$.

Ans. $4\sqrt{3}$

27. If $a = 2, b = 3$ then find the values of the following :

(i) $(a^b + b^a)^{-1}$ (ii) $(a^a + b^b)^{-1}$

Ans. (i) $\frac{1}{17}$ (ii) $\frac{1}{31}$

28. Prove that $\frac{2^{30} + 2^{29} + 2^{28}}{2^{31} + 2^{30} - 2^{29}} = \frac{7}{10}$

29. Show that $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} = -1 + \sqrt{3}$.

30. If $x = 3 - 2\sqrt{2}$ then find the value of $\left(x^2 - \frac{1}{x^2}\right)$.

Ans. $-24\sqrt{2}$

31. If $a = \frac{3+\sqrt{7}}{2}$, then find the value of $a^2 + \frac{1}{a^2}$.

Ans. $\frac{40-9\sqrt{7}}{2}$

32. Simplify the following by rationalising the denominators.

$$\frac{\sqrt{5}-1}{\sqrt{5}+1} + \frac{\sqrt{5}+1}{\sqrt{5}-1}$$

Ans. 3

33. If $x = 5 - 2\sqrt{6}$ then find the value of $x^2 + \frac{1}{x^2}$.

Ans. 98

34. If $\frac{5+2\sqrt{3}}{7+4\sqrt{3}} = a + b\sqrt{3}$ then find the value of a and b .

Ans. $a = 11, b = -6$

35. If $x = \frac{\sqrt{3}-1}{\sqrt{3}+1}$ and $y = \frac{3+2\sqrt{2}}{3-2\sqrt{2}}$ then find the value of $x + y$

Ans. $19 + 12\sqrt{2} - \sqrt{3}$

36. If $a = \frac{4}{3-\sqrt{5}}$. Find the value of $a + \frac{4}{a}$.

Ans. 8

37. Represent $\sqrt{10}$ on the number line.

38. Prove that $\left(\frac{2^a}{2^b}\right)^{a+b} \times \left(\frac{2^b}{2^c}\right)^{b+c} \times \left(\frac{2^c}{2^a}\right)^{c+a} = 1$

39. If $(5)^{x-3} \times (3)^{2x-8} = 225$ then find the value of x .

Ans. $x = 5$

40. Prove that $\frac{1}{1+x^{a-b}} + \frac{1}{1+x^{b-a}} = 1$.

41. Locate $\sqrt{4.7}$ on the number line

42. Express $5.\overline{347}$ in the form $\frac{p}{q}$ where p and q are integers and $q \neq 0$.

Ans. $\frac{5342}{999}$

43. Show that : $(x^a - b)^a + b \cdot (x^b - c)^b + c \cdot (x^c - a)^c + a = 1$

SECTION - D

(4 Marks each)

Long Answer Type Questions

1. Simplify : $\frac{1}{2+\sqrt{5}} + \frac{1}{\sqrt{5}+\sqrt{6}} + \frac{1}{\sqrt{6}+\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{8}}$

Ans. $2\sqrt{2} - 2$

2. Prove that $\frac{0.75 \times 0.75 \times 0.75 + 0.25 \times 0.25 \times 0.25}{0.75 \times 0.75 - 0.75 \times 0.25 + 0.25 \times 0.25} = 1$

14. The sum of the digits of a number is subtracted from the number, the resulting number is always divisible by:
 (a) 2 (b) 5 (c) 8 (d) 9 **Ans. (d)**
15. If $\sqrt{3} = 1.732$ and $\sqrt{2} = 1.414$, the value of $\frac{1}{\sqrt{3} - \sqrt{2}}$ is:
 (a) 0.318 (b) 3.146 (c) $\frac{1}{3.146}$ (d) $\sqrt{1.732} - \sqrt{1.414}$ **Ans. (b)**
16. If $x = 2 + \sqrt{3}$, then $\left(x + \frac{1}{x}\right)$ equals to :
 (a) $-2\sqrt{3}$ (b) 2 (c) 4 (d) $4 - 2\sqrt{3}$ **Ans. (c)**
17. A rational number lying between $\sqrt{2}$ and $\sqrt{3}$ is :
 (a) $\frac{\sqrt{2} + \sqrt{3}}{2}$ (b) $\sqrt{6}$ (c) 1.6 (d) 1.9 **Ans. (c)**
18. If $\sqrt{x}$ is an irrational number then x is :
 (a) Rational (b) Irrational (c) 0 (d) Real **Ans. (d)**
19. Which of the following is an irrational number ?
 (a) 2.2 (b) π (c) 3.763 (d) 3.763 **Ans. (b)**
20. Which of the following is an irrational number ?
 (a) $\sqrt{23}$ (b) $\sqrt{225}$ (c) 0.3796 (d) $7.\overline{478}$ **Ans. (a)**
21. Which of the following is the value of $(\sqrt{11} - \sqrt{7})(\sqrt{11} + \sqrt{7})$
 (a) -4 (b) 4 (c) $\sqrt{11}$ (d) $\sqrt{7}$ **Ans. (b)**
22. A rational number between -3 and 3 is
 (a) 0 (b) -4.3 (c) -3.4 (d) 1.101100110001.... **Ans. (a)**
23. A number is an irrational if and only if its decimal representation is :
 (a) non-terminating (b) non-terminating and repeating
 (c) non-terminating and non-repeating (d) terminating **Ans. (c)**
24. Add $5\sqrt{2} + 3\sqrt{3}$ and $2\sqrt{2} - 5\sqrt{3}$.
 (a) $7\sqrt{2} - 2\sqrt{3}$ (b) $6\sqrt{2} - 6\sqrt{3}$ (c) $6\sqrt{2} - 8\sqrt{3}$ (d) $6\sqrt{2} + 8\sqrt{3}$ **Ans. (a)**
25. The value of $\sqrt[4]{\sqrt[3]{2^2}}$ equal to :
 (a) $2^{-1/6}$ (b) 2^{-6} (c) $2^{1/6}$ (d) 2^6 **Ans. (c)**
26. Which one of the following is an irrational number ?
 (a) 0.14 (b) $0.\overline{1416}$ (c) $0.14\overline{16}$ (d) 0.4014001400014.... **Ans. (d)**
27. Which of the following is not the value of $\left[\left(\frac{5}{6}\right)^{\frac{1}{5}}\right]^{\frac{1}{6}}$?
 (a) $\left(\frac{5}{6}\right)^{\frac{1}{6} - \frac{1}{5}}$ (b) $\left(\frac{5}{6}\right)^{-\frac{1}{30}}$ (c) $\left(\frac{6}{5}\right)^{\frac{1}{30}}$ (d) $\frac{1}{\left[\left(\frac{5}{6}\right)^{\frac{1}{5}}\right]^{\frac{1}{6}}}$ **Ans. (a)**
28. $(5 + \sqrt{5})(5 - \sqrt{5})$ on simplification gives :
 (a) 20 (b) $2\sqrt{5}$ (c) 10 (d) 25 **Ans. (a)**
29. The simplest rationalisation factor of $\sqrt{50}$ is :
 (a) $5\sqrt{2}$ (b) $\sqrt{2}$ (c) 50 (d) $\sqrt{50}$ **Ans. (b)**
30. The sum of $0.\overline{3}$ and $0.\overline{4}$ is :
 (a) $0.\overline{4}$ (b) $0.\overline{7}$ (c) $0.\overline{12}$ (d) $0.\overline{1}$ **Ans. (b)**
31. Every point on a number line represents :
 (a) A natural number (b) A rational number (c) A unique number (d) An irrational number **Ans. (c)**
32. 8 is a polynomial of degree :
 (a) 1 (b) $\frac{1}{2}$ (c) 1 (d) 0 **Ans. (d)**
33. Simplified value of $(16)^{-\frac{1}{4}} \times \sqrt[4]{16}$ is
 (a) 16 (b) 4 (c) 1 (d) 0 **Ans. (c)**

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Sum of the digits of a number is subtracted from the number, the resulting number is always divisible by:

(b) 5

(c) 8

(d) 9

Ans. (d)

$\frac{1}{\sqrt{3}-\sqrt{2}}$ is:

3.18

(b) 3.146

(c) $\frac{1}{3.146}$

(d) $\sqrt{1.732} - \sqrt{1.414}$

Ans. (b)

$2 + \sqrt{3}$, then $\left(x + \frac{1}{x}\right)$ equals to:

$2\sqrt{3}$

(b) 2

(c) 4

(d) $4 - 2\sqrt{3}$

Ans. (c)

Rational number lying between $\sqrt{2}$ and $\sqrt{3}$ is:

$\frac{\sqrt{2} + \sqrt{3}}{2}$

(b) $\sqrt{6}$

(c) 1.6

(d) 1.9

Ans. (c)

If x is an irrational number then x is:

Rational

(b) Irrational

(c) 0

(d) Real

Ans. (d)

Which of the following is an irrational number?

2

(b) π

(c) 3.763

(d) 3.763

Ans. (b)

Which of the following is an irrational number?

$\sqrt{23}$

(b) $\sqrt{225}$

(c) 0.3796

(d) 7.478

Ans. (a)

Which of the following is the value of $(\sqrt{11} - \sqrt{7})(\sqrt{11} + \sqrt{7})$

4

(b) 4

(c) $\sqrt{11}$

(d) $\sqrt{7}$

Ans. (b)

Rational number between -3 and 3 is

(b) -4.3

(c) -3.4

(d) 1.101100110001....

Ans. (a)

A number is an irrational if and only if its decimal representation is:

non-terminating

(b) non-terminating and repeating

non-terminating and non-repeating

(d) terminating

Ans. (c)

$5\sqrt{2} + 3\sqrt{3}$ and $2\sqrt{2} - 5\sqrt{3}$.

$7\sqrt{2} = 2\sqrt{3}$

(b) $6\sqrt{2} - 6\sqrt{3}$

(c) $6\sqrt{2} - 8\sqrt{3}$

(d) $6\sqrt{2} + 8\sqrt{3}$

Ans. (a)

Value of $\sqrt[4]{3\sqrt{2^2}}$ equal to:

$2^{1/6}$

(b) 2^{-6}

(c) $2^{1/6}$

(d) 2^6

Ans. (c)

Which one of the following is an irrational number?

0.14

(b) $0.\overline{1416}$

(c) $0.14\overline{16}$

(d) 0.4014001400014.....

Ans. (d)

Which of the following is not the value of $\left[\left(\frac{5}{6}\right)^{\frac{1}{5}}\right]^{\frac{1}{6}}$?

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

(b) $\left(\frac{5}{6}\right)^{-\frac{1}{30}}$

(c) $\left(\frac{6}{5}\right)^{-\frac{1}{30}}$

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

Ans. (a)

$(\sqrt{5})(5 - \sqrt{5})$ on simplification gives:

20

(b) $2\sqrt{5}$

(c) 10

(d) 25

Ans. (a)

Simplest rationalisation factor of $\sqrt{50}$ is:

$5\sqrt{2}$

(b) $\sqrt{2}$

(c) 50

(d) $\sqrt{50}$

Ans. (b)

Sum of $0.\overline{3}$ and $0.\overline{4}$ is:

$0.\overline{4}$

(b) $0.\overline{7}$

(c) $0.\overline{12}$

(d) $0.\overline{1}$

Ans. (b)

Which point on a number line represents:

natural number

(b) A rational number

(c) A unique number

(d) An irrational number

Ans. (c)

Polynomial of degree:

(b) $\frac{1}{2}$

(c) 1

(d) 0

Ans. (d)

Simplified value of $(16)^{\frac{1}{4}} \times \sqrt[4]{16}$ is

16

(b) 4

(c) 1

(d) 0

Ans. (c)

25. Rationalise the denominator:

(i) $\frac{\sqrt{7}+\sqrt{2}}{9+2\sqrt{14}}$

(ii) $\frac{1}{\sqrt{6}-\sqrt{5}}$

(iii) $\frac{6-4\sqrt{2}}{6+4\sqrt{2}}$

(iv) $\frac{30}{5\sqrt{3}-3\sqrt{5}}$

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

(vi) $\frac{1}{5+\sqrt{3}}$

(vii) $\frac{1}{\sqrt{6}+\sqrt{5}-\sqrt{11}}$

(viii) $\frac{1}{\sqrt{7}+\sqrt{6}-\sqrt{13}}$



HOTS-based Questions



26. If $\frac{\sqrt{p+3q}+\sqrt{p-3q}}{\sqrt{p+3q}-\sqrt{p-3q}} = x$, then find the value of $3qx^2 - 2px + 3q$.

27. If $y = \frac{\sqrt{a+2b}+\sqrt{a-2b}}{\sqrt{a+2b}-\sqrt{a-2b}}$, prove that $by^2 - ay + b = 0$.

28. Find the value of $\frac{1}{\sqrt{3}-\sqrt{2}-1}$ correct to three places of decimal if $\sqrt{2} = 1.414$ and $\sqrt{6} = 2.45$

29. Using $\sqrt{5} = 2.236$ and $\sqrt{10} = 3.162$ prove that $\frac{\sqrt{15}}{\sqrt{10}+\sqrt{20}+\sqrt{40}} = \frac{\sqrt{5}-\sqrt{80}}{5} = 5.398$

30. If $x = 3 + 2\sqrt{2}$, find $x^4 + \frac{1}{x^4}$.

31. Find the values of a and b :

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

(ii) $\frac{3+2\sqrt{2}}{3-2\sqrt{2}} = a + b\sqrt{2}$

(iii) $\frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}} = a - b\sqrt{6}$

(iv) $\frac{5+\sqrt{6}}{5-\sqrt{6}} = a + b\sqrt{6}$

(v) $\frac{\sqrt{7}-1}{\sqrt{7}+1} - \frac{\sqrt{7}+1}{\sqrt{7}-1} = a + b\sqrt{7}$

32. In the following, determine the value of p and q .

(i) $\frac{\sqrt{3}-1}{\sqrt{3}+1} + \frac{\sqrt{3}+1}{\sqrt{3}-1} = p + \sqrt{3}q$

(ii) $\frac{3+\sqrt{7}}{3-\sqrt{7}} = p + \sqrt{7}q$

(iii) $47p + \sqrt{3}q = \frac{5+\sqrt{3}}{7-4\sqrt{3}}$

(iv) $p + 7\sqrt{5}q = \frac{7+\sqrt{5}}{7-\sqrt{5}} - \frac{7-\sqrt{5}}{7+\sqrt{5}}$

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16. Write the following in decimal form.

(i) $\frac{51}{4}$

(ii) $\frac{101}{7}$

(iii) $\frac{13}{5000}$

17. Find x such that $-\frac{3}{7}$ and $\frac{x}{-68}$ are equivalent rational numbers.

18. Convert the following into rational number $\left(\frac{p}{q}\right)$.

(i) $0.12\overline{36}$

(ii) $0.1\overline{8}$

(iii) $10.03\overline{6}$



LONG-ANSWER QUESTIONS (4 marks)

19. Visualise 3.765 on number line.

20. Show that $1.272727 \dots = 1.\overline{27}$

21. Simplify the following:

(i) $4\sqrt{12} - 7\sqrt{48} - \sqrt{50}$

(ii) $\sqrt[4]{81} - 8\sqrt[3]{216} + 15\sqrt[5]{32} + \sqrt{225}$

(iii) $4\sqrt{8} - 5\sqrt{32} - 6\sqrt{128} + 12\sqrt{162}$

(iv) $\sqrt{45} - 3\sqrt{20} + 4\sqrt{5}$

(v) $2\sqrt[3]{40} + 3\sqrt[3]{625} - 4\sqrt[3]{320}$

22. Simplify the following:

(i) $\sqrt[4]{81} - 8\sqrt[3]{216} + 15\sqrt[5]{32} + \sqrt{225}$

(ii) $\sqrt[3]{a^4b} + \sqrt[3]{ab^4}$

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

(iv) $(4\sqrt{3} - 3\sqrt{5})^2$

(v) $(\sqrt{7} + \sqrt{5})(\sqrt{5} - 7)$

(vi) $\sqrt[4]{2} - 2\sqrt{8} + \frac{3}{\sqrt{2}}$

(vii) $\sqrt{50} - \sqrt{98} + \sqrt{162}$

(viii) $\sqrt{48} - \sqrt{72} - \sqrt{27} + 2\sqrt{18}$

23. Simplify the following:

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

(ii) $\frac{1}{\sqrt{3}+\sqrt{2}-\sqrt{5}}$

(iii) $\frac{4}{2+\sqrt{3}-\sqrt{7}}$

(iv) $\frac{\sqrt{a^2-b^2}+a}{\sqrt{a^2+b^2}+b} + \frac{\sqrt{a^2+b^2}-b}{a-\sqrt{a^2-b^2}}$

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

(vi) $\frac{2}{(\sqrt{2}+\sqrt{3}-\sqrt{5})}$

24. Find the simplest rationalising factor for the following:

(i) $\sqrt{3} + \sqrt{5}$

(ii) $2\sqrt{5} - \sqrt{3}$

(iii) $\sqrt[3]{500}$

(iv) $\sqrt[4]{768}$

(v) $\sqrt{108}$

(vi) $\sqrt[3]{a^2b^3c^4}$

HOTS-based Questions

CH-1 IX

55. Find the value of the following, it being given that $\sqrt{2} = 1.4142$, $\sqrt{6} = 2.4495$; $\sqrt{5} = 2.236$,

$$\sqrt{10} = 3.162 \text{ and } \sqrt{6} = 2.4495$$

(a) $\frac{\sqrt{2} + 1}{\sqrt{5}}$

(b) $\frac{3 - \sqrt{5}}{3 + 2\sqrt{5}}$

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

56. Find the value of:

$$\frac{\sqrt{15}}{\sqrt{10} + \sqrt{20} + \sqrt{40} - \sqrt{5} - \sqrt{80}}, \sqrt{5} = 2.236 \text{ and } \sqrt{10} = 3.162.$$

57. If $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, $\sqrt{5} = 2.236$ and $\sqrt{6} = 2.449$, then find the values of:

(a) $\frac{1 + \sqrt{2}}{\sqrt{5} + \sqrt{3}} + \frac{1 - \sqrt{2}}{\sqrt{5} - \sqrt{3}}$

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

58. (a) If $x = \frac{\sqrt{2a+1} + \sqrt{2a-1}}{\sqrt{2a+1} - \sqrt{2a-1}}$, then prove that $x^2 - 4ax + 1 = 0$.

(b) If $x = \frac{\sqrt{2p+3q} + \sqrt{2p-3q}}{\sqrt{2p+3q} - \sqrt{2p-3q}}$

Find the value of $3qx^2 - 4px + 3q$

59. If $x = \frac{\sqrt{5} - \sqrt{3}}{\sqrt{5} + \sqrt{3}}$ and $y = \frac{\sqrt{5} + \sqrt{3}}{\sqrt{5} - \sqrt{3}}$, find the value of $x^2 + y^2 - 6xy$

60. If $x = 6 - \sqrt{35}$, find $x^2 + \frac{1}{x^2}$

61. If $x = 9 + 4\sqrt{5}$, find the value of $\sqrt{x} - \frac{1}{\sqrt{x}}$

62. If $2^x = 3^y = 12^z$, prove that $\frac{2}{x} + \frac{1}{y} = \frac{1}{z}$

63. Prove that:

$$\left(\frac{x^a}{x^b}\right)^{(a+b)} \cdot \left(\frac{x^b}{x^c}\right)^{(b+c)} \cdot \left(\frac{x^c}{x^a}\right)^{(c+a)} = 1$$

64. If $x = \frac{1}{2 - \sqrt{3}}$, find $x^3 - 2x^2 - 7x + 4$

IX - CHAPTER - ONE

Number Systems

Irrational Numbers

46. Prove that $\sqrt{2}$ is an irrational number.
47. Represent $1 + \sqrt{3}$ on number line.

Representing Real Numbers on Number Line

48. Visualise 3.765 on number line.
49. Visualise 4.26 on number line.

Operation on Real Numbers

50. Rationalise the denominator of the following

(i) $\frac{\sqrt{2} + \sqrt{3}}{3\sqrt{2} - 2\sqrt{3}}$ (ii) $\frac{2\sqrt{6} - \sqrt{5}}{3\sqrt{5} - 2\sqrt{6}}$ (iii) $\frac{7\sqrt{3} - 5\sqrt{2}}{\sqrt{48} + \sqrt{18}}$

51. Rationalise the denominator of the following

(i) $\frac{1}{3 + \sqrt{5} - 2\sqrt{2}}$ (ii) $\frac{1}{\sqrt{6} + \sqrt{5} - \sqrt{11}}$

52. Simplify the following expressions:

(i) $\frac{3\sqrt{2}}{\sqrt{6} + \sqrt{3}} + \frac{\sqrt{6}}{\sqrt{2} + \sqrt{3}} - \frac{4\sqrt{3}}{\sqrt{6} + \sqrt{2}}$ (ii) $-\frac{2\sqrt{5}}{\sqrt{6} + \sqrt{5}} + \frac{7\sqrt{3}}{\sqrt{10} + \sqrt{3}} - \frac{3\sqrt{2}}{\sqrt{15} + 3\sqrt{2}}$

53. Find the values of a and b in each of the following equalities (a and b are rational numbers)

(i) $\frac{\sqrt{3} - 1}{\sqrt{3} + 1} = a + b\sqrt{3}$

(ii) $\frac{\sqrt{3} + \sqrt{5}}{\sqrt{5} - \sqrt{3}} = a + b\sqrt{15}$

(iii) $\frac{\sqrt{2} + \sqrt{3}}{3\sqrt{2} - 2\sqrt{3}} = a - b\sqrt{6}$

(iv) $\frac{3 - \sqrt{5}}{3 + 2\sqrt{5}} = a\sqrt{5} - b$