SINGLE OPTION CORRECT

1. Which of the following Statement is True?

   (A) Every rational number is a whole number. (B) Every integer is a whole number.

   (C) Every Whole number is a natural number. (D) Every natural number is a whole number.

2. Four Rational numbers between 3 and 4 are:

   (A) $\frac{3}{5}, \frac{4}{5}, 1, \frac{6}{5}$ (B) $\frac{13}{5}, \frac{14}{5}, \frac{16}{5}, \frac{17}{5}$ (C) 3.1, 3.2, 4.1, 4.2 (D) 3.1, 3.2, 3.8, 3.9

3. The number 1.101001000100001 .... is

   (A) a natural number (B) a whole number (C) a rational number (D) a irrational number

4. If $\sqrt{2} = 1.414, \sqrt{3} = 1.732, \sqrt{5} = 2.236$ and $\sqrt{6} = 2.449$, find the value of $\frac{2+\sqrt{3}}{2-\sqrt{3}} + \frac{2-\sqrt{3}}{2+\sqrt{3}} + \frac{\sqrt{3}-1}{\sqrt{3}+1}$.

   (A) 14.268 (B) 18.428 (C) 14.629 (D) 14.662

5. What is the value of $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}}$ ... upto 15 terms?

   (A) 4 (B) 0 (C) 2 (D) 3

6. If the radius of a circle is a rational number, then its area is given by a number which is

   (A) rational (B) irrational (C) integral (D) a perfect square

7. Decimal representation of a rational number cannot be:

   (A) Terminating (B) Non-terminating non-repeating

   (C) Non-terminating repeating (D) None of these

8. If $a + b + c = 6$, $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{3}{2}$ then $\frac{a}{b} + \frac{a}{c} + \frac{b}{a} + \frac{b}{c} + \frac{c}{a} + \frac{c}{b} =$

   (A) 4 (B) 5 (C) 6 (D) 7

9. If $(a + b + c)\{ (a - b)^2 + (b - c)^2 + (c - a)^2 \} = k(a^3 + b^3 + c^3 - 3abc)$ then $k =$

   (A) 2 (B) 3 (C) 4 (D) 5

10. When $x + y = -4$ then the value of $x^3 + y^3 - 12xy + 64$

    (A) 0 (B) - 1 (C) 1 (D) 2

11. If x = 2 and y = 4 then $\left(\frac{x}{y}\right)^{x-y}+\left(\frac{y}{x}\right)^{y-x}=$ _____

(A) 4 (B) 8 (C) 12 (D) 2

12. If $\frac{5-\sqrt{3}}{2+\sqrt{3}}=x+y\sqrt{3}$, then (x, y) is

(A) (13, - 7) (B) (- 13, 7) (C) (- 13, - 7) (D) (13, 7)

13. If $\frac{3^{5x}\times(81)^2\times6561}{3^{2x}}=3^7$, then x = _____

(A) 3 (B) - 3 (C) $-\frac{1}{3}$ (D) $\frac{1}{3}$

14. If $\left[\left\{\left(\frac{1}{7^2}\right)^{-2}\right\}^{-\frac{1}{3}}\right]^{\frac{1}{4}}=7^m$, then m = _____

(A) $-\frac{1}{3}$ (B) $\frac{1}{4}$ (C) - 3 (D) 2

15. If $x=2+\sqrt{3}$, then value of $x^2+\frac{1}{x^2}$ is

(A) 16 (B) 14 (C) 12 (D) None of these

16. Simplest form of $15\sqrt{6}-\sqrt{216}+\sqrt{96}$ is

(A) $11\sqrt{6}$ (B) $12\sqrt{3}$ (C) $5\sqrt{6}$ (D) $13\sqrt{6}$

17. Ascending order of $\sqrt{2}$, $\sqrt[3]{3}$ & $\sqrt[4]{5}$ is

(A) $\sqrt{2}<\sqrt[4]{5}<\sqrt[3]{3}$ (B) $\sqrt{2}<\sqrt[3]{3}<\sqrt[4]{5}$ (C) $\sqrt[4]{5}<\sqrt{2}<\sqrt[3]{3}$ (D) None of these

18. If $\sqrt{5}=2.236$ & $\sqrt{2}=1.414$, then approximate value of $\frac{3}{\sqrt{5}+\sqrt{2}}+\frac{4}{\sqrt{5}-\sqrt{2}}$ is _____

(A) 6.452 (B) 4.746 (C) 5.146 (D) 5.689

19. The value of x, if $5^{x-3}\times3^{2x-8}=225$, is

(A) 2 (B) 3 (C) 1 (D) 5

20. $\left(\frac{a}{b}\right)^{x-1}=\left(\frac{b}{a}\right)^{x-3}$, where $a\neq b$, $a\neq0$, $b\neq0$ then value of x is _____

(A) 1/2 (B) 1 (C) 2 (D) 7/2

21. Which of the following is not equal to $\left[\left(\frac{5}{6}\right)^{\frac{1}{5}}\right]^{-\frac{1}{6}}$?

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

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

(A) 2.4142 (B) 5.8282 (C) 0.4142 (D) 0.1718

23. If $a=7+4\sqrt{3}$ and $b=\frac{1}{a}$, then what will be the value of $a^2 + b^2$?

(A) 196 (B) 194 (C) 198 (D) None of these

24. Select the wrong rational number match

(A) $0.\bar{3}=\frac{1}{3}$ (B) $0.1\overline{01}=\frac{1}{9}$ (C) $1.2\overline{25}=\frac{1213}{990}$ (D) $0.\bar{9}=1$

25. Consider $\frac{79}{15}=I+f$, where $0\le f<1, I=$ Integer then

(A) $I\times f\neq 1.\bar{3}$ (B) $I+\frac{1}{f}=\frac{35}{4}$ (C) $\frac{1}{I}>f$ (D) I is composite No.

26. The value of $\sqrt{7+2\sqrt{6}}+\sqrt{7-2\sqrt{6}}$ is ____

(A) $2\sqrt{6}$ (B) 2 (C) - 2 (D) None of these

27. If $\left(\sqrt[3]{4}\right)^{2x+\frac{1}{2}}=\frac{1}{32}$, then x =

(A) - 2 (B) 4 (C) - 6 (D) – 4

28. The value of $\left(\frac{64}{125}\right)^{-2/3}\div\frac{1}{\left(\frac{256}{625}\right)^{1/4}}+\left(\frac{\sqrt{25}}{\sqrt[3]{64}}\right)^{0}$ is _____

(A) 9/2 (B) 9/4 (C) 4 (D) 2

29. If $m = a^x$, $n = a^y$ and $a^2 = (m^y \times n^x)^z$ then xyz is

(A) 1 (B) – 1 (C) 2 (D) – 2

30. If $y=\sqrt{\sqrt{7}+7+\sqrt{8+2\sqrt{7}}}-\sqrt{7}$, Then the value of y will be

(A) 1 (B) $\sqrt{7}$ (C) $8-2\sqrt{7}$ (D) $\sqrt{7}-1$

MULTIPLE OPTIONS CORRECT

1. Which of the following is/are correct?

   (A) There are infinitely many numbers between any two given rational numbers.

   (B) Every point on the number line represents a unique real number.

   (C) The decimal expansion of an irrational number is non-terminating non-recurring.

   (D) A number whose decimal expansion is non-terminating non-recurring is rational.

2. Which of the following statement is true?

   (A) Between two integers, there exist infinite number of rational numbers.

   (B) Between two rational numbers, there exist infinite number of integers.

   (C) Between two rational numbers, there exist infinite number of rational numbers.

   (D) Between two real numbers, there exist infinite number of real numbers.

3. If $\frac{1}{7}=0.\overline{142857}$, Then which of the following is/are true.

   (A) $\frac{3}{7}=0.\overline{428571}$ (B) $\frac{4}{7}=0.\overline{571482}$ (C) $\frac{5}{7}=0.\overline{714285}$ (D) $\frac{6}{7}=0.\overline{857142}$

4. Which of the following is/are True?

   (A) One of every three consecutive positive integers is divisible by 3.

   (B) One of every three consecutive positive integers is divisible by 5.

   (C) The product of two consecutive integers is divisible by 2.

   (D) The product of two consecutive integers may or may not be divisible by 2.

5. Which of the following is/are True?

   (A) If $x=2+\sqrt{3}$ then $x^2+\frac{1}{x^2}=14$. (B) $\frac{1}{\sqrt{2}+1}+\frac{1}{\sqrt{3}+\sqrt{2}}+\frac{1}{2+\sqrt{3}}=1$.

   (C) $\frac{1}{\sqrt{3}+\sqrt{2}-1}=\frac{1}{4}(\sqrt{2}-2+\sqrt{6})$.

   (D) If $\sqrt{3}=1.73$ then the value of $\frac{2+\sqrt{3}}{2-\sqrt{3}}+\frac{2-\sqrt{3}}{2+\sqrt{3}}+\frac{\sqrt{3}-1}{\sqrt{3}+1}-\frac{\sqrt{3}+1}{\sqrt{3}-1}=10.54$

6. Which of the following is/are True?

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

   (C) $a^3+b^3=(a+b)(a^2-ab+b^2)$ (D) $(a-b)^3=a^3-b^3-3a^2b+3ab^2$

7. If $(1005)^3 = a$ and $(997)^3 = b$, then

(A) $a = 1015075125$ (B) $b = 991027973$ (C) $a = 1025075125$ (D) $b = 991026973$

8. Which of the following is/are true?

(A) If $[a^2 + b^2 + c^2 - ab - bc - ac] = \frac{1}{2}[(a-b)^2 + (b-c)^2 + (c-a)^2] = 0$ then $a = b = c$

(B) If $a + b + c = 0$ then $a^3 + b^3 + c^3 = 3abc$

(C) If $a^3 + b^3 + c^3 - 3abc = 0$ then either $a + b + c = 0$ or $a = b = c$

(D) $a^4 + 4b^4 = (a^2 + 2ab + 2b^2)(a^2 - 2ab + 2b^2)$

9. Which of the following is/are rational?

(A) $\sqrt{\frac{4}{9}}$ (B) $\frac{\sqrt{12}}{\sqrt{3}}$ (C) $\sqrt{7}$ (D) $\sqrt{81}$

10. Which of the following is/are irrational?

(A) $(\sqrt{3} + \sqrt{2}) + (\sqrt{3} - \sqrt{2})$ (B) $(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})$

(C) $(\sqrt{3} + \sqrt{2}) - (\sqrt{3} - \sqrt{2})$ (D) $(\sqrt{3} + \sqrt{2}) \div (\sqrt{3} - \sqrt{2})$

11. 120^3 Can be written as

(A) $(2^3)^3 \cdot 27 \cdot (5)^3$ (B) $(2^3)^3 \cdot (3)^3 \cdot (5)^3$ (C) $(40)^3 \cdot (3)^3$ (D) $2^{27} \cdot (3)^3 \cdot (5)^3$

12. Which of the statements are true

(A) Every Integer is a Natural Number (B) Every whole number is an Integer

(C) Every Integer is Rational Number (D) Every Rational number is not an Integer

13. Select the correct statement

(A) The sum of the digits of the number $2^{2000}5^{2002}$ in decimal system is 7.

(B) $2 - \sqrt{3}$ is an irrational number (C) $\sqrt[3]{27}$ is an irrational Number

(D) denominator's Rationalizing factor for $\frac{2}{3-\sqrt{3}}$ is $3+\sqrt{3}$.

14. If N = $\sqrt{3-2\sqrt{2}}$, Then

(A) $N-\sqrt{2}$ is an irrational Number (B) $N-\sqrt{2}$ is a rational Number

(C) $N-\sqrt{3}$ is a rational number

(D) If $N = p + q\sqrt{r}$, where p, q & r are integers, Then $p+q+r=2$.

15. Select the correct statements

(A) $N=\{1,2,3,4,5,.....\}$ (B) $W=\{0,1,2,3,4,5,.....\}$

(C) $Z^{+}=\{1,2,3,4,5,.....\}$ (D) $Q=R-Q^{c}$

16. Select the correct option(s)

(A) $9^{5/2}-3\times 8^{0}-\left(\frac{1}{81}\right)^{-\frac{1}{2}}=231$ (B) $\frac{3}{0}=\infty$ (Infinite)

(C) $3^{x-1}\times 5^{2y-3}=225\rightarrow x=3,\ y=\frac{5}{2}$ (D) $0^{x}=\begin{cases}1 & \text{if } x=0\\ 0 & \text{if } x>0\\ \text{N.D.} & \text{if } x<0\end{cases}$

17. If $2^{x}=4^{y}=8^{z}$ and $\frac{1}{2x}+\frac{1}{4y}+\frac{1}{9z}=\frac{4}{3}$, then

(A) x = 2z (B) 2y = 3z (C) x = 1 (D) z = 3

18. If $\sqrt{13-x\sqrt{10}}=\sqrt{8}+\sqrt{5}$, then x cannot be

(A) - 5 (B) - 6 (C) - 4 (D) - 2

Olympiad TYPE (Higher Order Thinking)

1. If $x=\frac{7-\sqrt{45}}{2}$, find the value of $x^{3}+\frac{1}{x^{3}}-7\left(x^{2}+\frac{1}{x^{2}}\right)+(x+\frac{1}{x})$.

2. If $x=\sqrt{\frac{5+2\sqrt{6}}{5-2\sqrt{6}}}$, then $x^{2}(x-10)^{2}=$

3. Find the number of integers between $-\sqrt{8}$ and $\sqrt{32}$.

4. 75, 192, 250, 100 which number can be expressed as the sum of square of two positive integers as well as three positive integers?

5. If $2^{a}=3^{b}=6^{c}$ then find c.

6. If $\frac{3-\sqrt{5}}{3+2\sqrt{5}}=a\sqrt{5}-\frac{19}{11}$, find a.

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

8. Which number is greater $\sqrt{3}+\sqrt{11}$ or $\sqrt{5}+\sqrt{8}$?

9. Simplify: $\frac{5^{n+2}-6\times 5^{n+1}}{13\times 5^{n}-2\times 5^{n+1}}$

10. If $\frac{9^{n}\times 3^{2}\times\left(3^{-n/2}\right)^{-2}-27^{n}}{3^{3m}\times 2^{3}}=\frac{1}{27}$, prove that m – n = 1.

SUBJECTIVE PROBLEMS

1. Express the following rational number as decimals:

   (i) $-\frac{4}{9}$ (ii) $-\frac{2}{15}$

2. Express $0.12\overline{3}$ in rational form (p/q)

3. Find two irrational numbers lying between $\sqrt{2}$ and $\sqrt{3}$.

4. Prove that $\sqrt{3}+\sqrt{5}$ is an irrational number.

5. $0.2353535\ldots\ldots = 0.2\overline{35}$ can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$. Find it

6. Simplify $\frac{6(8)^{n+1}+16(2)^{3n-2}}{10(2)^{3n+1}-7(8)^{n}}$.

7. If $x = 2\sqrt{2}+\sqrt{7}$, identify the value of $\frac{1}{2}\left(x+\frac{1}{x}\right)$.

8. If $\frac{6}{3\sqrt{2}-2\sqrt{3}} = 3\sqrt{2}-a\sqrt{3}$, find the value of a.

9. Find the value of $\sqrt{\frac{1}{2}\sqrt{\frac{1}{2}\sqrt{\frac{1}{2}\ldots\infty}}}$

10. If $a = \frac{\sqrt{5}+1}{\sqrt{5}-1}$ and $b = \frac{\sqrt{5}-1}{\sqrt{5}+1}$, then find the value of $\frac{a^2+ab+b^2}{a^2-ab+b^2}$.

11. $\frac{7+\sqrt{5}}{7-\sqrt{5}}-\frac{7-\sqrt{5}}{7+\sqrt{5}} = a+\frac{7}{11}\sqrt{5}b$, If both a and b are rational numbers, find the values of a and b.

12. If $x^4+\frac{1}{x^4} = 194$, find $x^3+\frac{1}{x^3}$, $x^2+\frac{1}{x^2}$ and $x+\frac{1}{x}$.

13. If $a+b+c = 6, \frac{1}{a}+\frac{1}{b}+\frac{1}{c} = \frac{3}{2}$, then $\frac{a}{b}+\frac{a}{c}+\frac{b}{a}+\frac{b}{c}+\frac{c}{a}+\frac{c}{b} =$

14. If $x+y+z = 5$ and $xy+yz+xz = 7$, then $x^3+y^3+z^3-3xyz =$

15. $\left(\frac{2}{3}\right)^{\frac{3}{4}}$ when divided by $\left(\frac{2}{3}\right)^{\frac{7}{6}}$ gives $\left(\frac{2}{3}\right)^{7-x}$. Find the value of x.

16. If a and b are different positive prime such that $\left(\frac{a^{-1}b^2}{a^2b^{-4}}\right)^7 \div \left(\frac{a^3b^{-5}}{a^{-2}b^3}\right) = a^x b^y$, find x and y.

17. Prove that $\frac{1}{1+x^{2a-2b}}+\frac{1}{1+x^{2b-2a}} = 1$.

18. Prove that: $\frac{3^{-3}\times 6^2\times\sqrt{98}}{5^2\times\sqrt[3]{\left(\frac{1}{25}\right)}\times(15)^{-\frac{4}{3}}\times 3^{\frac{1}{3}}} = 28\sqrt{2}$.

19. (i) If $x = 2+\sqrt{3}$, find the value of $x+\frac{1}{x}$.

    (ii) If $a = 7+\sqrt{40}$, find the value of $\sqrt{a}+\frac{1}{\sqrt{a}}$.

20. Represent $\sqrt{13}$ on number line.

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THANKS!

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ANSWER KEY & SOLUTION

SINGLE OPTION CORRECT

1. D	2. D	3. D	4. A
5. D	6. B	7. B	8. C
9. A	10. A	11. B	12. A
13. B	14. A	15. B	16. D
17. B	18. D	19. D	20. C
21. A	22. C	23. B	24. B
25. B	26. A	27. D	28. B
29. A	30. A		

MULTI OPTIONS CORRECT

1. A, B, C	2. A, C, D	3. A, C, D	4. A, C, D
5. A, B, C, D	6. A, C, D	7. A, D	8. A, B, C, D
9. A, B, D	10. A, C, D	11. A, B, C	12. B, C, D
13. A, B, D	14. B, D	15. A, B, C, D	16. A, C, D
17. B, C	18. A, B, D		

OLYMPIAD TYPE

1. 0	2. 1	3. 8	4. 250
5. $c = \frac{ab}{a+b}$	6. $\frac{9}{11}$	7. 4	8. $\sqrt{3} + \sqrt{11}$.
9. $-\frac{5}{3}$			

SUBJECTIVE

1. $-0.\overline{4}, -0.1\overline{3}$	2. $\frac{111}{900}$	3. $6^{\frac{1}{4}}$ and $2^{\frac{1}{4}} \times 6^{\frac{1}{8}}$.	5. $\frac{233}{990}$
6.	7. $2\sqrt{2}$	8.	9. $0, \frac{1}{2}$
10. $\frac{4}{3}$	11. $a = 0$ and $b = 1$	12. 52, 14, 4	13. 6
14. 20	15. $\frac{89}{12}$	16. x = 4 and y = 2	