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Class: 11
Subject: Math's
Topic: Principle of Mathematical Induction
No. of Questions: 25

1. Let S (K) be $1 + 3 + 5 + \ldots + (2K - 1) = 3 + K^2$. Which of the following is true?

A. $S(K) \not\Rightarrow S(K+1)$
B. $S(K) \Rightarrow S(K+1)$
C. S (1) is correct.
D. Principle of mathematical induction can be used to prove the formula.

2. If $a_n = \sqrt{7+\sqrt{7+\sqrt{7+\ldots}}}$ having n radical signs, then by methods of mathematical induction which of the following is true?
A. $a_n > 7 \ \forall \ n \geq 1$
B. $a_n > 3 \ \forall \ n \geq 1$
C. $a_n < 4 \ \forall \ n \geq 1$
D. $a_n < 3 \ \forall \ n \geq 1$

3. For each $n \in N$, $x^{2n-1} + y^{2n-1}$ is divisible by

A. $x + y$
B. $(x + y)^2$
C. $x^3 + y^3$
D. none of these

4. Let $x > -1$, then statement $P(n) : (1 + x)^n > 1 + nx$ is true for

A. all $n \in N$
B. all $n > 1$
C. all $n > 1$ provided $x \neq 0$
D. none of these

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5. **Statement - 1:** For each natural number n, $(n + 1)^7 - n^7 - 1$ is divisible by 7.
Statement - 2: For each natural number n, $n^7 - n$ is divisible by 7.

A. Statement – 1 is true, statement – 2 is true and statement – 2 is the correct explanation for statement – 1.
B. Statement – 1 is true, statement – 2 is true and statement – 2 is not the correct explanation for Statement – 1.
C. Statement – 1 is true, statement – 2 is false.
D. Statement – 1 is false, statement – 2 is true.

6. Given a, b, c $\in$ N. If $a^n + b^n$ is divisible by c when n is odd but not when n is even, then the value of c is

A. $a + b$
B. $a - b$
C. $a^3 + b^3$
D. $a^3 - b^3$

7. Let S = $\sqrt{1+\frac{1}{1^2}+\frac{1}{2^2}}+\sqrt{1+\frac{1}{2^2}+\frac{1}{3^2}}+\ldots+\sqrt{1+\frac{1}{1999^2}+\frac{1}{2000^2}}$, find $|2000(S-2000)|$.

8. A sequence is obtained by deleting all perfect squares from set of natural numbers. What is the remainder when the
2003^{rd} term of new sequence is divided by 2048?

9. **STATEMENT–1:** If $S_n = \left(1+\frac{1}{2}+\frac{1}{3}+\ldots+\frac{1}{n}\right)$, then

$nS_n = n+\left(\frac{n-1}{1}+\frac{n-2}{2}+\ldots+\frac{2}{n-2}+\frac{1}{n-1}\right)$

STATEMENT–2: $S_n = n-\left(\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\ldots+\frac{n-1}{n}\right)$

A. Statement – 1 is true, Statement – 2 is true; Statement – 2 is the correct explanation for Statement – 1.
B.Statement – 1 is true, Statement – 2 is true; Statement – 2 is NOT the correct explanation for Statement – 1.
C.Statement – 1 is true, Statement – 2 is false.
Statement – 1 is false, Statement – 2 is true.

10. For a positive integer, n, let $S(n) = \sum_{k=1}^{2^n-1}\frac{1}{k}$, then let us consider two statements:
$A_1 : S(100) \leq 100$;
$A_2 : S(200) > 100$, then

A. A_1 is correct but A_2 is not correct
B.A_2 is correct but A_1 is not correct
C.A_1 and A_2 are both correct
D. Neither A_1 nor A_2 is correct

11. For a positive integer n, $let\ S(n)=1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\ldots+\frac{1}{2^n-1}$. Which of the following expressions holds true?

A. $S_n \leq n\ S_{2n} \leq n$
B.$S_n < n$
C.$S_{2n} \leq n$
D. $S_{2n} > n$

12. The number $\frac{5^k+3}{4}(k \in N)$, when divided by 10, may leave remainder

A. 2
B. 6
C. 7
D. 8

13. **Direction:** Let f(n) = $3^{2n} + 3^n + 1$ for every positive integer n. Which of the following is true?

A. $f(n+3) = 3^6 f(n) - 702.3^n - 728$
B. $f(n+3) = 3^6 f(n) - 701.3^n - 729$
C. $f(n+3) = 3^6 f(n) + 702.3^n - 728$
D. none of these

14. **Direction:** Let f(n) = $3^{2n} + 3^n + 1$ for every positive integer n. Which of the following is false?

A. f(100) is divisible by 13.
B.f(1001) is divisible by 13.
C.f(2007) is divisible by 13.
D. none of these

15. If $S_n = \sum_{r=1}^{n} t_r = \frac{1}{6}n(2n^2+9n+13)$, then $\sum_{r=1}^{n} \sqrt{t_r}$ equals

A. $\frac{1}{2}n(n+1)$
B. $\frac{1}{2}n(n+2)$
C. $\frac{1}{2}n(n+3)$
D. $\frac{1}{2}n(n+5)$

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16. $1, \alpha_1, \alpha_2, \alpha_3, \ldots, \alpha_k$ are divisions of number N = $2^{n-1}(2^n - 1)$ where $2^n - 1$ is a prime number and $1 < \alpha_1 < \alpha_2 < \alpha_3 \ldots < \alpha_k$, then value of $\left(1 + \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \ldots + \frac{1}{\alpha_k}\right)$ is

17. Answer the following questions based upon above passage.

Sum of the series

$$\frac{1^3}{1} + \frac{1^3 + 2^3}{1+3} + \frac{1^3 + 2^3 + 3^3}{1+3+5} + \ldots \text{to 16 terms is}$$

A. 346
B. 446
C. 546
D. 444

18. Answer the following questions based upon above passage.

$1 + \frac{4}{5} + \frac{7}{5^2} + \frac{10}{5^3} + \ldots \text{to } \infty$ is

A. $\frac{16}{35}$
B. $\frac{11}{8}$
C. $\frac{35}{16}$
D. $\frac{7}{16}$

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19. Answer the following questions based upon above passage.

The sum of the series $\frac{1}{3\times7}+\frac{1}{7\times11}+\frac{1}{11\times15}+....\text{to }\infty$ is

A. $\frac{1}{3}$
B. $\frac{1}{6}$
C. $\frac{1}{9}$
D. $\frac{1}{12}$

20. If n is a positive integer and *p* is a prime number, then $n^p - n$ is always divisible by

A. p – 1
B. p
C. p + 1
D. p^2

21. If $S_{(n)} = 1+\frac{1}{2}+\frac{1}{3}+.....+\frac{1}{n},(n \in N)$, then $S_{(1)}+S_{(2)}+.......+S_{(n-1)}$ is equal to

A. $nS_{(n)} - n$
B. $nS_{(n)} - 1$
C. $(n-1)S_{(n-1)} - n$
D. $nS_{(n-1)} - n + 1$

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22. **Statement – 1**: Let $d_1, d_2, d_3 \ldots. d_k$ be all the factors of a fixed positive integer n including 1 and n.

If $d_1 + d_2 + d_3 + \ldots\ldots + d_k = 72$, then the value of $\frac{1}{d_1} + \frac{1}{d_2} + \frac{1}{d_3} + \ldots\ldots + \frac{1}{d_k} = \frac{72}{n}$ because

Statement – 2: For a positive integer n, if d is a factor then $\frac{n}{d}$ is also a factor.

A. Statement – 1 is true, Statement – 2 is true; Statement – 2 is the correct explanation for Statement – 1.
B. Statement – 1 is true, Statement – 2 is true; Statement – 2 is NOT the correct explanation for Statement – 1.
C. Statement – 1 is true, Statement – 2 is false.
D. Statement – 1 is false, Statement – 2 is true.

23. If 12 divides the seven digit number ab313ab, then the smallest values of a + b is

A. 2
B. 4
C. 6
D. 8

24. The sum of the cubes of three consecutive natural no. is divisible by 9.

25. Prove that $12^n + 25^{n-1}$ is divisible by 13