1. $\sum_{x=1}^{4}(x+3) =$

A. 11 B. 13 C. 21 D. 22 E. NOTA

2. $\sin 1° \cdot \sin 2° \cdot \sin 3° \cdot .... \cdot \sin 359° =$

A. $\frac{3}{2}$ B. $\frac{2}{3}$ C. $\frac{\sqrt{3}}{2}$ D. $-1$ E. NOTA

3. An arithmetic sequence has common difference 4 and the $10^{th}$ term is 12. What is the first term?

A. -98 B. -32 C. -24 D. -22 E. NOTA

4. $(\log_2 3)\cdot(\log_3 4)\cdot(\log_4 5)\cdot(. ...)\cdot(\log_7 8) =$

A. 2 B. 3 C. 4 D. 8 E. NOTA

5. Which describes the sequence 0.12, 0.22, 0.32, 0.42, … ?

A. arithmetic with common difference 0.1 B. geometric with common ratio 0.2
C. arithmetic with common difference 0.2 D. geometric with common ratio 2 E. NOTA

6. For $i = \sqrt{-1}$, $\sum_{n=1}^{20}(i)^n =$

A. 0 B. 2 C. 4 D. $i$ E. NOTA

7. For $i = \sqrt{-1}$, $\sum_{n=1}^{20}\left|(i)^n\right| =$

A. 0 B. 10 C. 20 D. $20\sqrt{2}$ E. NOTA

8. The first four terms of a geometric sequence are R, S, T and U, in that order. If $\frac{S}{R} = \frac{1}{2}$, then $\frac{T}{U} =$

A. ¼ B. ½ C. 2 D. 4 E. NOTA

9. The tenth term of an arithmetic sequence is 20, and the third term is 1. What is the positive difference between the first and second terms of the sequence?

A. $\frac{21}{9}$ B. $\frac{19}{7}$ C. $\frac{19}{6}$ D. $\frac{7}{2}$ E. NOTA

10. What is the sum of the first 400 terms (first term $a_1$) of the sequence for which $a_1 = 0$ and $a_n = 4 \cdot a_{n-1}$ ?

A. $4^{400}$ B. 4(400) C. 4 D. 0 E. NOTA

11. $a_1 = a_2 = 1$ and for $n > 2$, and $n \in$ positive integers, $a_n = a_{n-1} + a_{n-2}$.
Which is equivalent to $a_6 - a_5$ ?

A. $a_4$ B. $a_7 - a_5$ C. $a_7 - a_6$ D. 1 E. NOTA

12. The terms of a geometric sequence are $a_1$, $a_2$, $a_3$ and $a_4$, in that order. If there is a 10% decrease from $a_2$ to $a_1$ (in that order), and $a_3 = 1000$ then which is the value of $a_1$ ?

A. 81 B. 270 C. 810 D. $\frac{100}{81}$ E. NOTA

13. The Smiths dined out last night, and their dinner bill prior to tax was $B_1$ dollars. With tax, their bill came to $B_2$ dollars, and with a 15% tip on the $B_2$ amount, the total came to $B_3$ dollars. If $B_1$, $B_2$, and $B_3$ form a geometric sequence, then what percent of $B_1$ was the tax? (Answers are percents)

A. $\sqrt{15}$ B. $5$ C. $7.5$ D. $15$ E. NOTA

14. Of the two geometric means between $2$ and $-54$, find the one which is not evenly divisible by 9.

A. -6 B. -8 C. -12 D. -14 E. NOTA

15. The five arithmetic means of *x* and *y* are $f$ ,20, $g$ , 34, and $h$ , and $f < 20 < g < 34 < h$ .
Find the value of g. .

A. 24 B. 26 C. 27 D. 28 E. NOTA

16. If the domain of $f$ is a subset of the set of integers, $f(n) = \begin{cases} (-2)^n & for \;\; n \le 0 \\ (2)^n & for \;\; n > 0 \end{cases}$ , then the value of $\sum_{n=-2}^{2} f(n) =$ ?

A. 0 B. 6.75 C. 7.25 D. 2.75 E. NOTA

17. The roots of the quadratic function $f(x) = x^2 - 8x + k$ (for *k* some positive integer) form an arithmetic sequence with 1. That is, for the roots *a* and *b*, the sequence is 1, *a*, and *b*. What is the value of *k*?

A. -20 B. 10 C. 15 D. 16 E. NOTA

18. A geometric sequence has four positive terms $a_1$, $a_2$, $a_3$, and $a_4$. If $\frac{a_3}{a_1}=9$ and $a_1+a_2=\frac{4}{3}$, *then* $a_3=$

A. $\frac{\sqrt{3}}{3}$ B. $\frac{2}{3}$ C. 3 D. $3\sqrt{3}$ E. NOTA

19. $\prod_{n=1}^{4}(n+1)$

A. 196π B. 120 C. 196 D. 14π E. NOTA

20. For sequences with terms $p_n$ and $a_n$, $n \in$ natural numbers; $a \in$ positive integers, $\sqrt{a_n+\sqrt{a_n+\sqrt{a_n+\sqrt{...}}}}=p_n$, and $p_n=3n+1$. Which describes the term $a_n$ ?

A. $p_n(p_n-1)$ B. C. $p_n+30$ D. $(p_n)^2-p_n-1$ E. NOTA

21. $\left(\sum_{n=1}^{8}2^n\right)\div\left(\frac{1}{2}\right)=$

A. $\sum_{n=2}^{9}2^n$ B. $\sum_{n=2}^{7}2^n$ C. $\sum_{n=0}^{7}2^n$ D. $2^n-2$ E. NOTA

22. $f(x)=(x-1)(x-2)(x-3)...(x-10)$ for domain integers, $x$, such that $x>10$. What is the least value of $f$ for this domain?

A. 0 B. 40! C. $\frac{11!}{2}$ D. 11! E. NOTA

23. If $\frac{1}{2}+\frac{1}{2\sqrt{3}}+\frac{1}{6}+\frac{1}{6\sqrt{3}}+...=\frac{a+\sqrt{a}}{4}$ then which is the value of $a$ ?

A. 2 B. 3 C. 5 D. 6 E. NOTA

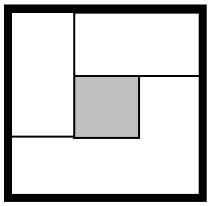
24. The five $5^{th}$ roots of $i$ may be written as $cis\theta_1$, $cis\theta_2$, $cis\theta_3$, $cis\theta_4$ and $cis\theta_5$ for $\theta\in[0,2\pi]$. If $\theta_1<\theta_2<\theta_3<\theta_4<\theta_5$ then $\theta_1$, $\theta_2$, $\theta_3$, $\theta_4$, and $\theta_5$ form an arithmetic sequence. Give the third term $\theta_3$ of that sequence. ($cis\theta$ denotes ($\cos\theta+i\sin\theta$).)

A. $\frac{3\pi}{10}$ B. $\frac{2\pi}{5}$ C. $\frac{3\pi}{4}$ D. $\frac{9\pi}{10}$ E. NOTA

25. If $2 \bullet \left( \sum_{n=1}^{5} n \right) = \sum_{m=1}^{2} x^m$ for some positive value of $x$, then $x =$

A. 4 B. 5 C. 6 D. 15 E. NOTA

26. A sequence of figures is shown at the right. The first (shaded) is a square of side length 1. Each term after the first term is a rectangle with width (shorter side) 1. The first five terms create a larger square (darker segments show the perimeter) and each subsequent 4 terms join with the preceding terms to create another square. Find the total area of the first 17 figures of this sequence.



A. 189 B. 164 C. 81 D. 49 E. NOTA

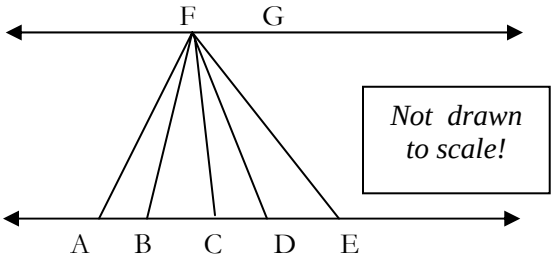
27. The sequence $a_n = (64)^{n/(n+1)}$ has first term $64^{1/2}$ for n=1. How many terms of this sequence are integers for $n > 1$ ?

A. 1 B. 2 C. 3 D. 4 E. NOTA

28. The $n^{th}$ term of a sequence is determined by $C(100, n)$, and the sequence has 100 terms, with first term $C(100, 1)$. What is the sum of the first 99 terms of the sequence? (note: *C(a, b)* is the number of combinations of *a* objects taken *b* at a time.)

A. $2^{100} - 2$ B. $2^{99} - 1$ C. $2^{98}$ D. $2^{99} - 2$ E. NOTA

29. Lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{FG}$ are parallel, with A, B, C, D and E collinear. The areas of triangles ABF, ACF, ADF and AEF, in that order, form a geometric sequence, with a common ratio of 5. If $\overline{AB}$ has length k then $\overline{DE}$ has length __.




A. 125k B. 100k C. 25k D. 5k E. NOTA

30. The function *f(x)* = [*x*] defines the greatest integer less than or equal to *x*. The values of $f(-1)$, $f(5/2)$, $f(-\pi)$, and $f(e^2 + 1)$ form a sequence. Which expression below gives the sum of that sequence?

A. $\sum_{n=1}^{4} (-2)^n$ B. $\sum_{n=1}^{4} (-2)^{n-1}$ C. $\sum_{n=1}^{4} (-1)^{n+1}(2)^n$ D. $\sum_{n=1}^{4} (-1)^n(2)^{n-1}$ E. NOTA