Good Luck! :)

1. How many different strictly increasing sequences of five positive integers whose sum is 17 exist?

   A. 0 B. 1 C. 2 D. 3 E. NOTA

2. If the sides of a triangle have lengths of $3L + 4$, $6L - 1$, and $8L + 2$, find all possible values of L.

   A. $L > \frac{-7}{5}$ B. $L > -1$ C. $L > 1$ D. $L > \frac{3}{11}$ E. NOTA

3. Find the area bounded by the graphs of $x \leq 0, y \leq 0$, and $y \geq -|x + 2|$.

   A. unbounded B. 2 C. 4 D. 6 E. NOTA

4. Given $3^{5k} \cdot 81^{-k} \geq 9^{k^2-3}$: How many nonnegative integer solutions are there for k?

   A. 1 B. 2 C. 3 D. Infinitely many E. NOTA

5. Find the directrix of $y^2 + 8x - 6y + 25 = 0$.

   A. $x = 0$ B. $y = 0$ C. $x = 5$ D. $y = 5$ E. NOTA

6. What is the equation of the conic whose distance between vertices is 4 and whose foci are the points $\left(0, \sqrt{7}\right)$ and $\left(0, -\sqrt{7}\right)$?

   A. $\frac{y^2}{4} - \frac{x^2}{3} = 1$ B. $\frac{y^2}{3} - \frac{x^2}{4} = 1$ C. $\frac{y^2}{16} - \frac{x^2}{9} = 1$ D. $\frac{y^2}{9} - \frac{x^2}{16} = 1$ E. NOTA

7. If $f(n)=\prod_{j=3}^{n}\log_{j-1} j$, then what does $\sum_{k=2}^{10} f\left(2^k\right)$ equal to?

A. 45 B. 54 C. 55 D. 7 E. NOTA

8. In parallelogram JWIG, JW = 16, GJ = $3\sqrt{2}$, and sides JW and GJ form a 45-degree interior angle. In isosceles trapezoid MRLU, segment MR is the longer base and has length 16, and interior base angles of 45-degrees each. If the Trapezoid and parallelogram have the same area, what is the length of segment LU?

A. $4\sqrt{2}$ B. 8 C. $8\sqrt{2}$ D. 12 E. NOTA

9. The average of M and 3R is 7, the average of M and 3L is 8, and the average of M and 3U is 9. What is the average of M, R, L, and U?

A. 3 B. 4 C. 8 D. 12 E. NOTA

10. What percent of the interval $[-5,5]$ satisfies the inequality: $\frac{8}{k-1} < k+1$?

A. 40 B. 60 C. 64 D. 80 E. NOTA

11. Wiggie's watch has a minute hand that is twice as long as its hour hand. What is the ratio of the distance the tip of the minute hand travels in 9 hours to the distance the tip of the hour handle travels in 3 hours?

A. 6 B. 36 C. 72 D. 144 E. NOTA

12. The Snowman runs a distance of R miles at a speed of $R+1$ mph and then turns up the speed and runs another $2R+1$ miles at a speed of R^2+R mph. If the total time for his run was 6 hours, what was the Snowman's average speed, in mph?

A. $\frac{4}{15}$ B. $\frac{2}{9}$ C. $\frac{48}{5}$ D. $\frac{35}{4}$ E. NOTA

13. What is the sum of real numbers a and b for which $(1+i)^{13} = a+bi$?

A. -128 B. -64 C. 64 D. 128 E. NOTA

14. What is the shortest distance from the origin to the graph of $y = \sqrt{6x - x^2 - 9}$?

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

15. There are some integers less than 10 for which $\sqrt{k+3+2+1}$ has an integral value. What is the sum of these numbers?

A. -10 B. -6 C. -4 D. 6 E. NOTA

16. How many distinct ordered pairs of positive integers (x, y) satisfy $x^y = 2^{20}$?

A. 3 B. 4 C. 5 D. 6 E. NOTA

17. An arithmetic sequence has a first term of 81, a last term of 256 and another term of 144. If the common difference is not 1, how many terms does the sequence have?

A. 12 B. 24 C. 25 D. 26 E. NOTA

18. If Mr. Lu and J Wigs each toss 3 fair coins, what is the probability that they get the same number of tails?

A. $\frac{1}{8}$ B. $\frac{5}{16}$ C. $\frac{21}{64}$ D. $\frac{3}{8}$ E. NOTA

19. The diagonals of a trapezoid divide the trapezoid into four small triangular regions. If the area of the two triangles bordering the bases are 18 and 32, what is the area of the trapezoid?

A. 98 B. 100 C. 108 D. 158 E. NOTA

20. How many positive two-digit factors does $2^{16}-1$ have?

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

21. In triangle MAT, MT=9, $m\angle MAT = 45^\circ$, $\sin\angle MTA = \frac{8}{9}$, and $(MA)^2$ =L. What is the sum of the digits of L?

A. 5 B. 7 C. 11 D. 13 E. NOTA

22. A circle with center O and radius 1 contains chord $\overline{ZU}$ of length 1, and point L is the midpoint of $\overline{ZU}$. If the perpendicular to $\overline{OZ}$ through L intersects $\overline{OZ}$ at A, the area of triangle ZLA is $\frac{\sqrt{3}}{X}$. What is X?

A. 8 B. 16 C. 32 D. 64 E. NOTA

23. The horizontal line $y = k$ intersects $f(x) = 2x^2 - 12x + 16$ at exactly one point. What is k?

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

24. Of the 400 math teamers at Heritage, 117 take Physics C, 109 take AP Comp Sci, and 114 take BC Calc. Furthermore, 70 take both Physics C and AP Comp Sci, 34 take both Physics C and BC Calc, and 29 take both AP Comp Sci and BC Calc. They also have 164 team members who take none of these classes. How many team members take all 3 classes?

A. 4 B. 19 C. 24 D. 29 E. NOTA

25. Deerfield practices on the 5th Monday of any month. If school begins on Monday, September 4, what is the date of the first practice?

A. 10/29 B. 11/29 C. 11/30 D. 12/29 E. NOTA

26. Mr. Lu's piggy bank has 20 coins made up of only quarters, dimes, and nickels and has a total value of $3.35. If the quarters were dimes, the nickels were quarters, and the dimes were nickels, the total value of his piggy bank would be $2.75. How many quarters are in his original piggy bank?

A. 8 B. 9 C. 10 D. 11 E. NOTA

27. Triangle ZLU has a right angle at U. Point W and F are on $\overline{ZL}$ in the order ZFWL such that $ZW = ZU$ and $LF = LU$. What is the degree measure of $\angle WUF$?

A. 15 B. 30 C. 45 D. 60 E. NOTA

28. Circles X and Y have a common external tangent. The tangent line meets circle X at point P and meets circle Y at point Q. If circle X and Y have respective radii of 5 and 8 and PQ = 20 then what is the distance from the centers of the two circles?

A. 13 B. $\sqrt{391}$-13 C. $\sqrt{391}$ D. $\sqrt{409}$ E. NOTA

29. Mr. Lu runs along the x-axis with his distance from the origin given by $x(t) = \left|-16t^2 + 48t + 2\right|$, where t is in minutes. For the time interval [0,4] minutes, what is the greatest distance that Mr. Lu is from the origin?

A. 34 B. 38 C. 62 D. 68 E. NOTA

30. Snow makes a Snowman consisting of three perfect spheres. If their diameters are consecutive even integers whose sum is 72 meters, what is the total surface area in square meters of his Snowman?

A. 576π B. 1024π C. 1440π D. 1736π E. NOTA