Answer "E" will be "NOTA" meaning none of the above answers is correct.

1. Simplify: $-2^4+\sqrt{1024}+3+(-2)^4\div 8$

a.13 b.21 c.23 d.53 e. NOTA

2. After jogging from home towards Buchholz for 1.5 hours at a constant rate, Mr. Lu gets tired and decides to rest for 30 minutes and then continue on to Buchholz at 4/5 of his former rate. If Mr. Lu had maintained his starting rate for the entire trip, he would have arrived at Buchholz just in time for math practice; however, he instead arrived 3 hours late. What is the ratio of his starting rate in mph to the length of the entire trip, in miles?

a. $\frac{2}{23}$ b. $\frac{1}{11}$ c. $\frac{3}{23}$ d. $\frac{3}{22}$ e. NOTA

3. Two non-zero real numbers, x and y, satisfy xy = x - y. Find a possible value of $\frac{x}{y}+\frac{y}{x}-xy$.

a. -2 b. $\frac{-1}{2}$ c. $\frac{1}{2}$ d. 2 e. NOTA

4. Through a point on the hypotenuse of a right triangle, lines are drawn parallel to the legs of the triangle so that the triangle is divided into a square and two smaller right triangles. The area of one of the two small right triangles is "k" times the area of the square. the ratio of the area of the square to the area of the other small right triangle is?

a. 2k+1 b. 4k c. $8k^2$ d. $\frac{1}{1-k}$ e. NOTA

5. Given $f\left(\frac{x}{3}\right)=x^2+x+1$: Find the sum of all values of k for which $f(3k)=7$.

a. $\frac{-1}{9}$ b. 0 c. $\frac{5}{9}$ d. $\frac{5}{3}$ e. NOTA

6. Find the equation of the perpendicular bisector of the line segment with endpoints (7,-3) and (-3,9).

a.5x – 6y = -8 b.5x + 6y = 28 c.6x – 5y = -5 d.6x + 5y = 2 e. NOTA

7. $\sqrt{a}+i\sqrt{b}=\sqrt{9+4i\sqrt{5}}$, where a and b are positive real numbers; Find the value of $a - b$.

a. Undefined b. 1 c. 9 d. -71 e. NOTA

8. Simplify, where defined: $\dfrac{\sqrt{x}-\sqrt{y}}{x^{\frac{-1}{2}}-y^{\frac{-1}{2}}}$

a. $-\sqrt{xy}$ b. $\sqrt{y}-\sqrt{x}$ c. $x-y$ d.-1 e. NOTA

9. If a, b, and c are positive with ab = 24, ac = 48, and bc = 72, then a +b + c =?

a. 18 b. 20 c. 22 d. 24 e. NOTA

10.Given regular polygon MNOPQRST with side length 1, find the area of MOQS.

a. 1 b. $\sqrt{2}$ c. $2+\sqrt{2}$ d. 4 e. NOTA

11. The cable of a suspension bridge has supporting towers that are 24 yards high and 80 yards apart. The cable lies in a parabolic shape. If the lowest point of the cable is 4 yards above the floor of the bridge, find the height in yards of a supporting rod 30 yards from the center of the span.

a. $\dfrac{51}{4}$ b. $\dfrac{25}{4}$ c. $\dfrac{131}{8}$ d. $\dfrac{61}{4}$ e. NOTA

12. What is the sum of the x-values of the x-intercepts of $f(x)=3x^4+7x^3-3x-7$?

a. 0 b. $\dfrac{-4}{3}$ c. $\dfrac{-7}{3}$ d. 1 e. NOTA

13. Find the foci for the following conic: $9x^2 - 4y^2 - 18x + 16y + 29 = 0$

a. $\left(1 \pm \sqrt{13}, -2\right)$ b. $\left(1, -2 \pm \sqrt{13}\right)$ c. $\left(1, 2 \pm \sqrt{13}\right)$ d. $\left(1 \pm \sqrt{13}, 2\right)$ e. NOTA

14. If an arc of 45 degrees on circle X has the same length as an arc of 30 degrees on circle Y, then what is the ratio of the area enclosed by circle X to the area enclosed by circle Y?

a. $\frac{4}{9}$ b. $\frac{2}{3}$ c. $\frac{3}{2}$ d. $\frac{9}{4}$ e. NOTA

15. Find the value of the constant term in the expansion of $\left(x - 3x^{-2}\right)^9$

a. -2268 b. -84 c. 84 d. 2268 e. NOTA

16. Find k such that the matrix $\begin{bmatrix} 3 & k \\ -2 & -3 \end{bmatrix}$ is equal to its own inverse.

a. -4 b. 2 c. 4 d. 5 e. NOTA

17. Find the domain of y = $\sqrt{\frac{5}{x^2 + 6x + 9}}$

a. $(-\infty, \infty)$ b. $(-3, \infty)$ c. $(-\infty, -3)$ d. $[-3, \infty)$ e. NOTA

18. Math teamers at Buchholz have 7 class periods each day. Annoying Sohan requests to take his AP Calculus BC, AP Physics C and AP Computer Science classes consecutively. In how many ways can Sohan accomplish this but not necessarily in that order? Sohan is only taking those three classes. Neither the last 2 classes of the day and the first the next morning nor the last class of the day and the first two the next morning count as consecutive classes.

a. 5 b. 6 c.15 d. 30 e. NOTA

19. Mr. Lu's dog has a regular hexagonal doghouse that measures one yard on each side. He is tied to a vertex with a 2 yard rope. What is the area, in square yards, of the region outside the doghouse that Mr. Lu's dog can reach?

a. 2π b. $\frac{5\pi}{2}$ c. $\frac{8\pi}{3}$ d. 3π e. NOTA

20. The graph of $y = x^5 - 5x^3 - 36x$ intersects the x-axis how many times?

a. 1 b. 2 c. 3 d. 5 e. NOTA

21. You are given an arithmetic series such that:
$a_1 + a_2 + ... + a_{100} = 100 \, and \, a_{101} + a_{102} + ... a_{200} = 200$. What is the value of "d", the common difference between each term?

a. 0.0001 b. 0.001 c. 0.01 d. 0.1 e. NOTA

22. . Given right triangle ZLU with right angle at vertex L. If X and Y are the midpoints of legs ZL and LU, respectively and ZY = 19 and UX = 22, what is ZU?

a. 24 b. 26 c. 28 d. 30 e. NOTA

23. If the coefficient of the 3rd and 11th terms in the expansion of $(L-U)^n$ are equal, where the terms are written in decreasing order of the exponent of *L*, find the coefficient of the 8th term.

a. -3003 b. -792 c. -495 d. -330 e. NOTA

24. Simplify, where defined: $\left(\frac{x^{-1}z - y^{-1}z}{x^{-2}z^2 - y^{-2}z^2} \right)^{-1}$

a. xz + yz b. xz – xy c. $\frac{xz + yz}{xy}$ d. $\frac{z}{x+y}$ e. NOTA

25. If $f(x)=x^3+1$ and $g(x)=2x-6$, find $\left[g^{-1}\circ f^{-1}\right](2)$

a. $\frac{-5}{2}$ b. $\sqrt[3]{3}$ c. $\frac{7}{2}$ d. 4 e. NOTA

26. Find the x-intercept of the line that passes through the midpoint of the line segment with endpoints at (4,2) and (-8,8) and is parallel to 6x – 2y = 9.

a. $\frac{-11}{3}$ b. $\frac{-1}{3}$ c. $\frac{13}{3}$ d. 11 e. NOTA

27. The centers of two circles of radii of lengths 3 and 8 are 13 units apart. What is the length of the common external tangent segment?

a.5 b. 12 c.13 d. $\sqrt{194}$ e. NOTA

28. Find the sum of the values of x that satisfies the equation $(\log x)\log 5+\log 4-2=0$.

a. 25 b. 100 c. 500 d. 1000 e. NOTA

29. The equation $x^2+mx+n=0$ has roots that are twice those of $x^2+kx+m=0$, and none of m, n, and k is zero. What is the value of $\frac{k}{n}$?

a. $\frac{1}{16}$ b. $\frac{1}{8}$ c. $\frac{1}{4}$ d. $\frac{1}{2}$ e. NOTA

30. For the smallest positive integer *r* for which the sum $100r+99r+98r+...r$ is a perfect square, what is the sum of the digits of *r*?

a. 1 b. 2 c. 4 d. 10 e. NOTA