

1. What is the reciprocal of $1 + i$?

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

2. The graph of $x = \log y$ intersects:

- a. the x-axis b. the y-axis c. neither axis d. line $y=x$ e. NOTA

3. $2 - i\sqrt{3}$ is one solution to $x^2 + bx + c = 0$; If b and c are real numbers, what does $b + c = ?$

- a. -5 b. -3 c. 3 d. 5 e. NOTA

4. The sum of 2 numbers is 1 and the ratio of these 2 number is $1 : \sqrt{2}$. Find the larger number

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

5. If $\frac{5}{(x-2)(3x^2-7)} = \frac{A}{x-2} - \frac{Bx+C}{3x^2-7}$, where A , B , and C are real numbers, what is the value of

$A + B - C$?

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

6. The least value of the function $f(x) = ax^2 + bx + c$ ($a > 0$) is?

- a. $\frac{-b}{a}$ b. $\frac{-b}{2a}$ c. $b^2 - 4ac$ d. $\frac{4ac - b^2}{4a}$ e. NOTA

7. $\sum_{n=0}^{\infty} \left(\frac{2}{9}\right)^n = ?$

- a. $\frac{2}{9}$ b. $\frac{7}{9}$ c. 1 d. $\frac{9}{7}$ e. NOTA

8. The value of y which will satisfy the equations: $2x^2 + 6x + 5y + 1 = 0$ may be found by solving?
 $2x + y + 3 = 0$

- a. $y^2 + 14y - 7 = 0$ b. $y^2 + 8y + 1 = 0$ c. $y^2 + 10y - 7 = 0$ d. $y^2 + y - 12 = 0$ e. NOTA

9. The number of terms in the expansion of $[(a + 5b)^2 (a - 5b)^2]^2$ when simplified is?

- a. 4 b. 5 c. 6 d. 7 e. NOTA

10. The equation $n + \sqrt{n - 2} = 4$ has?

- a. One real root b. two real roots c. 2 imaginary roots
d. one real and one imaginary e. NOTA

11. Simplify: $\frac{3 - \sqrt{2}}{4 + \sqrt{2}}$.

- a. $\frac{2 - \sqrt{2}}{2}$ b. $1 - \sqrt{2}$ c. $\frac{10 - \sqrt{2}}{8}$ d. $\frac{10 - \sqrt{2}}{18 + 8\sqrt{2}}$ e. NOTA

12. The ratio of the radii of two concentric circles is 1:3. If \overline{LU} is a diameter of the larger circle, \overline{MU} is a chord of the larger circle that is tangent to the smaller circle and $LM = 12$, then the radius of the larger circle is?

- a. 13 b. 18 c. 21 d. 24 e. NOTA

13. How many pairs of positive integers (x,y) with $x + y \leq 100$ satisfy the equation $\frac{x + y^{-1}}{x^{-1} + y} = 13$?

- a. 1 b. 5 c. 7 d. 9 e. NOTA

14. Simplify: $\frac{1}{i^{2017}}$.

- a. i b. -i c. 1 d. -1 e. NOTA

15. Simplify: $\frac{4^{-2}a^3b^{-3}}{2^3(ab^{-2})^2} \cdot \frac{(a^3b^3)^{-1}}{(8a)^{-3}}$

- a. $\frac{4}{b^2}$ b. $\frac{4a}{b^4}$ c. $\frac{a}{16b^2}$ d. $\frac{4a}{b^2}$ e. NOTA

16. In triangle ZLU, the degree measures of angle Z, L and U are 100, 50 and 30 respectively. If ZW is an altitude and LM is a median, what is the degree measure of angle MWU=?

- a. 15 b. 22.5 c. 30 d. 45 e. NOTA

17. For how many integers k between 1 and 100 does $y^2 + y - k$ factor into the product of two linear factors with integer coefficients?

- a. 1 b. 2 c. 9 d. 10 e. NOTA

18. Thirteen Gemini teams, each consisting of one boy and one girl, won trophies. On stage each girl shook hands with everyone except her Gemini teammate, and no handshakes took place between boys. How many handshakes were there among the 26 people on stage getting trophies?

- a. 78 b. 185 c. 234 d. 312 e. NOTA

19. How many lattice points are on the line segment (including endpoints) whose endpoints are (5,19) and (50, 283). A lattice point is a point with integer coordinates.

- a. 2 b. 4 c. 6 d. 16 e. NOTA

20. In triangle ZLU, the degree measure of angle ZLU equals 120, $ZL = 3$ and $LU = 4$. If perpendiculars constructed to \overline{ZL} at Z and to \overline{LU} at U meet at M, then $MU = ?$

- a. 3 b. $\frac{8\sqrt{3}}{3}$ c. 5.5 d. $\frac{10\sqrt{3}}{3}$ e. NOTA

21. Given X and Y are real numbers and $i = (X + Yi)^2$. What does $X^2 + Y^2 = ?$

- a. 0 b. 1 c. $\sqrt{2}$ d. 2 e. NOTA

22. Which of the following matrices does not have a multiplicative inverse?

- a. $\begin{pmatrix} -4 & -2 \\ -2 & 1 \end{pmatrix}$ b. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ c. $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ d. $\begin{pmatrix} -2 & -4 \\ 4 & 8 \end{pmatrix}$ e. NOTA

23. Find the sum of all x and y-intercepts of : $y = |3x - 5|$

- a. $\frac{-20}{3}$ b. $\frac{-5}{3}$ c. $\frac{5}{3}$ d. $\frac{20}{3}$ e. NOTA

24. Find the value of n such that the vertex of the given parabola lies on the x-axis:

$$y = x^2 + 2nx + (n^2 - 9n + 9)$$

- a. $\frac{-2}{3}$ b. 1 c. 2 d. 3 e. NOTA

25. Simplify: $\left(\frac{e^y + e^{-y}}{2}\right)^2 - \left(\frac{e^y - e^{-y}}{2}\right)^2$

- a. -1 b. 0 c. 1 d. e e. NOTA

26. A factor of: $a^2 - b^2 + c^2 - x^2 - 2ac + 2bx$ is?

- a. $a-c+x-b$ b. $a-c-x-b$ c. $a+c+x-b$ d. $a+c-x-b$ e. NOTA

27. The number of cubic feet in the volume of a cube is the same as the number of square inches in its surface area. The length of the edge in feet is?

- a. 6 b. 72 c. 144 d. 864 e. NOTA

28. A rhombus has side length 13 and two diagonals of length 8 and L. Which interval below does L lie in?

- a. (5,10) b. (10,15) c. (15,20) d. (20,25) e. NOTA

29. Find the number of intersection points for the following equations:

$$x^2 + y^2 - 8x - 65 = 0$$

$$x^2 + y^2 - 16x - 10y + 73 = 0$$

- a. 0 b. 1 c. 2 d. 4 e. NOTA

30. If $|2m+n+6| + |2m-n-14| = 0$, what is the value of $|m+n|$?

- a. 0 b. 2 c. 8 d. 12 e. NOTA