Instructions: In each question, choice E (NOTA) stands for None of These Answers. In #19 and #22, $i=\sqrt{-1}$.

1. Each asymptote of the hyperbola $\frac{(x-3)^2}{9}-\frac{(y-2)^2}{4}=1$ intersects the line 3y+7x=8 once. What is the sum of the abscissas of these two intersection points?

A. $\frac{4}{3}$ B. $\frac{4}{45}$ C. $\frac{4}{5}$ D. $\frac{68}{15}$ E. NOTA

2. In an infinite geometric series, the first term is 24 and the fifth term is 3/2. What is the sum of this series?

A. 48 B. 36 C. 16 D. Cannot be Determined E. NOTA

3. The circle $x^2+y^2=R^2$ is comprised of infinitely many points (x,y). What is the maximum value of xy?

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

4. Simplify $\frac{\tan(x)\cos(x)}{\csc(x)}-\frac{\cot(x)\sin(x)}{\sec(x)}$, where it exists.

A. 1 B. tan(x) C. sin(2x) D. -cos(2x) E. NOTA

5. Which of the following statements are true about the vectors P, <3,1,4> and Q, <4,-4,-2>, anchored at the origin?

I. P and Q are orthogonal
II. P and Q are parallel
III. P and Q are coplanar
IV. Q x P = P x Q

A. I only B. I, III, IV only C. I, III only D. II, III, IV only E. NOTA

6. What is the product of the amplitude and period of the graph of $y = 6\sin(3x) + 8\cos(3x)$?

A. $\frac{20\pi}{3}$ B. 30 C. $\frac{16\pi}{3}$ D. 24 E. NOTA

7. If sin(x) equals 4/7, and x is in quadrant II, what is tan(x)?

A. $\frac{\sqrt{33}}{7}$ B. $\frac{-\sqrt{33}}{7}$ C. $\frac{4}{\sqrt{33}}$ D. $\frac{-4}{\sqrt{33}}$ E. NOTA

8. Given that f(x) is the inverse of g(x), if $f(x) = \frac{3x}{x+2}$, what is g(1) + g(2)?

A. 2.5 B. 5 C. 6 D. 7 E. NOTA

9. What is $\sum_{n=1}^{2004} \cos(\frac{n\pi}{4})$?

A. 0 B. $\sqrt{2}$ C. $\sqrt{2}-1$ D. –1 E. NOTA

10. A baseball manager decides his team is doing so badly that something must be wrong with his batting order. However, he does not know what to do, so he decides to randomly arrange the order of his nine hitters. What is the probability that at most two batters are in a different spot than their original positions after the randomization?

A. $\frac{43}{9!}$ B. $\frac{37}{9!}$ C. $\frac{36}{9!}$ D. $\frac{73}{9!}$ E. NOTA

11. What is the hundredths digit of the sum of the two largest angles (in degrees) in the triangle with sides of length 9, 10, and 12?

A. 1 B. 4 C. 7 D. 0 E. NOTA

12. What is the period of the graph of $y = \frac{\sin(9x)+\sin(3x)}{\cos(9x)+\cos(3x)}$?

A. $\frac{\pi}{12}$ B. $\frac{\pi}{6}$ C. $\frac{\pi}{4}$ D. $\frac{\pi}{3}$ E. NOTA

13. If $\begin{vmatrix} 3 & 5 & 1 \\ x & 0 & -3 \\ 2 & x & 6 \end{vmatrix} = 0$, what is the sum of the possible values of x?

A. 21 B. -39 C. -21 D. 39 E. NOTA

14. Which of the following has the same value as 786_9?

A. 1440_5 B. 547_{11} C. 2553_6 D. 11000100100_2 E. NOTA

15. Consider rectangle ABCD, AB = 4 and BC = 7. Extend the line segment BA past point A to point E such that BE = AD. Now, extend the line segment BD past point D to point F such that DF = AC. If points E and F are connected, what is the length between them, to the nearest hundredth?

A. 14.04 B. 29.41 C. 14.52 D. 29.28 E. NOTA

16. If the shortest distance from the latus rectum to the directrix of a parabola is 6, what is the length of the latus rectum?

A. 3 B. 6 C. 12 D. Cannot be determined E. NOTA

17. The function $f(x) = 9x^2 - x$ is reflected about the line y=x and then about the x-axis to form a new relation, y = ?

A. $9x^2 + x$ B. $\frac{-1 \pm \sqrt{1+36x}}{3}$ C. $\frac{-1 \pm \sqrt{1+6x}}{3}$ D. $\frac{-1 \pm \sqrt{1+36x}}{18}$ E. NOTA

18. What is the area enclosed by the graph of $r^2 = \frac{225}{16\cos^2(\theta)+9}$?

A. 15π B. 25π C. 16π D. 12π E. NOTA

19. Which of the following is a fourth root of $8 + 8\sqrt{3}\,i$?

A. $4\text{cis}(\frac{\pi}{6})$ B. $2\text{cis}(\frac{\pi}{12})$ C. $2\text{cis}(\frac{\pi}{24})$ D. $4\text{cis}(\frac{\pi}{12})$ E. NOTA

20. If $\tan(\frac{x}{2}) = \sqrt{5}$, what is $\sin^2(x)$?

A. $\frac{8}{9}$ B. $\frac{4}{9}$ C. $\frac{2}{3}$ D. $\frac{9}{25}$ E. NOTA

21. If n>1 and $\log_n 3 = x$, $\log_n 5 = y$, and $\log_n 8 = z$, which of the following is equivalent to $\log_n \frac{108}{25}$?

A. 4xyz B. $3x + z - 2y$ C. $3x + \frac{2}{3}z - 2y$ D. $3x + \frac{2}{3}z - \frac{1}{2}y$ E. NOTA

22. The polynomial with rational coefficients $x^4 + Ax^3 + Bx^2 + Cx + D$ has 2 roots $1+3i$ and $2-5i$. What is the value of A + D?

A. 296 B. 284 C. –284 D. –296 E. NOTA

23. What is $\lim_{x\to 5^+} \frac{x^2 - 6x + 5}{x^2 - 2x + 15}$?

A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. 1 D. Does not Exist E. NOTA

24. What is the determinant of the product of the inverse and transpose (in that order) of the matrix $\begin{bmatrix} 4 & 1 \\ 6 & 3 \end{bmatrix}$?

A. 1 B. 2 C. 3 D. 6 E. NOTA

25. What is the constant term in the expansion of $(4x^2 - \frac{5}{x})^6$?

A. 160,000 B. 96,000 C. 216,000 D. 150,000 E. NOTA

26. If $2f(x) = xf(x+1) + 6$, what is f(-4)?

A. 3 B. $\frac{3}{2}$ C. $\frac{3}{4}$ D. $-\frac{3}{4}$ E. NOTA

27. In polar coordinates, roses can be written as $r = \cos(b\theta)$, where b is a positive integer. How many leaves can a rose of this type not have?

A. 10 B. 9 C. 8 D. 7 E. NOTA

28. What is the value of $(1+\mathbf{i})^{12}$?

A. 4096 B. 128 C. 64 D. 1024 E. NOTA

29. What is the natural domain of the function $f(x) = \dfrac{\sqrt{3-x}}{\sqrt{(x+2)}\sqrt[3]{x}}$?

A. (-2,0) U (0,3] B. (-2,3] C. (0,3] D. (0,3) E. NOTA

30. On the graph parametrically defined by x=2cos(3t) and y = 2sin(3t), a point begins at t = 0. At which of the following values of t does the point return to its original location?

A. $\dfrac{\pi}{3}$ B. $\dfrac{2\pi}{3}$ C. π D. The point never returns to its original location
E. NOTA