

If no correct answer is given, choose E. NOTA

1. For b and c real numbers, the equation $x^2 + 2bx + c = 0$ has two complex roots if and only if
 - A. $b^2 < c$
 - B. $b^2 < 2c$
 - C. $b^2 < 3c$
 - D. $b^2 < 4c$
 - E. NOTA

2. Of the closed intervals given below, which most closely fits the range of $f(x) = \cos|\sin x|$?
 - A. $[0.3, 1]$
 - B. $[0.4, 1]$
 - C. $[0.5, 1]$
 - D. $[0.6, 1]$
 - E. NOTA

3. Given triangle ABC with side a opposite angle A , side b opposite angle B , and side c opposite angle C . Which of the following is/are true?
 - I. $a \sin A = b \sin B$
 - II. The area of triangle ABC is $0.5 ab \sin C$
 - III. $a^2 = b^2 + c^2 - 2bc \cos A$
 - IV. $a + b > c$
 - A. I only
 - B. II and IV only
 - C. II and III only
 - D. II, III, and IV only
 - E. NOTA

4. Chip surfed the net and found this equation to approximate the circumference of an ellipse: $C \approx \pi[3a + 3b - \sqrt{(a + 3b)(b + 3a)}]$, where a and b are the lengths of the semi axes. With this in mind, the circumference of the ellipse with equation $x^2 + 4y^2 = 64$ is near
 - A. 12
 - B. 17
 - C. 39
 - D. 65
 - E. NOTA

5. The graph of the relation given parametrically by the equations $x = \sin^2 t + 1$ and $y = \cos^2 t + 3$ is a
 - A. line
 - B. circle
 - C. parabola
 - D. hyperbola
 - E. NOTA

6. Tulip needed to rationalize a fraction with numerator 1 and denominator $1 + \sqrt{2} - \sqrt{3}$. She first multiplied both numerator and denominator by $1 + \sqrt{2} + \sqrt{3}$. To complete the task she still needed to multiply both numerator and denominator by
 - A. $\sqrt{2}$
 - B. $1 + \sqrt{2}$
 - C. $\sqrt{3}$
 - D. $1 + \sqrt{3}$
 - E. NOTA

7. When the 18th term of the geometric sequence $1, 1998, 1998^2, 1998^3, \dots$ is expanded, the unit's digit of the resulting calculation is
 - A. 2
 - B. 4
 - C. 6
 - D. 8
 - E. NOTA

8. If $i = \sqrt{-1}$, then $\sum_{n=0}^{100} i^n =$
- A. i B. -1 C. 0 D. 1 E. NOTA
9. The domain of the function $f(x) = \log(\sin x)$ is [Note: k is an integer.]
- A. $(2k\pi, (2k+1)\pi)$ B. $[2k\pi, (2k+1)\pi]$ C. $((2k-1)\pi, 2k\pi)$
D. $[(2k-1)\pi, 2k\pi]$ E. NOTA
10. Given: $g(1) = 3$, and, for $n > 1$, $g(n) = \frac{g(n-1) + g(1)}{1 + g(n-1)g(1)}$. The value of $g(3)$ is
- A. $\frac{2}{3}$ B. $\frac{3}{5}$ C. $\frac{9}{7}$ D. $\frac{15}{11}$ E. NOTA
11. The measure of the acute angle, to the nearest degree, formed by the graph of $y = 25x + 14$ and the X-axis is
- A. 78 B. 80 C. 85 D. 88 E. NOTA
12. A given parallelogram has sides of length 135 and 115, and an acute angle with measure 25 degrees. To the nearest integer, what is the length of the longer diagonal?
- A. 235 B. 244 C. 248 D. 252 E. NOTA
13. A triangle is inscribed in a parabola with vertices the end points of the latus rectum and the vertex of the parabola. If the focal distance of the parabola is p , then the area of the triangle is
- A. p^2 B. $2p^2$ C. $3p^2$ D. $4p^2$ E. NOTA
14. Consider the Fibonacci sequence: 1, 1, 2, 3, 5, ... The twelfth term is
- A. less than 125 B. greater than 144 C. a perfect cube D. a prime number E. NOTA
15. If $\sin 4x = \sin 2x$, and $\sin 2x \neq 0$, then $\cos 2x$ equals
- A. 0 B. $\frac{1}{2}$ C. $\frac{\sqrt{2}}{2}$ D. $\frac{\sqrt{3}}{2}$ E. NOTA

16. The eccentricity of a parabola is always

- A. -1 B. 0 C. 1 D. > 1 E. NOTA

17.
$$\begin{bmatrix} \sin x & \cos x \\ \cos x & \sin x \end{bmatrix} \begin{bmatrix} \sin x \\ \cos x \end{bmatrix} =$$

- A. $\begin{bmatrix} 1 \\ 2 \sin x \end{bmatrix}$ B. $\begin{bmatrix} 1 \\ \sin 2x \end{bmatrix}$ C. $\begin{bmatrix} \cos x \\ \sin x \end{bmatrix}$ D. $\begin{bmatrix} \cos 2x \\ \sin 2x \end{bmatrix}$ E. NOTA

18. The period of the function $f(x) = a \sin(bx + c)$ is

- A. $\frac{2\pi}{a}$ B. $\frac{2\pi}{b}$ C. $\frac{2\pi}{c}$ D. $\frac{2\pi}{b+c}$ E. NOTA

19. The coordinates of the center of the ellipse defined by the equation $x^2 - 4x + 4y^2 - 24y = -28$ are

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

20. Suppose 1998 degrees are changed to radians. The result, rounded to the nearest hundredth, is

- A. 17.44 B. 34.87 C. 69.74 D. 138.48 E. NOTA

21. At Betty Boop's party, Betty, her two children, and 4 guests are to be seated around a round table. If Betty is to be seated between her two children, how many different seating arrangements exist?

- A. $2(4!)$ B. $2(5!)$ C. $2(6!)$ D. $2(7!)$ E. NOTA

22. The range of $f(x) = a \sin(bx+c) + d$ is

- A. $[-a,a]$ B. $[-a-d,a+d]$ C. $[-a+d,a+d]$ D. $[-a-c-d,a+c+d]$ E. NOTA

23. $\frac{(y-3)^2}{25} - \frac{(x+1)^2}{4} = 1$ is the equation of a hyperbola. The measure of the acute angle, rounded to the nearest degree, formed by the intersection of its asymptotes is

- A. 22 B. 34 C. 42 D. 44 E. NOTA

24. Given: $f(x) = 2x + 7$; $g(x) = x^2$. The set of x such that $g(f(x)) = f(x)$ is
- A. $\{-4, -3\}$ B. $\{-3.5, -3\}$ C. $\{-1, 1\}$ D. $\{0, 1\}$ E. NOTA
25. The distance from the point $(2, 3)$ to the graph of the line with equation $5x = 12y$ is
- A. 1 B. 1.8 C. 2 D. $\frac{46}{13}$ E. NOTA
26. Suppose (a, b) is a point on the circle with equation $(x-2)^2 + (y-8)^2 = 4$. The slope of the tangent to the circle at point (a, b) is
- A. $\frac{2-a}{b-8}$ B. $\frac{2-a}{8-b}$ C. $\frac{b-8}{a-2}$ D. $\frac{8-b}{a-2}$ E. NOTA
27. If $f(x) = \log(x+2)^3$, then $f^{-1}(x) =$
- A. $\frac{1}{\log(x+2)^3}$ B. $\sqrt[3]{\log(x+2)}$ C. $\sqrt[3]{10^x} - 2$ D. $\sqrt[3]{10^x} - 2$ E. NOTA
28. Consider the rectangle bounded by the graphs of $x = -2$, $x = 4$, $y = 0$, and $y = 2$. Let P equal the volume of the cylinder generated by revolving the rectangle about the line $x = 1$. Let Q equal the volume of the cylinder generated by revolving the rectangle about the line $y = 0$. By how many cubic units is Q greater than P ?
- A. 0 B. 3π C. 6π D. 9π E. NOTA
29. If $a^6 + b^6$ is factored over the set of real numbers, one of the prime factors is
- A. $a + b$ B. $a^2 + b^2$ C. $a^3 + b^3$ D. $a^4 + b^4$ E. NOTA
30. Two trees of equal height stand on a level plane 50 feet apart. One, cut off at ground level falls against the other and lodges at a point 20 feet from its top. What is the original height of the trees?
- A. 42.5 ft. B. 52.5 ft. C. 62.5 ft. D. 72.5 ft. E. NOTA