NOTE: "E) NOTA" denotes None of These Answers

1) Given that $f(x) = 2x^2 - 16x + 7$, find the minimum value of $f(x)$.

A) -25 B) -4 C) $\frac{3}{2}$ D) 7 E) NOTA

2) Determine the value of $7k$ if $\begin{vmatrix} 3 & 2 & 7 \\ k & -1 & k \\ 0 & 1 & -4 \end{vmatrix} = -2k + 4$.

A) -4 B) $\frac{-4}{7}$ C) $\frac{4}{7}$ D) 4 E) NOTA

3) The Bank of Springfield offers money market accounts that yield an interest rate of 6.5% per annum, compounded continuously. Sideshow Bob wants to have \$1,000,000 in 20 years when he retires. Assuming he makes no further deposits or withdrawals after his initial deposit, what is the minimum amount he has to invest now to have his \$1,000,000? (Round to the nearest dollar, assume 365.000 days in a year if needed)

A) \$260,070 B) \$272,532 C) \$323,471 D) \$3,669,297 E) NOTA

4) Evaluate the following: $\lim_{x \to 0^+} \frac{\sin(x)}{x}$.

A) -1 B) 0 C) 1 D) ∞ E) NOTA

5) Simplify the following expression: $\frac{\cot(x)(1+\tan^2 x)}{\sec(x)}$.

A) sec(x) B) csc(x) C) tan(x) D) cot(x) E) NOTA

6) The following system of equations has a solution of the form (x, y), find $x + y$: $\begin{cases} 3x+4y-6=0 \\ 4x-3y+17=0 \end{cases}$

A)-2 B) -1 C) 0 D) 1 E) NOTA

7) It is known that y is directly proportional to the cosine of three times another variable, x. Furthermore, it is know that when $x = \frac{\pi}{4}$, $y = \frac{-3\sqrt{2}}{2}$. Find the value of x when $y = -3$. (Assume that $0 \le x < \pi$.)

A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{2}$ E) NOTA

8) Find the y-intercept of the line perpendicular to $5x-2y+3=0$ and passing through the point (4, 7).

A) -3 B) $\frac{26}{5}$ C) $\frac{31}{5}$ D) $\frac{43}{5}$ E) NOTA

For questions # 9, 10, 11 use the fact that there are two vectors, $\vec{u}$ and $\vec{v}$ and that $\vec{u} = 2\mathbf{i} + 5\mathbf{j} - \mathbf{k}$ and $\vec{v} = -2\mathbf{j} + 4\mathbf{k}$

9) What is the dot product of the vectors $\vec{u}$ and $\vec{v}$?

A) -14 B) -10 C) -8 D) 0 E) NOTA

10) What is the cross product of the vectors $\vec{u}$ and $\vec{v}$ (e.g. $\vec{u} \times \vec{v}$)?

A) $-18\mathbf{i} + 8\mathbf{j} + 4\mathbf{k}$ B) $2\mathbf{i} + 3\mathbf{k}$ C) $-2\mathbf{i} - 3\mathbf{k}$ D) $18\mathbf{i} - 8\mathbf{j} - 4\mathbf{k}$ E) NOTA

11) What is the angle (to the nearest whole degree) between these two vectors in Cartesian space?

A) 10° B) 55° C) 125° D) 145° E) NOTA

12) Let $f(x) = x^6 + x^5 - 2x^4 + 3x^2 + x - 1$. Determine the remainder when $f(x)$ is divided by the factor $(x-2)$.

A) -77 B) -22 C) 22 D) 77 E) NOTA

13) Find x given the following: $x = \sqrt{30 - \sqrt{30 - \sqrt{30 - \sqrt{30 - \ldots}}}}$

A) $x = -5$ B) $x = 5$ C) $x = \{-5, 5\}$ D) $x = \{\}$ E) NOTA

14) Find T given that $f(x+1) = 2x + 9 - \cos(x + 1 - \pi)$ and $f(T) = \pi + 7$.

A) T = 0 B) T = 1 C) $T = \frac{\pi}{2}$ D) $T = \pi$ E) NOTA

15) Which of the following angles is co-terminal with -727°?

A) -173° B) 7° C) 173° D) 353° E) NOTA

16) Find the 14th term in the geometric sequence: 81, 27, 9, 3 ...

A) 19683^{-1} B) 6561^{-1} C) 2187^{-1} D) 729^{-1} E) NOTA

17) Which of the following is an odd function?

A) $f(\Phi) = \text{cosine}(\Phi)$
B) $f(x) = [x]$ where $[\alpha]$ represents the greatest integer of α
C) $f(\gamma) = \gamma^{\gamma}$
D) $f(\delta) = e^{\delta}$ where "e" represents the natural logarithmic base, $e \approx 2.71$ ...
E) NOTA

18) Find the rectangular form of the polar equation $r = \cos(\theta)$.

A) $\left(x-\frac{1}{2}\right)^2+y^2=1$ B) $x^2+\left(y-\frac{1}{2}\right)^2=1$ C) $\left(x+\frac{1}{2}\right)^2+y^2=1$ D) $\left(x-\frac{1}{2}\right)^2+y^2=\frac{1}{4}$ E) NOTA

19) Find $u(w(v(-1)))$ given that $u(x) = 3x + 2$, $v(x) = x^3$, and $w(x) = x^{-1}$.

A) -1 B) $-\frac{1}{2}$ C) $\frac{1}{2}$ D) 1 E) NOTA

20) Find $(1 + i)^9$.

A) $-16 - 16i$ B) $-16 + 16i$ C) $16 - 16i$ D) $16 + 16i$ E) NOTA

21) Identify all the asymptotes of $y = \tan(2x)$.

A) $x=\pm\frac{\pi}{4}, y=0$ C) $x=\frac{n\pi}{4}$ where $n \in$ {odd integers} E) NOTA

B) $x=\pm\frac{\pi}{4}$ D) C) $x=\frac{n\pi}{4}$ where $n \in$ {even integers}

22) The degree measure 434° is changed to radians. What is the radial measure (to the nearest tenth)?

A) 3.8 B) 7.6 C) 15.1 D) 24866.4 E) NOTA

23) The complex number $5cis(45^\circ)$ can be expressed in a + bi form. Find a + b.

A) $\sqrt{2}$ B) $2\sqrt{2}$ C) $5\sqrt{2}$ D) $7\sqrt{2}$ E) NOTA

24) What is the value of $\left(\sqrt{-3}\right)\left(\sqrt{-27}\right)$?

A) -9i B) -9 C) 9 D) 9i E) NOTA

25) Which of the following is an equivalent expression for the following?

$$(\log_A B)(\log_B C)(\log_C D)(\log_D E)(\log_E F)\ldots(\log_R S)(\log_S T)$$

A) $A(B^2)(C^2)\ldots(R^2)(S^2)T$ C) $\log AT$ E) NOTA

B) $\log_A T$ D) $\log(A \bullet B \bullet \ldots \bullet S \bullet T)$

26) Evaluate: $\lim_{x\to\infty}\left(1-\frac{1}{x}\right)$

A) $-\infty$ B) 0 C) 1 D) ∞ E) NOTA

27) Evaluate: $\left|\begin{bmatrix}1 & 2\\ 2 & 1\end{bmatrix}^{-1}\right|$

A) -3 B) $-\frac{1}{3}$ C) $\frac{1}{3}$ D) 3 E) NOTA

28) Simplify the following: $\frac{3-5i}{2+7i}$

A) $\frac{-29-31i}{53}$ B) $\frac{-29+31i}{53}$ C) $\frac{29-31i}{53}$ D) $\frac{29+31i}{53}$ E) NOTA

29) Evaluate the following: $\lim_{x\to 4^+}\frac{(x-2)(x+3)}{(x+2)(x-3)(x-4)}$

A) -∞ B) 0 C) 1 D) ∞ E) NOTA

30) Which of the following functions has a range of [-3,7]?

A) $f(x) = -10\sin(x) + 2$
B) $f(x) = 10\sin(x) - 2$
C) $f(x) = -5\cos(x) + 2$
D) $f(x) = \cos(5x) + 2$
E) NOTA