

All questions were "borrowed" from past tests. "NOTA" denotes "None of these Answers."

- What is the range of the function $f(x) = x^2 - 4x + 11$?
A. $[11, \infty)$ B. $[0, \infty)$ C. $[7, \infty)$ D. $(-\infty, 7]$ E. NOTA
- $f(x) = f(x-1) + x^2$, for $x > 2$. $f(2) = 5$. Find $f(5)$.
A. 30 B. 34 C. 55 D. 62 E. NOTA
- What is the tangent of the acute angles formed when the two lines whose equations are $3x - 4y = 7$ and $2x + 3y = 8$ intersect?
A. $-\frac{17}{6}$ B. $\frac{1}{6}$ C. $\frac{17}{6}$ D. $\frac{17}{18}$ E. NOTA
- What is $\ln|3e^{5i+2} \cdot 7e^{-2i}|$?
A. $2 + \ln 21 + 3i$ B. $\sqrt{13} + \ln 21$ C. $2 + \ln 21$ D. $\ln 21$ E. NOTA
- What is the equation of the directrix of the parabola $y^2 + 4y + 8x + 28 = 0$?
A. $x = -1$ B. $y = 0$ C. $x = 1$ D. $x = 3$ E. NOTA
- Which of the following is an equation of the plane perpendicular to the vector $\langle 1, -2, 3 \rangle$ and passing through the point $(2, -3, -4)$?
A. $x - 2y + 3z = -4$ B. $x - 2y + 3z = 14$ C. $2x - 3y - 4z = 29$
D. $2x - 3y - 4z = 6$ E. NOTA
- Find x if $\frac{e^x + e^{-x}}{e^x - e^{-x}} = 2$
A. 1 B. $\frac{\ln 3}{2}$ C. $2\ln 3$ D. $\ln 3$ E. NOTA
- Evaluate $\cos^2(1^\circ) + \cos^2(2^\circ) + \cos^2(3^\circ) + \dots + \cos^2(90^\circ)$.
A. $\frac{99}{2}$ B. $\frac{105}{2}$ C. 255 D. $\cos(45.5^\circ)$ E. NOTA
- For $0 < x < \frac{\pi}{2}$, $\frac{\sin(x)+1}{\sin(x)-1} + \frac{1}{1-\sin(x)} = -1$, give the value of $\frac{3x}{4\pi}$.
A. $\frac{1}{8}$ B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. 1 E. NOTA

10. Twelve distinct points lie on a circle. How many distinct inscribed convex quadrilaterals are determined with vertices at these points?
A. 240 B. 48 C. 11880 D. 2970 E. NOTA
11. Which of the following matrices does not have a multiplicative inverse?
A. $\begin{bmatrix} -4 & -2 \\ -2 & 1 \end{bmatrix}$ B. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ C. $\begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$ D. $\begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix}$ E. NOTA
12. Evaluate: $\sum_{k=1}^{\infty} 2\left(\frac{1}{3}\right)^{k-1}$
A. 1 B. 2 C. 6 D. 3 E. NOTA
13. Many ancient cultures used a counting system based on the number 6 (in contrast to our base 10 system). How many days (in base 6) would these ancient astronomers say are in one "leap" year?
A. 1405 B. 365 C. 366 D. 1404 E. NOTA
14. Find $\tan(2\theta)$, if θ is the first-quadrant angle needed to rotate the axes through and eliminate the xy -term of $5x^2 + 3xy + 4y^2 + 2x + 5y - 10 = 0$.
A. 3 B. -3 C. $\frac{1}{3}$ D. $-\frac{1}{3}$ E. NOTA
15. Find the EXACT value of $\tan(165^\circ)$.
A. $2\sqrt{3}$ B. $\sqrt{3}-2$ C. $2-\sqrt{3}$ D. $\frac{2\sqrt{3}}{3}$ E. NOTA
16. A crazy heptagon with vertices located at $(-6,2)$, $(-3,-2)$, $(2,-3)$, $(4,-1)$, $(3,4)$, $(1,6)$, and $(-2,7)$ has been mysteriously revolved around the line $7x - 7y - 70 = 0$. The area of the heptagon is $\frac{131}{2}$. A visit from the Calculus Fairy reveals that the volume of such a figure can be found by the formula $V = 2\pi \cdot MN$, where M is the distance from the centroid of the heptagon to the line and N is the area of the heptagon. Find the volume of this polygonal taurus.
A. 131π B. $4108\pi\sqrt{2}$ C. 100π D. $786\pi\sqrt{2}$ E. NOTA
17. If $\log_b(\sin(x)) = a$, solve for $\frac{\cos^2(x)}{1+\sin(x)}$ in terms of a and b . (Note: $0 < x < \frac{\pi}{2}$)
A. $1-b^a$ B. b^a C. $1-a^b$ D. $\log_a(b)$ E. NOTA

18. Find the minimum distance between $f(x) = x^2 - 8$ and the point $(0,5)$.
- A. $\frac{1}{2}$ B. $\frac{3\sqrt{2}}{2}$ C. $\frac{5\sqrt{2}}{2}$ D. $\frac{\sqrt{51}}{2}$ E. NOTA
19. How many lines of symmetry does the graph of the polar equation $r = \cos(6\theta)$ have?
- A. 0 B. 6 C. 12 D. 24 E. NOTA
20. Simplify: $(4\text{cis}(217^\circ))(7\text{cis}(98^\circ))\left(\frac{1}{2}\text{cis}(53^\circ)\right)$.
- A. $14\text{cis}(378^\circ)$ B. $14\text{cis}(8^\circ)$ C. $\frac{23}{2}\text{cis}(368^\circ)$ D. $28\text{cis}(278^\circ)$ E. NOTA
21. How many five digit numbers between 56,000 and 60,000 can be made given that no number can have a digit repeated within itself?
- A. 2880 B. 2688 C. 1680 D. 1344 E. NOTA
22. Find the average value of 1 over $[-1,8]$
- A. 0 B. 9 C. 1 D. $\frac{1}{9}$ E. NOTA
23. Evaluate: $\lim_{x \rightarrow 0} \frac{2 \sin x \cos x}{2x}$.
- A. 0 B. 1 C. 2 D. Undefined E. NOTA
24. If $x + y = 4$ and $xy = 2$, what is $x^6 + y^6$?
- A. 576 B. 1584 C. 1728 D. 4096 E. NOTA
25. A cone has a constant volume of 6π cubic inches but both the height and radius are changing at constant rates. At the instant when the height of the cone is 2 inches, the radius is increasing at a rate of 3 inches per minute. In inches per minute, how fast is the height decreasing at this same instant?
- A. $\frac{4}{3}$ B. 4 C. 12 D. 36 E. NOTA

26. Find the value k such that the remainder of $(2x^4 - kx^2 - 4x + 2) \div (x - 2)$ is 6.
- A. 4 B. 5 C. 6 D. 7 E. NOTA
27. A particle moves along a path defined parametrically by $x = \sec(\pi t)$ and $y = \tan(\pi t)$ for $0 \leq t \leq \frac{1}{2}$. The path of the motion is along a part of a
- A. line B. circle C. parabola D. hyperbola E. NOTA
28. If $K = \log(n!) - \log(n-1) - \log(n-2) - \dots - \log 1$ for $n > 20$, then $K =$
- A. 0 B. 1 C. $\log(n)$ D. $\log(n!)$ E. NOTA
29. If the $P(A) = .4$, $P(A|B) = .3$, and $P(B|A) = .6$, what is $P(B)$?
- A. Cannot be determined B. .6 C. .7 D. .8 E. NOTA
30. The area bounded by the curve $y = \sqrt{16 - x^2}$ and the x axis is
- A. 32π B. 4π C. 16π D. 8π E. NOTA