

1. Simplify: $4^a \cdot 8^{-a}$

A. $\frac{1}{2^a}$

B. 2^a

C. 1

D. 32^{-a^2}

E. nota

2. If $b = \frac{cd - a}{c - 1}$ and $d = ac^n - 1$, $c \neq 1$. Express b in terms of a , c , and n only.

A. $b = a \left(\frac{c^n - 1}{c - 1} \right)$

D. $b = a(c^{n-1} - 1)$

B. $b = a \left(\frac{c^{2n-1} - 1}{c - 1} \right)$

E. nota

C. $b = a \left(\frac{c^n}{c - 1} \right)$

3. An open box is made by cutting a 4-inch square from each corner of a square piece of tin. If the volume of the box must be 900 cubic inches, what must be the length of one side of this square of tin.

A. 15 inches

B. 19 inches

C. 23 inches

D. 34 inches

E. nota

4. Let P be a polynomial function such that, for all real x ,

$$P(x^2 - 1) = x^4 + 5x^2 + 3$$

For all real x , $P(x^2 + 1)$ is:

A. $x^4 + 9x^2 + 17$

D. $x^4 + x^2 + 3$

B. $x^4 + x^2 - 3$

E. nota

C. $x^4 + 9x^2 + 13$

5. If $f(x) = 1/x$ and $g(x) = (x^2 + x - 6)^{-1}$, what is the domain of $f[g(x)]$ if $x \in \mathbb{R}$?
- A. \mathbb{R} B. $\mathbb{R}, x \neq 0$ C. $\mathbb{R}, x \neq 0, 3$
 D. $\mathbb{R}, x \neq -3, 0, 2$ E. nota
6. Find the 4th term of the expansion of: $(x - 2y)^{12}$
- A. $-5280x^9y^3$ B. $-1760x^9y^3$ C. $-1320x^9y^3$ D. $660x^9y^3$ E. nota
7. Find the a_{33} element of the adjoint of A if $A = \begin{bmatrix} 1 & 3 & 1 \\ 2 & 2 & 2 \\ 1 & 3 & 3 \end{bmatrix}$
- A. $-1/8$ B. 0 C. $1/2$ D. -4 E. nota
8. Evaluate $i^{434} - i^{431}$
- A. 0 B. $1+i$ C. $-1-i$ D. $-1+i$ E. nota
9. Find the slope of the line perpendicular to the line passing through $(1, 3)$ and $(-2, 7)$.
- A. $4/3$ B. $-4/3$ C. $3/4$ D. $-3/4$ E. nota
10. If the partial sums of an infinite series are recursively defined as follows:

$$S_1 = 1, S_{n+1} = S_n + (1/3)^n \text{ for } n = 1, 2, 3, \dots$$

Find the number to which this series converges.

- A. $2/3$ B. 1 C. $3/2$ D. does not exist
 E. nota

11. What is the sum of the first 50 positive odd integers?
 A. 1275 B. 2475 C. 2500 D. 5000 E. nota
12. How many distinguishable permutations of 6 objects taken 2 at a time are possible if 3 of the objects are identical?
 A. 12 B. 13 C. 20 D. 30 E. nota

13. Which of the following statements is always true?

A. For any real numbers a , b , and x , except $x \neq -2$, and $x \neq -2(a + b)$, then:

$$\frac{3(a + b)}{x + 2(a + b)} = \frac{3}{x + 2}$$

B. For any real number x , $\sqrt{x^2} = x$

C. If a and b are real numbers $a^2 \neq b^2$, $a \neq b$, then: $\frac{a + b}{a - b} = -\frac{(a + b)^2}{b^2 - a^2}$

D. If x is a real number, then $-x$ is negative

E. nota

14. If i is a root of the equation $x^4 - 2x^3 - 2x - 1 = 0$, find the other roots.

A. $\{-1, 2, -2\}$ B. $\{-1, \sqrt{2}, -\sqrt{2}\}$ C. $\{-1, 1 + \sqrt{2}, 1 - \sqrt{2}\}$

D. $\{-1, 2 + i, 2 - i\}$ E. nota

15. If $n! = n(n - 1)(n - 2) \dots (1)$, in what digit does $794!$ end?

A. 1 B. 2 C. 4 D. 6 E. nota

16. If two geometric means were inserted between 128 and -2 , their sum could be:

A. -24 B. 24 C. 12 D. -12 E. nota

17. Solve for x if: $x^{\log x} = \frac{x^4}{10000}$
- A. 1 B. 10 C. 100 D. 1000 E. nota
18. What is the area bounded by the graph of $9x^2 + 16y^2 = 144$?
- A. 12π B. 16π C. 25π D. 144π E. nota
19. During half of a trip a car travels at 70 mph. After receiving a speeding ticket, it travels the other half at 55 mph. What is the average speed of the car for the entire trip?
- A. 61.6 B. 62.5 C. 63.6 D. 66 E. nota
20. A drawer contains 9 red socks and six blue socks. What is the probability that if two socks are picked (without looking) from the drawer, both of the socks will be red?
- A. $8/25$ B. $3/5$ C. $12/35$ D. $3/7$ E. nota
21. What is the radius of the circle defined by the equation:
- $$4x^2 - 8x + 4y^2 + 4y - 27 = 0$$
- A. 8 B. 4 C. $4\sqrt{2}$ D. $2\sqrt{2}$ E. nota
22. A brine contains 54 pounds of water and 6 pounds of salt. Salt is added to obtain a 20% salt solution. How many pounds of salt were added?
- A. $7\frac{1}{2}$ B. 6 C. 3 D. 2 E. nota
23. If $\log_4 |2x + 5| - \log_4 |3x + 1| = \frac{1}{2}$, solve for x
- A. 0 B. $-\frac{1}{3}$ C. $-\frac{5}{2}$ D. $\frac{3}{4}$ E. nota

24. If $P(x) = 2x^4 - 3x^2 + Ax + B$, find values for A and B such that $P(-2) = 24$ and $P(2) = 20$.
- A. $A = 0, B = 0$ B. $A = 0, B = -2$ C. $A = -1, B = 2$
 D. $A = 1, B = -2$ E. nota
25. What is the first term of an arithmetic sequence whose seventh term is 3 and whose eleventh term is 1?
- A. 6 B. $7\frac{1}{2}$ C. $6\frac{1}{2}$ D. $6\frac{1}{4}$ E. nota
26. Find the sum of all the roots of the equation: $x^5 - 8x^3 - 6x^2 + 7x + 6 = 0$
- A. -8 B. 0 C. 6 D. 8 E. nota
27. If $A = \begin{bmatrix} 6 & -4 \\ -2 & 0 \end{bmatrix}$, and $I =$ identity matrix, find X such that $AX = I$
- A. $\begin{bmatrix} -3/4 & -1/4 \\ 1/2 & 0 \end{bmatrix}$ B. $\begin{bmatrix} 0 & -1/2 \\ 1/4 & 3/4 \end{bmatrix}$ C. $\begin{bmatrix} 0 & -4 \\ 2 & 6 \end{bmatrix}$
 D. $\begin{bmatrix} -6 & -2 \\ 4 & 0 \end{bmatrix}$ E. nota
28. In how many ways can the letters in the word EXCELLENT be arranged?
- A. 15,120 B. 30,240 C. 60,480 D. 362,880 E. nota
29. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $A = \{1, 3, 5, 7, 9\}$,
 $B = \{2, 4, 6, 8, 10\}$, and $C = \{1, 4, 7, 10\}$, find:
- (A' ∩ C) ∪ (B' ∩ C)
- A. A' B. B' ∩ C C. B ∩ C' D. C E. nota
30. $\frac{5 + 2i}{6 - i} = ?$ where $i = \sqrt{-1}$
- A. $\frac{32 - 7i}{37}$ B. $\frac{32 + 17i}{37}$ C. $\frac{32 + 17i}{35}$ D. $\frac{28 + 17i}{37}$ E. nota