

1. If the roots of a quadratic equation are real, rational, and unequal, then the discriminant of the equation may be:
A. -9 B. 0 C. 9 D. 13 E. NOTA
2. Solve the following system of equations:
$$\begin{aligned}x^2 - xy + y &= 5 \\ 2x + y &= 3\end{aligned}$$

A. $\left(-\frac{1}{3}, \frac{11}{3}\right), (2, -1)\}$ B. $\left(\frac{1}{3}, \frac{8}{3}\right), (-2, 7)\}$ C. $\{(2, 1)\}$
D. $\left(-\frac{1}{3}, \frac{11}{3}\right), (-2, 7)\}$ E. NOTA
3. Find 3 integers that form a geometric progression if their sum is 21 and the sum of their reciprocals is $\frac{7}{12}$.
A. $\{-3, -6, -12\}$ B. $\{3, 6, 12\}$ C. $\{4, 8, 9\}$ D. $\{-6, -3, -\frac{3}{2}\}$ E. NOTA
4. What is the fourth term in the expansion of $(3x - 2y)^6$?
A. $4320x^3y^3$ B. $-3240x^3y^3$ C. $3240x^3y^3$ D. $-4320x^3y^3$ E. NOTA
5. Which one of the following is not a function?
A. $\{(x, y): y = x^3 + 1\}$ B. $\{(x, y): y = x^2 + 1\}$ C. $\{(x, y): x = |y + 1|\}$
D. $\{(x, y): y = [x] + 1\}$ E. NOTA
6. Find the equation of the circle that passes through the points $A(0, 0)$; $B(4, 0)$; and $C(0, -8)$.
A. $(x - 2)^2 + (y + 4)^2 = 20$ B. $(x + 2)^2 + (y - 4)^2 = 40$
C. $(x - 4)^2 + (y + 2)^2 = 20$ D. $(x + 4)^2 + (y - 2)^2 = 40$ E. NOTA
7. Find the sum of the arithmetic series: $3 + 9 + 15 + \cdots + 99$.
A. 812 B. 816 C. 832 D. 846 E. NOTA

16. If $\log_{21} 7 = a$ and $\log_{21} 6 = b$, find $\log_{21} 2$ in terms of a and b .

- A. $a + b - 1$ B. $a + b + 1$ C. $\frac{a+1}{b}$ D. $ab + 1$ E. NOTA

17. Solve: $\frac{x}{x+6} + \frac{2x+3}{2x(x+6)} = \frac{1}{x-1}$

- A. $\{-1 \pm \frac{\sqrt{2}}{2}, 3\}$ B. $\{1 \pm \frac{\sqrt{2}}{2}, -3\}$ C. $\{-2 \pm \frac{\sqrt{2}}{2}, -5\}$
D. $\{2 \pm \frac{\sqrt{2}}{2}, 5\}$ E. NOTA

18. If $x = \frac{1-i\sqrt{3}}{2}$, where $i = \sqrt{-1}$, then find $\frac{1}{x^2-x}$.

- A. -2 B. -1 C. $1 + i\sqrt{3}$ D. 1 E. NOTA

19. If three, fair six-sided dice are rolled, what is the probability the sum of their face value is 10?

- A. $\frac{1}{216}$ B. $\frac{5}{216}$ C. $\frac{5}{108}$ D. $\frac{1}{36}$ E. $\frac{1}{8}$

20. If $g(x) = \frac{x-1}{x+2}$, find $g^{-1}\left(-\frac{3}{2}\right) - g^{-1}\left(\frac{7}{2}\right)$.

- A. -4 B. $-\frac{4}{5}$ C. $-\frac{16}{5}$ D. $\frac{12}{5}$ E. NOTA

21. Find the area of the region between the graphs of $|x| + |y| = 1$ and $x^2 + y^2 = 1$.

- A. 2 B. π C. $2 - \pi$ D. $\pi - 2$ E. NOTA

22. Solve for y : $\sum_{k=10}^{13} (yk - 5) = 210$

- A. 5 B. 10 C. -5 D. 13 E. NOTA

23. An integer, N , has a remainder of 3 when divided by 4, 6 when divided by 7, and 2 when divided by 3. What is the least possible value of N ?

- A. 36 B. 41 C. 83 D. 167 E. 419

24. Given $\ln 5 = a$, $\ln 2 = b$, $\ln 3 = c$, $\ln 11 = d$, which of the following is equivalent to

$$\ln \left[\left(\frac{5\sqrt{330}}{36} \right)^2 \right]?$$

A. $3a - 3b - 3c + d$

B. $3a + 3b - 3c + d$

C. $3a + 3b + 3c - d$

D. $3a - b - c + d$

E. $3a - 3b - 3c + 3d$

25. If $f(n) = \frac{1}{3}n(n+1)(n+2)$, then $f(r) - f(r-1) =$

A. $r(r+1)$

B. $(r+2)(r+1)$

C. $\frac{1}{3}r(r+1)$

D. $\frac{1}{3}(r+2)(r+1)$

E. NOTA

Tie Breaker 1: A right triangle has sides 3, 4, and 5. Determine the radius of the inscribed circle.

Tie Breaker 2: How many positive integers between 300 and 500 are divisible by 3 but not 4?

Tie Breaker 3: A treasure is located at a point along a straight road with towns A, B, C, and D on it in that order. A map gives the following instructions for locating the treasure:

a. Start at town A and go $\frac{1}{2}$ of the way to C.

b. Then, from where you are, go $\frac{1}{3}$ of the way to D.

c. Then, go back $\frac{1}{4}$ of the way to B, and dig for the treasure.

If $AB = 6$ miles, $BC = 8$ miles, and the treasure is buried midway between A and D, find the distance from C to D.