1. Simplify the following:

$$x = \sqrt{20 + \sqrt{20 + \sqrt{20 + \ldots}}}$$

A. 2 B. 5 C. $\sqrt{5}$ D. 20 E. NOTA

2. Solve for the positive solution of *x*:

$$16^{2x^2} = 32^{x}$$

A. $\frac{5}{4}$ B. $\frac{5}{8}$ C. 2 D. $\frac{5}{6}$ E. NOTA

3. Let A = the determinant of the matrix $\begin{bmatrix} 2 & -1 \\ -4 & -6 \end{bmatrix}$ and B = the determinant of the matrix $\begin{bmatrix} -2 & 1 \\ 4 & 6 \end{bmatrix}$. Find the product $A \cdot B$.

A. -64 B. 64 C. -256 D. 256 E. NOTA

4. Find $x + y + z$.

$$2x + y - z = 1$$
$$3x + 3y - 2z = 3$$
$$2x - y + 4z = 12$$

A. 2 B. 4 C. 6 D. 8 E. NOTA

5. What is the center of the circle whose equation can be given by the following.

$$x^2 + y^2 - 42x - 24y + 560 = 0$$

A. (12, 21) B. (21, 12) C. (-21, 12) D. (12, -21) E. NOTA

6. How many distinguishable ways can seven different colored keys be arranged on a key ring with no clasp?

A. 240 B. 360 C. 720 D. 2520 E. NOTA

7. Solve the following over the set of real numbers: $\left|3x^2 + 4\right| < \left|4x + 19\right|$.

A. $x < 3$ B. $x > -\frac{5}{3}$ C. $\frac{5}{3} < x < 3$ D. $-\frac{5}{3} < x < 3$ E. NOTA

8. Find the remainder of $\frac{36x^{19} - 24x^{13} - 4x^{12} + 8x^2 + 4x - 29}{x - 1}$.

A. -9 B. -10 C. -29 D. -49 E. NOTA

9. If $a = \log 2$, then which of the following represents $\log_5 2$ in terms of *a*?

A. $\frac{a^2}{a-1}$ B. $\frac{a}{1-a}$ C. $\frac{a}{a+1}$ D. $\frac{1}{a}-1$ E. NOTA

10. Let $P(x) = x^3 - 7x^2 + 8x - 11$ have roots *a*, *b*, and *c*. What is the value of $\frac{1}{ab} + \frac{1}{bc} + \frac{1}{ac}$?

A. $-\frac{7}{11}$ B. $-\frac{8}{11}$ C. $\frac{7}{11}$ D. $\frac{8}{11}$ E. NOTA

11. Find the sum of the roots of the equation $x^2 - 243x - 2008 = 0$

A. 243 B. 249 C. 253 D. 259 E. NOTA

12. Simplify the following.

$$(\log_8 81)(\log_5 64)(\log_9 49)(\log_7 125)$$

A. 18 B. 24 C. 36 D. $2\log 6$ E. NOTA

13. Find the cosine of angle *A* in the triangle whose sides have lengths of 17, 4, and15. Angle *A* is opposite the side of length 15.

A. $\frac{6}{17}$ B. $\frac{10}{17}$ C. $\frac{10}{19}$ D. $\frac{265}{68}$ E. NOTA

14. Which of the following is NOT a Pythagorean triple?

A. 13, 84, 85 B. 28, 45, 63 C. 48, 55, 73 D. 65, 72, 97 E. NOTA

15. If Drury Lane is defined by the equation $3x + 4y = 8$, and the Muffin Man is standing at the point (24, 9), then how far away from Drury Lane is the Muffin Man (assume a shortest distance)?

A. 24 B. 20 C. $\frac{116}{5}$ D. 9 E. NOTA

16. Find the sum of the infinite series $1 + \frac{1}{3} + \frac{2}{9} + \frac{1}{9} + \frac{4}{81} + \frac{5}{243} + \ldots$.

A. $\frac{13}{8}$ B. $\frac{11}{6}$ C. $\frac{7}{4}$ D. $\frac{8}{5}$ E. NOTA

17. Find the 9th term of the 15th row of Pascal's Triangle given that the first row of Pascal's Triangle has one term.

A. 1716 B. 2002 C. 3003 D. 3432 E. NOTA

18. Find the volume of the sphere $x^2 + y^2 + z^2 + 6x - 4y + 3z = \frac{515}{4}$.

A. 2304π B. 576π C. 192π D. 144π E. NOTA

19. Simplify $\sqrt[3]{2+\sqrt{5}} + \sqrt[3]{2-\sqrt{5}}$.

A. 1 B. $2\sqrt{5}$ C. $4-\sqrt{5}$ D. $4+\sqrt{5}$ E. NOTA

20. Horace is an avid fisherman whose favorite fishing spot is a perfectly elliptical pond with a maximum width of 144 meters and a maximum length of 240 meters. Horace has found the best spots for fishing in this pond are at the foci of the pond. So one day he sets off from the bank of the pond and rows directly to the closest focus. Finding no fish at this spot, he rows to the second focus, only to discover he has left the rest of his bait back on the bank at his original starting point on the bank. He rows back to the original starting point to pick up his bait. How many meters has Horace rowed?

A. $84\sqrt{3}+240$ B. 432 C. $864\sqrt{3}$ D. 864 E. NOTA

21. Find the last digit of $2008^{2008^{2008}}$.

A. 2 B. 4 C. 6 D. 8 E. NOTA

22. Which of the following classifies the system shown below?

$$6x - \frac{7}{9}y + \frac{5}{8}z = 25$$
$$9x - \frac{7}{6}y = \frac{75}{2} - \frac{15}{16}z$$
$$-2600 - \frac{364}{27}y = \frac{65}{6}z - 104x$$

I. Consistent
II. Dependent
III. Independent

A. I only B. III only C. I and II D. I and III E. NOTA

23. Ralph rows at a rate of 4 kilometers per hour in a stream without a current. He rows under one bridge and then rows under a second bridge 10 kilometers upstream. As he rows under the second bridge, his hat falls off. After rowing 5 more kilometers, he realizes his hat is gone so he turns around catching the hat exactly as it passes under the first bridge. How fast is the current (in kilometers per hour)?

A. 2 B. $\frac{7}{3}$ C. $\frac{7}{4}$ D. 4 E. NOTA

24. Find the sum of the infinite series.

$$\frac{1}{2} + i - 1 + \frac{1}{4} - 2i + \frac{1}{8} + 2 + 2i + \ldots$$

A. $2-i$ B. $2+i$ C. $\frac{2}{5} - \frac{1}{5}i$ D. $\frac{2}{5} + \frac{1}{5}i$ E. NOTA

25. Find $\frac{M}{N}$ given the following.

M = the fifth term of $(3x-4y)^7$
N = the ninth term of $(6x+2y)^{12}$

A. $\frac{495}{7x^4y^3}$ B. $\frac{35}{1296xy^5}$ C. $\frac{7}{495x^3y^4}$ D. $\frac{7}{4752xy^4}$ E. NOTA

TB1 How many times will Monday occur in a leap year that begins on a Sunday?

TB2 Solve the matrix equation. $3\begin{bmatrix} w & x \\ y & z \end{bmatrix}^T - \begin{bmatrix} 1 & 6 \\ 4 & 2 \end{bmatrix} = \begin{bmatrix} -1 & 3 \\ 6 & 0 \end{bmatrix}$.

TB3 How many positive proper divisors does 2652 have?