1. Find N + D where $\frac{N}{D} = 0.54 + 0.0054 + 0.000054 + 0.00000054 + \cdots$ and $\frac{N}{D}$ is the quotient of two positive integers in lowest terms.

a) 13 b) 17 c) 51 d) 153 e) None of these

2. It is 60 miles from point P to point Q. Two bikers A and B start from point P at the same time towards point Q. A goes 4 mph slower than B. When B reaches Q, she immediately heads back toward P and meets A 12 miles from Q. If both bikers travel at a constant speed throughout (never get tired), find A's speed.

a) 8 mph b) 10 mph c) 12 mph d) 14 mph e) None of these

3. A 25 foot long ladder leans against a vertical well such that the bottom of the ladder is 7 feet from the base of the wall. If the top of the ladder slides 4 feet down the wall, how far will the foot of the ladder have moved?

a) 4 ft b) 5 ft c) 6 ft d) 7 ft e) None of these

4. A palindrome is an integer that reads the same from left to right as it does from right to left—for example, 12321. How many positive integers between 99 and 1000 are palindromes?

a) 81 b) 90 c) 99 d) 100 e) None of these

5. A five digit number is formed by using each of the digits 1, 2, 3, 4, and 5 exactly once. What is the probability that this number is divisible by 6?

a) $\frac{1}{6}$ b) $\frac{1}{4}$ c) $\frac{1}{3}$ d) $\frac{2}{5}$ e) None of these

6. At XYZ High School, 70% of the students in the math club are also in the computer science club. Forty percent of the students in the computer science club are also in the math club. Find how many students are in the computer science club if there are a total of 20 students in the math club.

a) 14 b) 15 c) 21 d) 34 e) None of these

7. Suppose f is a function with the property that for all a and b $f(a+b) = f(a) + f(b) + 1$. Find $f(3)$ whenever $f(1) = 2$.

a) 4 b) 5 c) 6 d) 7 e) None of these

8. If the integer N has exactly 3 distinct positive integer divisors, how many distinct positive integer divisors must N^3 have?

a) 8 b) 9 c) 10 d) 12 e) None of these

9. At a party, the girls came alone or with a boy but NO boy came alone. The probability that a randomly selected girl arrived alone is 40%. What is the probability that a randomly chosen child in the room is a boy?

a) $\frac{1}{4}$ b) $\frac{1}{3}$ c) $\frac{3}{8}$ d) $\frac{2}{5}$ e) None of these

10. M men can do a job in H hours. How many hours should it take M + N men to do this same job assuming that all men work at the same rate?

a) $\frac{MH}{M+N}$ b) $\frac{H}{M+N}$ c) $H - \frac{N}{H}$ d) $H - \frac{M+N}{MH}$ e) None of these

11. A circle is inscribed in a triangle with sides 8, 13, and 17. The point of tangency on the side of length 8 divides the side of length 8 into segments of length x and y where $x < y$. Find the ratio $\frac{x}{y}$.

a) $\frac{1}{3}$ b) $\frac{2}{5}$ c) $\frac{1}{2}$ d) $\frac{2}{3}$ e) None of these

12. The solution set of the equation $3x^2 = 24x - 11$ is $\{a, b\}$. Find $a + b + ab$.

a) $11.\overline{4}$ b) $11.\overline{5}$ c) $11.\overline{6}$ d) $11.\overline{7}$ e) None of these

13. The endpoints of the major axis of an ellipse are (±7, 0), the foci are (±4,0), and the equation of the ellipse is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. Find a^2+b^2.

a) 58 b) 65 c) 82 d) 85 e) None of these

14. The area of the circle $x^2+y^2=22y-16x+20$ is

a) 203π b) 204π c) 205π d) 206π e) None of these

15. Find the measure of angle ACB to the nearest tenth of a degree where angle ACB is the vertex angle of isosceles triangle CAB with CA = CB. Also, AB = AD = DE = EC where D is a point on side CB and E is a point on side CA.

a) 25.6° b) 25.7° c) 25.8° d) 25.9° e) None of these

16. For how many real values of *b* is it true that the line $y=x+b$ passes through the vertex of the parabola $y=x^2+b^2$.

a) 0 b) 1 c) 2

d) infinitely many e) None of these

17. $\log_b M=a-\log_b N$ implies that M equals

a) aN^{-1} b) b^aN^{-1} c) abN^{-1} d) bN^{-1} e) None of these

18. A book company has offices in cities A, B, C, D, E, F, and G. A salesperson is to visit 4 different offices. A "schedule" is a set of 4 different offices and an order in which to visit them. How many "schedules" include visits to C or D or both?

a) 240 b) 360 c) 480 d) 600 e) None of these

19. Given $f(x) = \tan[\sin^{-1}(\sin x)]$, find $f'(x)$ wherever it is defined.

a) 1 b) $\frac{\cos x}{|\cos x|}$ c) $\frac{\sin x}{|\cos x|}$ d) $\sec x$ e) None of these

20. Given $0 < b < a < c$ where $a^2 + b^2 = c^2$. Find x such that $Arc\sin\frac{a}{c} - Arc\sin\frac{b}{c} = Arc\sin x$.

a) $\left(\frac{a+b}{c}\right)^2$ b) $\left(\frac{a-b}{c}\right)^2$ c) $\frac{a^2+b^2}{c^2}$ d) $\frac{a^2-b^2}{c^2}$ e) None of these

21. Find $a+b+c$ where $ax+by+cz=1$ is the equation of the plane on (2, 1, 1), (0, 4, 1), and (-2, 1, 4).

a) $\frac{3}{4}$ b) $\frac{2}{3}$ c) $\frac{7}{12}$ d) $\frac{1}{2}$ e) None of these

22. Which statement is true?

a) $\int_1^\infty x^{-1}dx$ converges b) $\int_1^\infty x^{-2}dx$ diverges

c) $\int_0^2 x^{-3}dx$ converges d) $\int_1^\infty x^{-5}dx$ diverges e) None of these

23. Find the interval of convergence $\sum_{N=2}^{\infty}\frac{(x+1)^N}{N\log_e N}$.

a) $x = 0$ b) $-2 \le x < 0$ c) $-2 < x \le 0$ d) $0 < x \le 2$ e) None of these

24. Find the volume of the sphere $x^2 + y^2 + z^2 = 100$ which is included between the parallel planes $z = 8$ and $z = 10$.

a) $37.\overline{1}\pi$ b) $37.\overline{2}\pi$ c) $37.\overline{3}\pi$ d) $37.\overline{4}\pi$ e) None of these

SOLUTIONS:

1. B
2. A
3. E
4. B
5. D
6. E
7. E
8. E
9. C
10. A
11. A
12. C
13. C
14. C
15. B
16. C
17. B
18. E
19. E
20. D
21. A
22. E
23. B
24. C