31. The equations of two lines are $x + 2y = 1$ and $2x - y = 3$.

    A. These lines are parallel.
    B. These lines are perpendicular.
    C. These lines are at an angle of $60°$.
    D. These lines are at an angle of $30°$.

32. Suppose the matrix $\begin{pmatrix} 2 & a \\ 3 & b \end{pmatrix}$ with a and b integers has determinant 1. A possible value for b is

    A. 1.
    B. 2.
    C. 3.
    D. 9.

33. There are five students. Arul and Neeraj are Mathematics students. Sunny likes Biology. Mathematics students dislike Chemistry. Students who like Biology cannot dislike Chemistry. Students who want to take Physics must like all other subjects. Swati and Manas want to take Physics. The number of students who dislike Chemistry is

    A. 1.
    B. 2.
    C. 3.
    D. 4.

34. Let $a_1, a_2, \cdots, a_{10}$ be 10 observations with median 3. Then

    A. at least 5 observations are less than or equal to 3.
    B. at most 5 observations are less than or equal to 3.
    C. exactly 5 observations are less than or equal to 3.
    D. all observations are less than or equal to 3.

35. The value of the integral $\int_{-1}^{1} \left(x^2 + \frac{x^{2013}}{x^2 + 2|x| + 1} \right) dx$ is

    A. positive.
    B. negative.
    C. 0.
    D. ∞.

36. The sum of the infinite series $\frac{9}{10} + \frac{9}{100} + \frac{9}{1000} + \ldots$ is

    A. ∞.
    B. $\frac{11}{9}$.
    C. 1.
    D. $\frac{10}{9}$.

37. The angle between the tangents to the circles $x^2 + y^2 = 1$ and $x^2 + (y-1)^2 = 2$ at the point $(1, 0)$ is

    A. $90°$.
    B. $30°$.
    C. $60°$.
    D. $45°$.

38. The length of the shortest path in space between the z-axis and the line given by the equations $z = 0$ and $y = 1$ is

    A. 1.

    B. 2.

    C. $\sqrt{2}$.

    D. $\frac{1}{2}$.

39. Consider the inequalities $x + y < 3$, $x - y < 5$, $5x - 3y < 15$ and $2x + y > 2$. The region in the plane that consists of points satisfying these inequalities is

    A. empty.

    B. rectangular.

    C. triangular.

    D. square.

40. The number of solutions of $\tan x = x - x^3$ with $-1 \leq x \leq 1$ is

    A. 1.

    B. 2.

    C. 3.

    D. 4.

41. Let $f(x) = |x|^a$ where a is a non-zero real number. For what values of a is $f(x)$ differentiable at $x = 0$?

    A. For all non-zero a.

    B. For all $a > 1$.

    C. For no values of a.

    D. For all a different from 1 and 0.

42. The set of solutions in complex numbers of the equation $z^4 = -1$ is

    A. the empty set.

    B. $\{i, -i\}$.

    C. $\left\{\frac{-1+i\sqrt{3}}{2}, \frac{-1-i\sqrt{3}}{2}, \frac{1+i\sqrt{3}}{2}, \frac{1-i\sqrt{3}}{2}\right\}$.

    D. $\left\{\frac{-1+i}{\sqrt{2}}, \frac{-1-i}{\sqrt{2}}, \frac{1+i}{\sqrt{2}}, \frac{1-i}{\sqrt{2}}\right\}$.

43. Let $f(x) = \lfloor x \rfloor / (x^2 + 1)$ where $\lfloor x \rfloor$ denotes the greatest integer less than or equal to x. Then

    A. f is continuous for all x.

    B. f is continuous only when x is an integer.

    C. f is continuous only when x is not an integer.

    D. f is not continuous at any value of x.

44. An unbiased usual six-sided die is thrown three times. The sum of the numbers coming up is 10. The probability that 2 has appeared at least once is

    A. $\frac{1}{36}$.

    B. $\frac{5}{36}$.

    C. $\frac{91}{216}$.

    D. $\frac{1}{18}$.

45. The number of solutions of $a + b + c = 15$ with non-negative integer values for a, b and c is

A. $\dfrac{15!}{3!\ 12!} = 455.$

B. $\dfrac{14!}{2!\ 12!} = 91.$

C. $\dfrac{17!}{2!\ 15!} = 136.$

D. $\dfrac{15!}{5!\ 5!\ 5!} = 756756.$