Q. 1. Let \( U = \{1,2,3,4,5\}, \ A = \{1,2,3\}, \ B = \{2,3,4\} \) then \((A \cup B) \cap A^c = \ldots\). Note \( U \) is the universal set and \( \emptyset \) is the null set.
A) A  
B) B  
C) \( \emptyset \)  
D) \( \{4, 5\} \)

Q. 2. If the area of a square is two more than twice the length of its diagonal then the length of one side of the square is
A) \( \sqrt{2} - 2 \)  
B) \( 2 - \sqrt{2} \)  
C) \( \sqrt{2} + 2 \)  
D) None of these

Q. 3. The volume of a rectangular solid is equal to 1000 \( m^3 \). If the length, width and height are decreased by 50\%, the volume of the new rectangular solid is equal to
A) 375 \( m^3 \)  
B) 350 \( m^3 \)  
C) 500 \( m^3 \)  
D) 125 \( m^3 \)

Q. 4. The area of the circle \( x^2 + y^2 - 8x - 24 = 0 \) is
A) 80\( \pi \)  
B) 60\( \pi \)  
C) 40\( \pi \)  
D) 20\( \pi \)

Q. 5. A possible interval of values of \( k \) for which the equation \((x + k) x = -4\) have two real solutions is
A) \( k > 0 \)  
B) \( k > 2 \)  
C) \( k > 4 \)  
D) \( k < 4 \)

Q. 6. If \( x - 1, \ x + 2\) and \( x + 1\) are all factors of a polynomial \( P(x) \) of degree 3, which of the following must also be a factor of \( P(x)\)?
I) \( x^2 + 3x + 2 \)  
II) \( x^2 - 1 \)  
III) \( x^2 + x - 2 \)  
A) III only  
B) II only  
C) I only  
D) All three are factors

Q. 7. If \( x \) and \( y \) are two real numbers such that \( 3x + 2y = 5 \) and \( 5x + 4y = 9 \), then \( x + y = \)
A) 0  
B) 2  
C) 4  
D) 6

Q. 8. \( \lim_{x \to \infty} \frac{100x^2 + 200}{x^2 - 300x + 400} = \)
A) 400  
B) 300  
C) 200  
D) 100

Q. 9. If \( a \oplus b \) equals the remainder when \( a + b \) is divided by 12, then \((11 \oplus 10) \oplus 9 = \ldots\)
A) 30  
B) 18  
C) 6  
D) Zero
Q.10. The coefficient of $x^5$ in the expansion of the binomial series $\left(x + \frac{1}{x}\right)^9$ is
A) 84
B) 36
C) 2
D) 1

Q.11. Two dice are tossed. What is the probability that the sum of the two dice is less than 11?
A) 1/4
B) 3/4
C) 5/6
D) 11/12

Q.12. $\log_8 512 =$
A) $0.75 \log_4 256$
B) $0.5 \log_{16} 256$
C) $0.25 \log_{32} 1024$
D) None of these

Q.13. If the equation $x^2 + 24x + c = 0$ has a unique root, then $c$ must be
A) $-25$
B) $144$
C) $24$
D) None of these

Q.14. The lines with equations $x - 5y = 2$ and $kx + y = -5$ are perpendicular for $k =$
A) $-5$
B) $5$
C) $-1$
D) $0$

Q.15. What are the coordinates of the centre of the circle that is entirely in first quadrant and is tangent to the lines $y = 8$, $y = 2$ and $x = 2$?
A) $(5, 8)$
B) $(5, 5)$
C) $(2, 2)$
D) $(-5, 5)$

Q.16. If $A = \begin{bmatrix} \lambda & 1 & 0 \\ 1 & \lambda & 2 \\ 0 & 0 & \lambda \end{bmatrix}$ is a singular matrix then value of $\lambda$ must be
A) 0
B) 1
C) $-1$
D) All of the above

Q.17. Find the value of constant $a$ such that $x = 1$ is a solution to the equation $a(x - 3)^2 - |1 - 2x| = 3$
A) 2
B) $-2$
C) 1
D) $-1$

Q.18. A machine performs a multiplication in 2 seconds and addition or subtraction in one second, the time required by the machine to find $A^2$ using usual method of matrix multiplication will be (here $A$ is a square matrix of order 3)
A) 81 seconds
B) 72 seconds
C) 27 seconds
D) None of these

Q.19. If a root of an equation of the form $f(x) = 2$ is 5, then a root of the equation defined by $f(11-2x) = 2$ is equal to
A) 4
B) 3
Q.20. Which of the following functions satisfy the condition \( f(2) = f(-2) \)?

I) \( f(x) = x^2 \)
II) \( f(x) = |x| \)
III) \( f(x) = x^3 \)

A) III and II only
B) III and I only
C) II and I only
D) I only

Q.21. Find the constant \( k \) so that the line segment with end points \( (k, 0) \) and \( (4, 6) \) has a slope of \(-3\).

A) 4
B) \(-2\)
C) 6
D) 2

Q.22. If \( \begin{vmatrix} 0 & a & 1 \\ b & c & 1 \\ 2 & 2 & 1 \end{vmatrix} = \begin{vmatrix} 2 & -2 & 2 \\ 2 & -2 & 2 \end{vmatrix} \) find \( a, b, \) and \( c \).

A) 1, 2, \(-3\)
B) 1, 2, 0
C) 3, \(-2, 1\)
D) 1, 2, 3

Q.23. If \(-3x > -27\) and \( |Y| < 9 \) then

A) \( x < 9 \) and \( -9 < Y < 9 \)
B) \( x > 9 \) and \( Y < 9 \)
C) \( x < 9 \) and \( Y > -9 \)
D) \( x > 9 \) and \( -9 < Y < 9 \)

Q.24. \( \sin 135^\circ = \___________\)

A) \(-\frac{1}{\sqrt{2}}\)
B) \(-\frac{2}{\sqrt{2}}\)
C) \(-\frac{1}{\sqrt{2}}\)
D) \(\frac{\sqrt{3}-1}{\sqrt{2}}\)

Q.25. The center of the circle \( x^2 + y^2 - 6x + 8y - 24 = 0 \)

A) (1, 2)
B) (2, 4)
C) (5, 6)
D) None of these

Q.26. A straight line passes through the points \( A(-12, -13) \) and \( B(-2, -5) \). The point of intersection of this line with \( x \)-axis is given by

A) (0, \(-3.4\))
B) (4.25, 0)
C) (3.4, 0)
D) None of these

Q.27. \( \cos(x) \sin(2x) + \sin(x) \cos(2x) = \)

A) \( \cos(3x) \)
B) \(-\cos(3x)\)
C) \(-\sin(3x)\)
D) \(\sin(3x)\)
Q.28. The sum of three numbers in a G.P is 19 and the sum of their squares is 133. If the first term is 9 then common ratio \( r \) and other two numbers are respectively
A) 1, 6, 4
B) \( \frac{2}{3}, 6, 4 \)
C) \( 5, \frac{5}{6}, 6 \)
D) 1, 2, 3

Q.29. The range of the function \( y = f(x) = |x + 2| + 3 \) is
A) \( y \geq 2 \)
B) \( y \leq -3 \)
C) \( y \geq 3 \)
D) \( y \leq 3 \)

Q.30. Find the real number \( a \) such that \( 7 - i = (2 - i)(a + i) \) where \( i = \sqrt{-1} \).
A) -3
B) 3
C) -2
D) 2

Q.31. For the remainder of the division of \( x^3 - x^2 + kx - 6 \) by \( x - 6 \) to be equal to zero, \( k \) must be equal to
A) 6
B) 1
C) 29
D) -29

Q.32. The domain of two polynomial functions \( f \) and \( g \) is the set of all real numbers and are defined by \( f(x) = x^2 - 3x + 4 \), \( g(x) = x + 1 \), then \( g(f(x)) \) is
A) \( x^2 - x + 5 \)
B) \( x^2 - 2x + 5 \)
C) \( x^2 - 3x + 5 \)
D) \( x^2 - 4x + 5 \)

Q.33. If the line \( x + y + 3 = 0 \) is parallel to the line \( ax + by = 0 \), then
A) \( a = 0 \)
B) \( b = 0 \)
C) \( a = b \neq 0 \)
D) None of these

Q.34. If \( 8^y = 2 \) and \( 3^x + y = 81 \), then \( x = \)
A) 1/3
B) 9/3
C) 11/3
D) 13/3

Q.35. If the area of a square is two more than twice the length of its diagonal then the length of one side of the square is
A) \( \sqrt{2} - 2 \)
B) \( 2 - \sqrt{2} \)
C) 2
D) \( \sqrt{2} + 2 \)

Q.36. The area of a triangle whose sides are of lengths 6, 8 and 10 units is
A) 30 square units
B) 40 square units
C) 24 square units
D) None of these

Q.37. The 5th term of a Harmonic progression is 9 and the 9th term is 5. The 45th term of this Harmonic progression
will be
A) 1
B) 2
C) 3
D) 4

Q.38. If a die is rolled twice, then the probability that the sum of points is 8 is
A) \( \frac{5}{36} \)
B) \( \frac{7}{36} \)
C) \( \frac{9}{36} \)
D) None of these

Q.39. The lines with equations \( x + 3y = 2 \) and \(-2x + ky = 5\) are parallel for \( k = \)
A) –3
B) –2
C) –6
D) 0

Q.40. The value of \( \begin{bmatrix} 2 & 4 & 6 \\ 6 & 4 & 2 \\ 2 & 4 & 6 \end{bmatrix} \) is
A) –3
B) –2
C) –1
D) 0

Q.41. Which of the statements below are true about the graphs of the equations \( x^2 + y^2 = 9 \) and \((x + 6)^2 + y^2 = 16\)? (I) Both graphs are circles. (II) The two graphs touches at one point. (III) The two graphs have two distinct points of intersection.
A) (I) only
B) (II) only
C) (III) only
D) (I) and (III) only

Q.42. Lines L1 and L2 are perpendicular that intersect at the point \((0, 3)\). If L1 passes through the point \((3, 0)\), then line L2 must pass through the point
A) \((3, 3)\)
B) \((0, –3)\)
C) \((-3, 0)\)
D) \((6, 7)\)

Q.43. Find the sum
\[ \sum_{k=1}^{100} (2 + k) \]
A) 5010
B) 5020
C) 5050
D) 5250

Q.44. It takes pump (A) 4 hours to empty a swimming pool. It takes pump (B) 6 hours to empty the same swimming pool. How much time is required to empty the same swimming pool if the two pumps are started together?
A) 2 hours 20 minutes
B) 2 hours 24 minutes
C) 2 hours 30 minutes
D) 3 hours
Q.45. The equation whose roots are reciprocals of the roots of \( x^2 - 6x + 8 = 0 \) is
   A) \( 6x^2 - 8x + 2 = 0 \)
   B) \( 8x^2 - 6x + 2 = 0 \)
   C) \( 6x^2 - 8x + 1 = 0 \)
   D) \( 8x^2 - 6x + 1 = 0 \)

Q.46. ABCD is a parallelogram and the area of the shaded region is 1 square meter, DE is perpendicular to AB. If AE is one fourth of AB then the area of the parallelogram ABCD shall be
   A) 2 square meters
   B) 4 square meters
   C) 6 square meters
   D) 8 square meters

Q.47. A dealer increased the price of an item by 20%, and then decreased the price of the same item by 30%. If \( x \) is the original price, what is the price after the two changes?
   A) 1.1 \( x \)
   B) 0.84 \( x \)
   C) \( x - 20 \)
   D) \( x - 30 \)

Q.48. The domain of \( f(x) = \sqrt{1 - 2x} / \sqrt{(4x - 1)} \) is given by the interval
   A) \((0.25, 0.5)\)
   B) \((0.25, 0.5]\)
   C) \([0.25, 0.5)\)
   D) \([0.25, 0.5]\)

Q.49. The number of teams of two boys and three girls can be selected out of six boys and five girls equals _______
   A) 150
   B) 15
   C) 1800
   D) 30

Q.50. The equation of the circle whose diameter is the latus rectum of the parabola \( x^2 = -36y \) is
   A) \( x^2 + y^2 + 18y = 243 \)
   B) \( x^2 + y^2 = 243 \)
   C) \((x - 1)^2 + (y - 1)^2 = 243 \)
   D) \((x - 1)^2 + (y - 1)^2 = 243 \)