1. Consider the conic \( \frac{x^2}{9} + \frac{y^2}{16} = 1 \) and the line \( 3y - 4x = 12 \). At what points, if any, do they meet?

   Ans: \((-3,0) \text{ and } (0,4)\) 1 point

2. A Double Mersenne Number, \( D_n \), is of the form \( 4^n - 1 \) where \( n \) is a positive integer. What is the binary form (base 2) for such a number?

   Ans: \( 2n \) 1’s 1 point

3. The symbol \( 25_b \) represents a 2 digit number to the base \( b \). If the number \( 52_b \) is twice \( 25_b \) then what is the value of \( b \)?

   Ans: \( b = 8 \) 1 point

4. What is the number of digits in the number \( 2^{12 \times 5^8} \)?

   Ans: 10 1 point

5. A parabola is known to have its vertex at \((2, 5)\) and its focus 2 units to the left of the vertex. What is its equation?

   Ans: \( x - 2 = -1/(4 \times 2) (y - 5)^2 \) 2 points

6. Two concentric circles are formed. What must be the ratio of the larger to smaller radii so that the area in between them is 84% of the area of the larger circle?

   Ans: 2.5 : 1 ratio 2 points

7. Express as single complex number: \( 1 + i + i^2 + i^3 + \ldots + i^{100} \) where \( i^2 = -1 \)

   Ans: 1 2 points
8. How many different 5 digit numbers can be constructed using the digits 1,1,1,4,7?

   Ans: 20  2 points

9. The parabola $y = ax^2 + bx + c$ has vertex $(p,p)$ and $y$ intercept at $(0, -p)$ where $p \neq 0$.
   What must the value of $b$ equal in order for this to happen?

   Ans: $b = 4$   3 points

10. A fair six-sided die is tossed three times and the resulting sequence of numbers is recorded.
    What is the probability of the event $E$ that either all of the numbers are equal or none of
    them is a 4?

    Ans: $p(E) = 7/12$   3 points

11. Consider the solutions to the equation $3x^2 - 4x + k = 0$. The value of $k$ for which the
    product of the roots is a maximum is what?

    Ans: $k = 4/3$   3 points