Q1: Find a unit vector perpendicular to the plane that passes through the points $P(1,4,6)$, $Q(-2,5,-1)$ and $R(1,-1,1)$.

Q2: Find the curvature $k(t)$, unit tangent vector $T(t)$, normal vector $N(t)$ and binomial vector $B(t)$ for $\langle t^2, \frac{2}{3}t^3, t \rangle$ at $(1,2/3,1)$.
Q3: Find the equation of normal and osculating plane to the curve \( x = t, y = t^2, z = t^3 \) at \((1, 1, 1)\).
Q4: Find the position vector of a particle that has acceleration \( \mathbf{a}(t) = ti + e^t j + e^{-t} k \), with \( v(0) = k \) and \( r(0) = j + k \).

Q5: Find and sketch the domain of the function \( f(x, y) = \sqrt{4 - x^2 - y^2} + \sqrt{1 - x^2} \).
Q.6 Find \( \lim_{(x,y) \to (0,0)} \frac{3x^2y}{y^2+y^2} \) if it exists.

Q.7 Show that \( f(x^2 - y^2, 2xy) \) is a harmonic function if \( f(x, y) \) is harmonic.
Q8: Show that \( f(x, y) = xe^{xy} \) is a differentiable function at (1.0) and find its linearization. Then use this to approximate \( f(1.1, -0.1) \)

Q9: If \( z = 5x^2 + y^2 \) and (x, y) changes from (1,2) to (1.05,2.1) compare the value of \( \Delta z \) and \( dz \)
Q10a: Use implicit differentiation to find $\frac{\partial z}{\partial x}$, for $y^2xz = \ln(x + yz)$

Q10b: You are told that there is a function $f(x, y)$ whose partial derivatives are $f_x(x, y) = x + 4y$ and $f_y(x, y) = 3x - y$. Should you believe it.