1. Find the magnitude of vector PQ, then find the unit vector
   \( P (1, 5, 0), Q (3, 11, 2) \)
   \( P (-2, 15, 9), Q (-3, -1, 5) \)
2. Find the projection vector \( u \) onto vector \( v \) where \( u = <1, 2, 3> \) and \( v = <3, 4, 5> \)
3. Find all possible \( a \) and \( b \) such that \( u = <1, b, 3> \) and \( v = <3, 4, a> \) are orthogonal.
4. Let \( u = <0, 2, 3> \) and \( v = <-3, 0, 5> \), Find the angle between them.
5. Find an area of a parallelogram of \( u = <1, 3> \) and \( v = <-1, -5> \)
6. Find an area of a triangle of \( a = <0, 1, 3>, b = <1, 1, 5> \) and \( c = <-1, 0, 2> \)
7. Find Unit orthogonal vector of \( u = <1, 2, 3> \) and \( v = <3, 4, 5> \)
8. Find a domain of the following functions:
   \( r(t) = <\sqrt{t+2}, \sqrt{2-t}, 1/t> \)
   \( r(t) = <\cot(2t), \exp(1/t), \ln(3t)> \)
9. A line through \((0, 4, 8)\), that is perpendicular to \( u = <1, 2, 1> \) and y-axis
10. Find the derivative of the vector \( r(t) = <t \exp(-t), t \sin(t), \tan(t)> \)
11. Find the unit tangent of the vector \( r(t) = <t, \sin(t), \cos(t)> \)
12. Find the unit tangent vector \( T \) and curvature \( k \) of
13. Let \( u(t) = <t, \sin(t), \cos(t)> \) and \( v(t) = <\tan(t), 5t^2, t - 5> \)
   \( \circ \) Find the derivative of \( u \times v \)
   \( \circ \) Find the derivative of \( u \cdot v \)
14. Find the Arc-Length of the following: (set up – ONLY )
   \( r(t) = <t, \sin(t), \cos(t)> \) where \( t \) on \([0, \pi]\)
   \( r(t) = <t, \exp(2t), 5t^2> \) where \( t \) on \([0, \pi]\)
   The polar coordinate \( r = \sec(\theta) \tan(\theta) \) where \( \theta \) on \([0, \pi]\)
15. Find the Arc-Length of the following: (Solve completely)
   \( r(t) = <2\sin(t), 4\cos(t)> \) where \( t \) on \([0, \pi]\)
   \( r(t) = <\exp(t), 2\exp(-t), t> \) where \( t \) on \([-1, 1]\)
   The polar coordinate \( r = 1 + \cos(\theta) \) where \( \theta \) on \([0, \pi]\)