## Problem 1

Find the length of the curve $r(t) = 2\cos(3t)\ i + 2\sin(3t)\ j + 2t\ k$, from $t = 0$ to $t = \pi$.

## Problem 2

For $r(t) = e^{2t}\ i + \tan(t)\ j + t^3\ k$, find the unit tangent vector $T$.

## Problem 3

For $r(t) = 2\cos(3t)\ i + 2\sin(3t)\ j + 2t\ k$, find the curvature, $\kappa$.

## Problem 4

For $r(t) = 2\cos(3t)\ i + 2\sin(3t)\ j + 2t\ k$, find the principal unit normal, $N$.

## Problem 5

For the curve $r(t) = t\cos(t)\ i + t\sin(t)\ j + t^2\ k$, write the acceleration $a$ in the form $a = a_T T + a_N N$ without finding $T$ and $N$.