

Let $r(t) = (3t \sin t + 3 \cos t, 3t \cos t - 3 \sin t, 2t^2)$.

(a) Prove that $r'(t) = (3t \cos t, -3t \sin t, 4t)$

(b) Given (a), prove that $T(t) = (\frac{3}{5} \cos t, -\frac{3}{5} \sin t, \frac{4}{5})$

(c) Given (b), find the principal normal to the curve at time $t = \pi$.