1. Let \( r(t) = < t, t^2, t \cos(t) > \). Find the derivative of \( r(t) \) at \( t = \pi \). What does this value give us?

**Solution:** Because \( r(t) \) has been parameterized (that is, \( r(t) = < f(t), g(t), h(t) > \)), \( r'(t) \) is found by finding \( f'(t), g'(t) \) and \( h'(t) \). In this case, \( f'(t) = 1 \), \( g'(t) = 2t \), and \( h'(t) = \cos(t) - t \sin(t) \). Therefore we get that:

\[
r'(t) = < 1, 2t, \cos(t) - t \sin(t) >
\]

Plugging in \( \pi \) for \( t \) gives us the vector \( < 1, 2\pi, -1 > \).

This is the tangent vector (but not necessarily the unit tangent vector) of \( r'(t) \) at \( t = \pi \).