[mex138] Rubber speed

A car is moving with constant velocity v along a level road. What is the instantaneous speed v_T relative to the road of a point on the tread (perimeter) of the tire, which has radius R? It oscillates between zero at the bottom and twice the speed of the car at the top.
(a) Show that the rubber speed relative to the road depends on the distance y from the road as follows:

$$v_T = v\sqrt{\frac{2y}{R}}.$$

(b) Find the time rate at which v_T changes, $a_T \doteq dv_T/dt$. It is a periodic function of time.
(c) Find the magnitude of the acceleration a of the same point on the tread. It is a constant.

Solution: