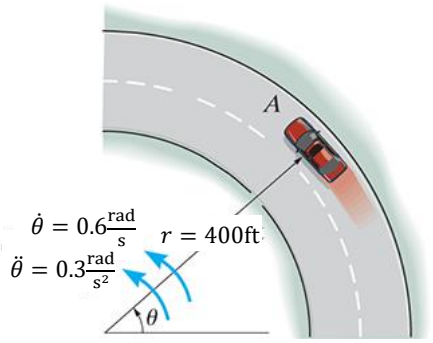
Quiz 03: Chapter 12

Due: Tuesday 31 Jan 23

Examine the solved problem below. There are four errors in the solution below. Your task is to locate and identify those errors, then correct them and calculate the proper result. If the same error occurs more than once, only count it as a single error, even if you have to correct it in more than one instance.

Each correctly identified error is worth 4 points, and the re-calculated result is worth 4 points as well. You must save your work in pdf format and submit via the Quiz 03 Assignment in the Chapter 12 folder in the Quizzes folder of the Online Classroom in Blackboard. Please do not use any other file format than pdf.

A car is traveling along the circular curve of radius $r = 400\text{ft}$. At the instant shown, its angular rate of rotation is $\dot{\theta} = 0.6\frac{\text{rad}}{\text{s}}$, which is increasing at the rate of $\ddot{\theta} = 0.3\frac{\text{rad}}{\text{s}^2}$. Determine the magnitudes of the car's velocity and acceleration at this instant.



A) Calculate the radial velocity v_r:

$$v_r = \dot{r} = 400\frac{\text{ft}}{\text{s}}$$

B) Calculate the tangential velocity v_θ:

$$v_\theta = r\dot{\theta} = (400\text{ft})\left(0.6\frac{\text{rad}}{\text{s}}\right) = 240\frac{\text{ft}}{\text{s}}$$

C) Calculate the magnitude of the velocity:

$$v = \sqrt{v_r^2 + v_\theta^2} = \sqrt{\left(400\frac{\text{ft}}{\text{s}}\right)^2 + \left(240\frac{\text{ft}}{\text{s}}\right)^2} = 401\frac{\text{ft}}{\text{s}}$$

D) Calculate the radial velocity a_r:

$$a_r = \ddot{r} = 0\frac{\text{ft}}{\text{s}^2}$$

E) Calculate the tangential velocity a_θ:

$$a_\theta = r\ddot{\theta} - 2\dot{r}\dot{\theta} = (400\text{ft})\left(0.3\frac{\text{rad}}{\text{s}^2}\right) - 2\left(400\frac{\text{ft}}{\text{s}}\right)\left(0.6\frac{\text{rad}}{\text{s}}\right) = -360\frac{\text{ft}}{\text{s}^2}$$

F) Calculate the magnitude of the acceleration:

$$a = \sqrt{a_r^2 + a_\theta^2} = \sqrt{\left(0\frac{\text{ft}}{\text{s}}\right)^2 + \left(-360\frac{\text{ft}}{\text{s}}\right)^2} = 360\frac{\text{ft}}{\text{s}^2}$$