## Quiz 11: Chapter 17

## Due: Tuesday 05 Mar 2024

Examine the solved problem below. There are six 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 3 points, and the re-calculated results are worth 7 points. You must save your work in pdf format and submit via the Quiz 10 Assignment in the Chapter 16 folder of the in the Quizzes folder in the Online Classroom in Blackboard. Please do not use any other file format than pdf.

The pipe has a length $l_{A C}=2.5 \mathrm{~m}$ and a mass $m=375 \mathrm{~kg}$. It is attached to the back of the truck using chain $A B\left(l_{A B}=0.75 \mathrm{~m}\right)$. If the coefficient of kinetic friction at $C$ is $\mu_{k}=0.35$, determine the acceleration of the truck if the angle $\theta=10^{\circ}$ with the road as shown.
A) Sketch the free body diagram for the pipe:

See diagram on the right

B) Calculate the angle $\varphi$ :

$$
\begin{aligned}
& \sin \varphi=\frac{\left(1 \mathrm{~m}-y_{A}\right)}{l_{A B}}=\frac{1-l_{A C} \sin 10^{\circ}}{l_{A B}} \\
& \varphi=\sin ^{-1}\left[\frac{1-(0.75) \sin 10^{\circ}}{2.5}\right]=20.4^{\circ}
\end{aligned}
$$

C) Write the equations of motion for the pipe:

$$
\sum F_{x}=T \cos \varphi-f_{k}=m a
$$


$T \cos \varphi-\mu_{k} N=m a$

$$
\begin{aligned}
& \sum F_{y}=T \sin \varphi+N-m g=0 \\
& N=m g-T \sin \varphi \\
& \sum M_{C}=(T \cos \varphi) x_{A}+(T \sin \varphi) y_{A}-(m g)\left(\frac{x_{A}}{2}\right)=(m a)\left(\frac{y_{A}}{2}\right)
\end{aligned}
$$

$$
(T \cos \varphi)\left(l_{A C} \cos 10^{\circ}\right)+(T \sin \varphi)\left(l_{A C} \sin 10^{\circ}\right)-(m g)\left(\frac{l_{A C} \cos 10^{\circ}}{2}\right)=(m a)\left(\frac{l_{A C} \sin 10^{\circ}}{2}\right)
$$

D) Re-write equations to enter into a solver:

$$
\begin{aligned}
& T \cos 20.4^{\circ}-(0.35)\left[(375 \mathrm{~kg})\left(9.8 \frac{\mathrm{~m}}{\mathrm{~s}^{2}}\right)-T \sin 20.4^{\circ}\right]=(375 \mathrm{~kg}) a \\
& 0.815 T-1286=375 a \\
& T\left[\cos 20.4^{\circ} \cos 10^{\circ}+\sin 20.4^{\circ} \sin 10^{\circ}\right]-\frac{1}{2}(375 \mathrm{~kg})\left(9.8 \frac{\mathrm{~m}}{\mathrm{~s}^{2}}\right)\left(\cos 10^{\circ}\right)=\frac{1}{2}(375 \mathrm{~kg})\left(\sin 10^{\circ}\right) a \\
& 0.984 T-1810=32.6 a
\end{aligned}
$$

E) Enter system into a solver:

$$
\begin{aligned}
& T=1860 \mathrm{~N} \\
& a=0.612 \frac{\mathrm{~m}}{\mathrm{~s}^{2}}
\end{aligned}
$$

