## Quiz 02: Chapter 12

Due: Friday 27 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 02 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.

At halftime of a football game, souvenir balls are thrown to the spectators with a velocity $v_{o}$. Determine $v_{o}$ for a ball to land halfway between points $B$ and $C$.
A) Determine horizontal range $x$ of the ball:

See figure on the right:

$$
\begin{aligned}
& x=8 \mathrm{~m}+l \\
& x=8 \mathrm{~m}+\frac{1}{2}(10 \mathrm{~m}+7 \mathrm{~m}) \cos 35^{\circ}=14.96 \mathrm{~m}
\end{aligned}
$$

B) Calculate the vertical range $y$ of the ball:

See figure on the right:

$$
y=1.5 m+\frac{1}{2}(10 m+7 m) \sin 35^{\circ}=3.38 m
$$

C) Analyze the horizontal motion:

$$
\begin{aligned}
& v_{o x}=v_{o} \cos \theta=v_{o} \cos 40^{\circ} \\
& x=v_{o x} t=v_{o} t \cos 40^{\circ}=14.96 \mathrm{~m}
\end{aligned}
$$

D) Analyze the vertical motion:

$$
\begin{aligned}
& v_{o y}=v_{o} \sin \theta=v_{o} \sin 40^{\circ} \\
& y=v_{o y} t+\frac{1}{2} a_{y} t^{2}=3.38 \mathrm{~m} \\
& v_{o} t \sin 40^{\circ}-\frac{1}{2} g t^{2}=3.38 \mathrm{~m}
\end{aligned}
$$

E) Combine motion equations and solve for time:

$$
\begin{aligned}
& v_{o} t=\frac{x}{\cos 40^{\circ}}=\frac{14.96 \mathrm{~m}}{\cos 40^{\circ}}=11.46 \mathrm{~m} \\
& \frac{1}{2} g t^{2}=(11.46 \mathrm{~m}) \sin 40^{\circ}-3.38=3.99 \mathrm{~m} \\
& t=\sqrt{2\left(\frac{3.99 \mathrm{~m}}{9.8 \frac{\mathrm{~m}}{\mathrm{~s}^{2}}}\right)}=0.902 \mathrm{~s}
\end{aligned}
$$

F) Use the time to solve for initial velocity $v_{o}$ :

$$
\begin{aligned}
& v_{o} t \cos 40^{\circ}=x \\
& v_{o}=\frac{x}{t \cos 40^{\circ}}=\frac{14.96 \mathrm{~m}}{(0.902 \mathrm{~s}) \cos 40^{\circ}}=21.6 \frac{\mathrm{~m}}{\mathrm{~s}}
\end{aligned}
$$

