Quiz 1
Name: Surname:
Section: 4

This quiz is composed of 2 problems (5 points each). Answer all problems.

Problem 1:

a) The equation describing the velocity of a pendulum of length $L$ for a given angle $\theta$ is ($g$ is the gravitational acceleration at sea level):

$$v = \sqrt{2gL^\alpha \cos \theta}$$

Define the factor $\alpha$ such the equation is dimensionally consistent.

$$[v] = \frac{LT^{-1}}{L} = \frac{1}{L^1} \Rightarrow \frac{L}{T} = \left(\frac{1}{T^1}\right)^{1/2} L^{1/2} \Rightarrow \text{from } L: 1 = \frac{1}{2} + \frac{\alpha}{2} \Rightarrow \alpha = 1$$

b) The average distance of the Earth and the Sun (149597871.0 Km) is defined to be as 1.0 Astronomical Unit (Au). How many meters is the average distance of Pluto to the Sun if in Au it is 39.5.

$$39.5 \text{ Au} \left( \frac{149597871.0 \text{ km}}{1 \text{ Au}} \right) \left( \frac{1000 \text{ m}}{1 \text{ km}} \right) = \overline{5.91 \times 10^{12} \text{ m}}$$

Problem 2:

A vector $A$ is pointing 30° above the x axis and has magnitude of 4.0. What should the x and y components of a vector $B$ be, such that the addition of $A + B$ results in a vector with a magnitude 10.0 and pointing 45° above the x axis.

Let $C = A + B$ then

$$c_x = a_x + b_x \Rightarrow b_x = c_x - a_x = c \cos 45° - a \cos 30.0^\circ = 10.0 \cos 45° - 4.0 \cos 30.0^\circ$$

$$b_x = 3.6$$

$$c_y = a_y + b_y \Rightarrow b_y = c_y - a_y = c \sin 45° - a \sin 30.0^\circ = 10.0 \sin 45° - 4.0 \sin 30.0^\circ$$

$$b_y = 5.1$$
Quiz 1
Name: 
Surname: 
Section: 5

This quiz is composed of 2 problems (5 points each). Answer everything.

Problem 1:

a) The equation describing the velocity of a pendulum of length \( L \) for a given angle \( \theta \) is (\( g \) is the gravitational acceleration at sea level):

\[
\nu = \sqrt{2gL \cos \theta}
\]

Define the factor \( \alpha \) such that the equation is dimensionally consistent.

\[
[\nu] = \frac{L}{T} \quad [L] = L \quad [\cos \theta] = 1 \quad \Rightarrow \quad \frac{L}{T} = \left(\frac{L}{T^2}\right)^{\alpha} L^{1} \quad \Rightarrow \quad \text{from } L: \quad 1 = \frac{\alpha}{2} + \frac{1}{2} \quad \Rightarrow \quad \alpha = 1
\]

\[\text{they agree.}\]

b) The average distance of the Earth and the Sun (149597871.0 Km) is defined to be as 1 Astronomical Unit (Au). How many meters is the average distance of Venus to the Sun if in Au it is 0.723.

\[
0.723 \text{ Au} \left(\frac{149,597,871,0 \text{ km}}{1 \text{ Au}}\right) \left(\frac{1000 \text{ m}}{1 \text{ km}}\right) = 1.08 \times 10^{11} \text{ m}
\]

Problem 2:

A vector \( \vec{A} \) is pointing 10° above the x axis and has magnitude of 6.0. What should the x and y components of a vector \( \vec{B} \) be, such that the addition of \( \vec{A} + \vec{B} \) results in a vector with a magnitude 10.0 and pointing 45° above the x axis.

Let \( \vec{C} = \vec{A} + \vec{B} \) then

\[
\begin{align*}
C_x &= A_x + B_x \Rightarrow C \cos \theta_c = A \cos \theta_a + B \Rightarrow B_x &= C \cos \theta_c - A \cos \theta_a \\
&= 10.0 \cos 45° - 6.0 \cos 10° \\
&= 11.2
\end{align*}
\]

\[
\begin{align*}
C_y &= A_y + B_y \Rightarrow C \sin \theta_c = A \sin \theta_a + B \Rightarrow B_y &= C \sin \theta_c - A \sin \theta_a \\
&= 10.0 \sin 45° - 6.0 \sin 10° \\
&= 6.0
\end{align*}
\]