8.5 – Center of Mass

Point at which an object's mass may be considered to be concentrated - also called the balance point. CM is often erroneously called "center of gravity (CG)," which accounts for the gravitational field around the object (or system). Usually, CM = CG.

Center of Mass

For a system of n masses on the x-axis, the center is:

\[ x_{cm} = \frac{\sum m_i x_i}{\sum m_i} \]

Where \( m \) = mass (kg)\n
Or, in Greek terms:

\[ \mu = \frac{\sum m_i x_i}{\sum m_i} \]

For the y-axis:

\[ y_{cm} = \frac{\sum m_i y_i}{\sum m_i} \]

Where \( m_i \) = individual items

1. Example

Where is the center of mass of this system (x, y)?

\[ m_1 = 14.3 \text{ kg} \]
\[ m_2 = 3.9 \text{ kg} \]
\[ m_3 = 2.1 \text{ kg} \]

\[ (x, y) = (-11, 7) \]
\[ (x, y) = (-2, -6) \]
\[ (x, y) = (12, -3) \]

\[ x_{cm} = \frac{14.3 \times 7 + 3.9 \times (-6) + 2.1 \times (-3)}{14.3 + 3.9 + 2.1} = 3.5 \text{ m} \]

Y-axis:

\[ y_{cm} = \frac{14.3 \times (-11) + 3.9 \times (-2) + 2.1 \times 12}{14.3 + 3.9 + 2.1} = -6.9 \text{ m} \]

The center of mass is at (-6.9, 3.5 m).

1. Example

x-axis:

\[ x_{cm} = \frac{14.3 \times (-11) + 3.9 \times (-2) + 2.1 \times 12}{14.3 + 3.9 + 2.1} = -6.9 \text{ m} \]

1. Example

Homework

8.5 Problems in your Booklet
Due: next class
Finish Unit 8 Review Problems