Center of Mass of a 737

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17 June 2025

This script calculates the center of mass of a Boeing 737 in several scenarios. Mass values are in kilograms. Distances are in meters from the nose of the aircraft.

The center of mass equation is given by: $\bar{x} = \frac{\sum_i m_i x_i}{\sum_i m_i}$

Givens

The values below are taken from the table in the problem statement.

```
% Empty Weight
empty_mass = 41e3;
empty_dist = 16.7;

% Crew and Equipment
crew_equip_mass = 340;
cerw_equip_dist = 5;

% Passengers
pax_mass = 15e3;
pax_dist = 17.5;

% Cargo
cargo_mass = 1000;
cargo_dist = 18.0;

% Fuel
fuel_mass = 20e3;
fuel_dist = 13.5;
```

Question 1

Where is the center of mass of the aircraft?

```
mass_total = empty_mass + crew_equip_mass + pax_mass + cargo_mass + fuel_mass;
weighted_sum = empty_mass*empty_dist + crew_equip_mass*cerw_equip_dist +
pax_mass*pax_dist + cargo_mass*cargo_dist + fuel_mass*fuel_dist;
```

```
center_of_mass = weighted_sum / mass_total
```

```
center_of_mass =

   15.9930
```

Question 2

When the aircraft runs out of fuel, where will the center of mass be?

```
mass_total_q2 = mass_total - fuel_mass;
weighted_sum_q2 = weighted_sum - fuel_mass*fuel_dist;

center_of_mass_q2 = weighted_sum_q2 / mass_total_q2
```

```
center_of_mass_q2 =

   16.8626
```

Question 3

If the aircraft needs to be ferried to another airport, with no passengers or cargo, where is the center of mass?

```
mass_total_q3 = mass_total - pax_mass - cargo_mass;
weighted_sum_q3 = weighted_sum - pax_mass*pax_dist - cargo_mass*cargo_dist;

center_of_mass_q3 = weighted_sum_q3 / mass_total_q3
```

```
center_of_mass_q3 =

   15.5918
```

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