Name

Date

Week: _____ **Problem:** _____

Given:

In terms of a particular reference frame, the position of the center of mass of the F-14 at the time shown ($t = 0$) is $\mathbf{r} = 10\mathbf{i} + 6\mathbf{j} + 22\mathbf{k}$ (m). The velocity from $t = 0$ to $t = 4$ s is $\mathbf{v} = (52 + 6t)\mathbf{i} + (12 + t^2)\mathbf{j} - (4 + 2t^2)\mathbf{k}$ (m/s). What is the position of the center of mass of the plane at $t = 4$ s?

Required:

Solution:

$\mathbf{r}_0 = 10\mathbf{i} + 6\mathbf{j} + 22\mathbf{k}$ m

$\mathbf{v} = (52 + 6t)\mathbf{i} + (12 + t^2)\mathbf{j} - (4 + 2t^2)\mathbf{k}$ m/s

$$x_4 = \int_0^4 v_x\, dt = 52t + 3t^2 + x_0$$

$$x_4 = (52)(4) + 3(4)^2 + 10 \text{ m} = 266.0 \text{ m}$$

$$y_4 = \int_0^4 v_y\, dt = 12t + t^3/3 + y_0$$

$$y_4 = 12(4) + (4)^3/3 + 6 \text{ m} = 75.3 \text{ m}$$

$$z_4 = \int_0^4 v_z\, dt = -(4t + 2t^3/3) + z_0$$

$$z_4 = -4(4) - 2(4)^3/3 + 22 = -36.7 \text{ m}$$

$\mathbf{r}|_{t=4s} = 266\mathbf{i} + 75.3\mathbf{j} - 36.7\mathbf{k}$ (m)