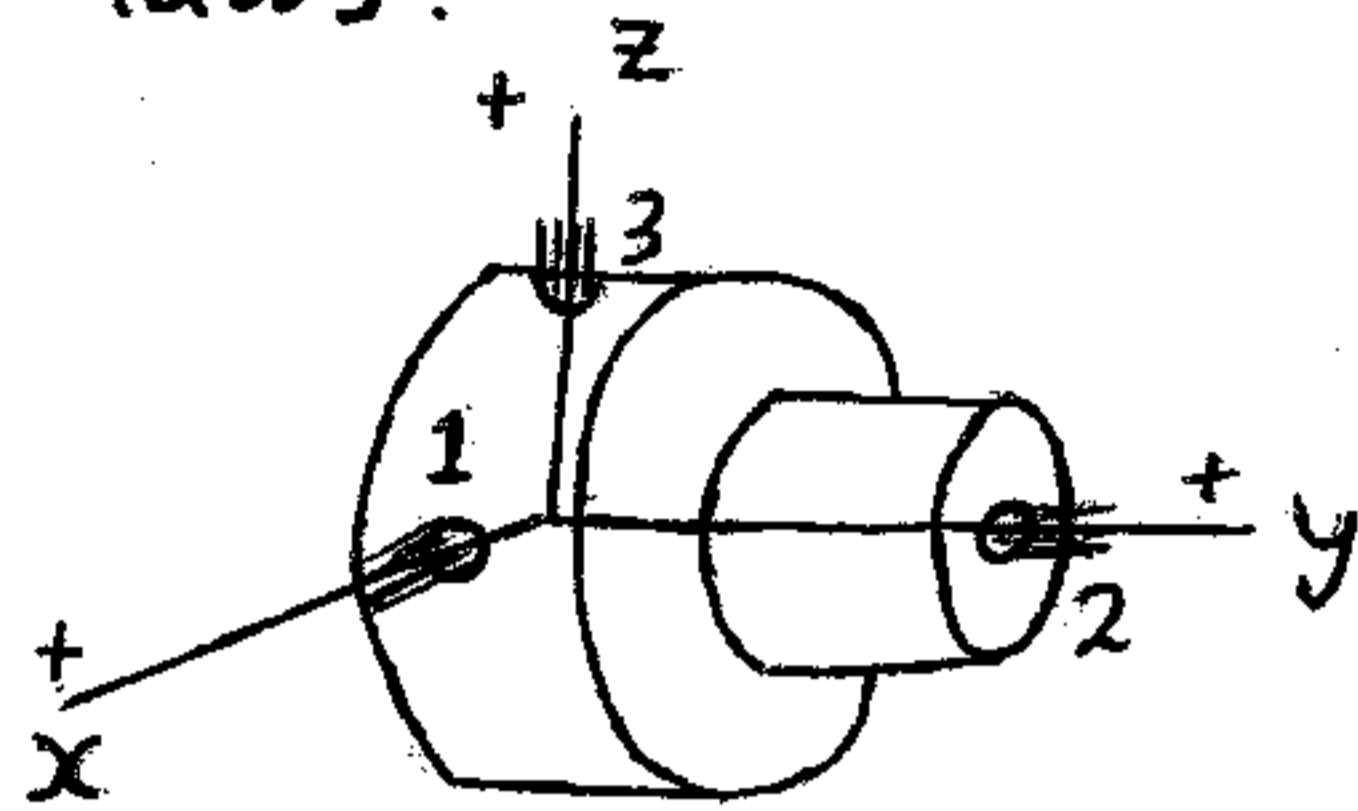


This is a force and motion problem involving Newton's laws.



A space capsule simultaneously fires three of its thrusters, denoted by 1, 2, 3. If the thrusters fire for 9.5 s, and $F_1 = 50\text{ N}$, $F_2 = 60\text{ N}$, and $F_3 = 65\text{ N}$, what is the velocity of the capsule after 9.5 s? The capsule is initially moving along the positive y-direction at 30 m/s, and its mass is 120 kg.

Solution:

Apply Newton's second law in the x, y, z directions:

$$\sum F_x = ma_x \Rightarrow -50 = 120 a_x, a_x = -0.417 \text{ m/s}^2$$

$$\sum F_y = ma_y \Rightarrow -60 = 120 a_y, a_y = -0.50 \text{ m/s}^2$$

$$\sum F_z = ma_z \Rightarrow -65 = 120 a_z, a_z = -0.542 \text{ m/s}^2$$

This now becomes a kinematics problem.

$$v_{xf} = v_{xi} + a_x \Delta t \Rightarrow v_{xf} = 0 - (0.417)(9.5) = -3.96 \text{ m/s}$$

$$v_{yf} = v_{yi} + a_y \Delta t \Rightarrow v_{yf} = 30 - (0.50)(9.5) = 25.3 \text{ m/s}$$

$$v_{zf} = v_{zi} + a_z \Delta t \Rightarrow v_{zf} = 0 - (0.542)(9.5) = -5.15 \text{ m/s}$$

(answer)