ENGR-2060

E.M. - DYNAMICS

NAME DATE

SOLUTION

PROBLEM: AP-7

GIVEN:

A rocket is fired from rest at $x = 0$ and travels along a parabolic trajectory described by $y^2 = [120(10^3)x]$ m. If the x component of acceleration is $a_x = \left(\frac{1}{4}t^2\right)$ m/s^2, where t is in seconds, determine the magnitude of the rocket's velocity and acceleration when $t = 10$ s.

REQUIRED:

$|v| = ?$

$|a| = ?$

SOLUTION:

$a_x = \frac{1}{4}t^2 \qquad \int a_x = \int \frac{dv_x}{dt} = \int_0^t \frac{1}{4}t^2 \qquad v_x = \frac{t^3}{12} \qquad x = \frac{t^4}{48}$

$y^2 = 120E3\,x \qquad y^2 = \frac{120E3}{12}t^4 \qquad y = 50t^2$

$\dot{y} = 100t \qquad \ddot{y} = 100$

@ $t = 10$s :

$x = 208.3^m \quad \dot{x} = 83.3\ m/s \quad \ddot{x} = 25\ m/s^2$

$Y = 5000^m \quad \dot{y} = 1000\ m/s \quad \ddot{y} = 100\ m/s^2$

$v = \sqrt{\Sigma^2} = 1003.5\ m/s$

$a = \sqrt{\Sigma^2} = 103.1\ m/s^2$

$$\boxed{\begin{aligned} |v| &= 1004\ m/s \\ |a| &= 103\ m/s^2 \end{aligned}}$$