HIBBELER 12-75

A THEORETICAL ONE!

PATH of PARTICLE $\Rightarrow$ $y^2 = 4kx$ EQUATION of CURVE

$y = f(x)$

VELOCITY $\Rightarrow$ $\vec{V} = V_x \hat{i} + V_y \hat{j}$

where $V_y = ct$ = VERTICAL COMPONENT

GIVEN: k and c = CONSTANTS

? FIND x & y components of ACCELERATION.

DIFFERENTIATION:

$$\frac{d}{dt}\left[y^2 = 4kx\right]$$

$$2y\frac{dy}{dt} = 4k\frac{dx}{dt}$$

$$2yV_y = 4kV_x \quad \text{DIF. AGAIN}$$

$\frac{d}{dt}[\ \underbrace{2yV_y}_{\text{BY PARTS}}\ ]$

$$2\frac{dy}{dt}V_y + 2y\frac{dV_y}{dt} = 4k\frac{dV_x}{dt}$$

$$2V_y^2 + 2yA_y = 4kA_x$$

SUB. FOR $V_y = ct$

and $A_y = \frac{dV_y}{dt} = c$ ✓

$$2(ct)^2 + 2y(c) = 4kA_x \quad \checkmark$$

$$\frac{c^2t^2 + cy}{2k} = A_x$$

$$\vec{A} = A_x\hat{i} + A_y\hat{j} = \left[\frac{c^2t^2 + cy}{2k}\right]\hat{i} + c\,\hat{j}$$

$$\vec{A} = c\left\{\left[\frac{ct^2 + y}{2k}\right]\hat{i} + 1\hat{j}\right\} = c\left\{\frac{V_y t + y}{2k}\,\hat{i} + 1\hat{j}\right\}$$

MILLAND