

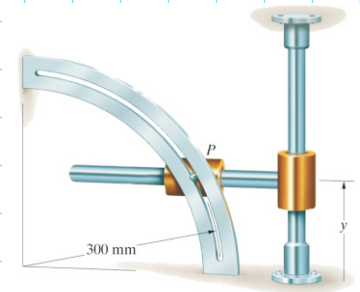
NAME _____

DATE _____

WEEK: _____ **PROBLEM:** _____

GIVEN:

If $y = 150 \text{ mm}$, $\frac{dy}{dt} = 300 \text{ mm/s}$, and $\frac{d^2y}{dt^2} = 0$, what are the magnitudes of the velocity and acceleration of point P ?



REQUIRED:

SOLUTION:

Solution: The equation for the location of the point P is $R^2 = x^2 + y^2$, from which $x = (R^2 - y^2)^{\frac{1}{2}} = 0.2598 \text{ m}$, and

$$\frac{dx}{dt} = -\left(\frac{y}{x}\right)\left(\frac{dy}{dt}\right) = -0.1732 \text{ m/s},$$

$$\begin{aligned} \frac{d^2x}{dt^2} &= -\frac{1}{x}\left(\frac{dy}{dt}\right)^2 + \frac{y}{x^2}\left(\frac{dx}{dt}\right)\left(\frac{dy}{dt}\right) - \left(\frac{y}{x}\right)\left(\frac{d^2y}{dt^2}\right) \\ &= -0.4619 \text{ m/s}^2. \end{aligned}$$

The magnitudes are:

$$|v_P| = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2} = 0.3464 \text{ m/s}$$

$$|a_P| = \sqrt{\left(\frac{d^2x}{dt^2}\right)^2 + \left(\frac{d^2y}{dt^2}\right)^2} = 0.4619 \text{ m/s}^2$$