SOLUTION

PROBLEM: AP-12

GIVEN:

If a particle's position is described by the polar coordinates
$r = (2 \sin 2\theta)$ m and $\theta = (4t)$ rad, where t is in seconds,
determine the radial and transverse components of its
velocity and acceleration when $t = 1$ s.

REQUIRED:

$v_r = ?$ $v_\theta = ?$
$a_r = ?$ $a_\theta = ?$

SOLUTION:

$\theta = 4t$ RAD $\quad = 4$
$\dot\theta = 4$ RAD/s $\quad = 4$ $\Big\} t = 1s$
$\ddot\theta = 0$ RAD/s² $\quad = 0$

$r = 2 \sin 2\theta$ m $\qquad\qquad = 1.98$
$\dot r = \dfrac{dr}{d\theta}\dfrac{d\theta}{dt} = 4\cos 2\theta \,\dot\theta \qquad = -2.33$ $\Big\} t = 1s$
$\ddot r = -8 \sin 2\theta (\dot\theta)^2 + 8 \cos 2\theta \,\ddot\theta \quad = -126.6$

$v_r = -2.33$ m/s
$v_\theta = 7.91$ m/s
$a_r = -158$ m/s²
$a_\theta = -18.6$ m/s²

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