Answer on Question #72182 Physics / Classical Mechanics

A particle which moves clockwise in a circle with a radius of $R = 1.5$ m slows down with constant acceleration from $v_i = 50$ m/s to $v_f = 30$m/s in $\tau = 5.00$ s at $t = 3.00$ s find:
1- tangential acceleration, 2- centripetal acceleration, 3- the angle between the vector of velocity and acceleration.

Solution:

The tangential acceleration

$$a_\tau = \frac{\Delta\omega}{\Delta t} = \frac{v_f - v_i}{\tau R} = \frac{30 - 50}{5 \times 1.5} = -2.67 \frac{\text{rad}}{\text{s}^2}$$

Centripetal acceleration

$$a_n(t) = \frac{v^2(t)}{R} = \frac{(v_i + a_\tau R t)^2}{R} = \frac{(50 + (-2.67) \times 1.5 \times 3.00)^2}{1.5} = 962.67 \frac{\text{m}}{\text{s}^2}$$

The angle between the vector of velocity and acceleration

$$\theta = 90° + \arctan\frac{|a_\tau|}{a_n} = 90° + \arctan\frac{2.67}{962.67} = 90.16°$$

Answers: $-2.67 \frac{\text{rad}}{\text{s}^2}, 962.67 \frac{\text{m}}{\text{s}^2}, 90.16°$